DRAFT

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

For

Upgradation of Weiloi - Mawsynram Road up to Phlangwanbroi for Meghalaya Logistics and Connectivity Improvement Project (MLCIP), funded by the World Bank

Submitted To

Meghalaya Infrastructure Development & Finance Corporation Ltd

Meghalaya Infrastructure Development Finance Corporation (MIDFC) Ltd.
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Disclaimer: The is a draft version and is being reviewed by the World Bank.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

ASI	:	Archaeological Survey of India
BIS	:	Bureau of Indian Standards
BMC	:	Biodiversity Management Committee
CESMP	:	Contractor's Environmental and Social Management Plan
CGWB	:	Central Ground Water Board
CoI	:	Corridor of Impact
CPR	:	Common Property Resources
CTE/CTO	:	Consent To Establish/Consent to Operate
CW	:	Carriageway
DG	:	Diesel Generator
DPR	:	Detailed Project Report
E&S	:	Environment and Social Cell
EHS	:	Environment Health and Safety
EIA	:	Environmental Impact Assessment
ESF	:	Environmental and Social Framework
ESIA	:	Environmental and Social Impact Assessment
ESMP	:	Environmental and Social Management Plan
ESS	:	Environmental and Social Standards
ESZ	:	Eco-Sensitive Zone
FPIC	:	Free, Prior, and Informed Consent
GBV	:	Gender-Based Violence
GIS	:	Geographic Information System
GoM	:	Government of Meghalaya

GRM	:	Grievance Redress Mechanism
HIV	:	Human Immunodeficiency Virus
IBA	:	Important Bird Area
IBAT	:	Integrated Biodiversity Assessment Tool
IEC	:	Information, Education, and Communication
IFC	:	International Finance Corporation
IRC	:	Indian Road Congress
ISFR	:	India State of Forest Report
IUCN	:	The International Union for Conservation of Nature
KBA	:	Key Biodiversity Area
LHS	:	Left Hand Side
LULC	:	Land Use Land Cover
MDR/ SH	:	Major District Roads/State Highways
MoEF&CC	:	Ministry of Environment, Forest and Climate Change
MLCIP	:	Meghalaya Logistics and Connectivity Improvement Project
MSPCB	:	Meghalaya State Pollution Control Board
MSDMA	:	Meghalaya State Disaster Management Authority
NABET	:	National Accreditation Board for Education and Training
NATMO	:	National Atlas and Thematic Mapping Organization
NBSAP	:	National Biodiversity Strategy and Action Plan
NGO	:	Non-Governmental Organization
NH	:	National Highway
NOC	:	No Objection Certificate
NO_x	:	Oxides of Nitrogen

OF	:	Open Forest
OHS	:	Occupational Health and Safety
OIP	:	Other Interested Parties
PAP	:	Project Affected Person
PESO	:	Petroleum and Explosives Safety Organization
PIA	:	Project Influence Area
PM	:	Particulate Matter
POSH	:	Prevention of Sexual Harassment
PPE	:	Personal Protective Equipment
PROW	:	Proposed Right of Way
PUC	:	Pollution Under Control
PWD	:	Public Works Department
R&R	:	Resettlement and Rehabilitation
RAP	:	Resettlement Action Plans
RF	:	Reserve Forest
RFCTLARR	:	Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013
RHS	:	Right Hand Side
RoW	:	Right of Way
SBB	:	State Biodiversity Board
SEA	:	Sexual Exploitation and Abuse
SEIAA	:	State Environment Impact Assessment Authority
SEP	:	Stakeholder Engagement Plan
SH	:	Sexual Harassment

SIA	:	Social Impact Assessment
SOP	:	Standard Operating Procedures
ST	:	Scheduled Tribes
TSG	:	Technical Support Group
WB	:	World Bank
WHO	:	World Health Organization
WMP		Weiloi - Mawsynram Road upto Phlangwanbroi
WPA, 1972	:	Wildlife Protection Act, 1972
WPA, 2022	:	Wild Life (Protection) Amendment Act, 2022

EXECUTIVE SUMMARY

E.1 INTRODUCTION

The Meghalaya Logistics and Connectivity Improvement Project (MLCIP), with a total investment of USD 300 million comprising USD 240 million from the World Bank and USD 60 million from the Government of Meghalaya (hereinafter refer to as the state government) aims to: a) enhance connectivity to key growth centers along identified road corridors; b) improved rural and district-level logistics infrastructure and services; c) provide greater market access and reduced average cost/time for select agriculture and horticulture products; and, d) strengthen institutional capacity for efficient, climate-resilient transport and logistics, West and East Meghalaya.

MLCIP includes 10 Roads and 5 Bridges totaling to approximately 300 km respectively. The proposed WMP sub project road has a total length of 27.858 km, starting from Weiloi at Chainage 22+500 and extending up to Phlangwanbroi at Chainage 48+881 including 1.547km bypass from Chainage 33+200 RHS to Chainage 35+100 RHS near Mawsynram Market.

The present sub-project would include upgradation of the existing pavement from a single lane carriageway to intermediate lane. It also includes climate-resilient design measures based on vulnerability assessment considering Meghalaya's high rainfall conditions. Drainage capacity has been improved through enlarged culverts, additional cross-drainage structures, and properly graded roadside drains to prevent flooding and waterlogging. Slope protection measures such as retaining walls, turfing, and bio-engineering local broom grass, vetiver/local grasses has been proposed. Turfing will be provided on embankment slopes for erosion control, and jute netting is also proposed. Durable pavement layers (CTB/CTSB) and paved shoulders, along with safety features, ensure an all-weather, resilient and safe road infrastructure.

E.2 PROJECT DESCRIPTION AND NEED

The project is designed to improve road infrastructure without requiring additional land acquisition, as adequate Right of Way (RoW) is available. However, about 4.466 ha land is required for spoil disposal. The intervention includes pavement strengthening, drainage improvement, slope stabilization, and safety enhancements. The road serves as a vital link connecting villages and economic centers, thereby improving mobility and reducing travel time and costs.

E.3 BASELINE ENVIRONMENTAL CONDITIONS

The project area experiences high rainfall and humid climatic conditions, making it prone to erosion, drainage congestion, and slope instability. The terrain is characterized by undulating topography with soil types vulnerable to erosion. Surface water bodies, streams, and riverbanks are present along the alignment, playing an important role in local hydrology and community use.

Air and noise quality in the region are generally within acceptable limits due to low industrial activity. The biological environment includes local vegetation and fauna typical of the East Khasi Hills, with no critical habitats significantly impacted by the project. The area also falls under a high seismic zone (Zone VI), indicating vulnerability to natural hazards.

E.4 SOCIO-ECONOMIC PROFILE

The project area is predominantly inhabited by tribal communities governed under the Sixth Schedule, with strong traditional institutions like Rangbah Shnong managing land and resources. Livelihoods are mainly dependent on agriculture, small businesses, and daily wage activities. The project affects a number of households (10 PAHs), with 66 PAPS with minor impacts on livelihoods and structures.

Consultations revealed key community concerns such as poor road conditions, flooding during monsoon, lack of drainage, and safety issues. Communities generally supported the project, expecting improved connectivity. The

proposed 27.858 km WMP road sub-project has been designed with no additional land acquisition and associated social impacts while improving connectivity. Community infrastructure proposed under FPIC will also be accommodated within the existing RoW.

The project will temporarily require 4.466 Ha of land for spoil disposal, identified across 3 locations in consultation with PWD officials and local communities, including the Rangbah Shnong. These sites will be taken on lease and will be restored and returned to landowners after construction. In total, 10 PAHs comprising 66 PAPs will be affected, with impacts being largely minor, partial, and localized. A significant portion includes 10 households (66 PAPs), who will need to relocate outside the RoW. While this will temporarily disrupt their business locations and income, they are expected to resume similar livelihood activities nearby, with no permanent livelihood loss anticipated.

A 30-day advance notice will be provided to affected persons for relocation, and impacts will be managed through compensation, livelihood assistance, and provisions outlined in the Resettlement Action Plan (RAP). Overall, the project does not involve physical displacement and is expected to have manageable social impacts, primarily limited to relocation of informal activities, which will be mitigated through appropriate planning and community engagement.

E.5 KEY ENVIRONMENTAL AND SOCIAL IMPACTS

During the **construction phase**, potential impacts include:

- Soil erosion and slope instability due to earthwork
- Air and noise pollution from construction activities
- Water contamination from runoff and waste
- Temporary disruption to local traffic and community access
- Occupational health and safety risks for workers

During the **operation phase**, impacts are relatively limited but may include:

- Increased vehicular emissions and noise
- Road safety concerns due to higher traffic speed
- Risk of erosion if drainage and slope protection are not maintained

Table E.1 : ESIA Observation and Compliance

Sr. No.	Observation of WMP Road	Compliance / Proposal in DPR
1	Construction of drain cum footpath with railings at Mawsynram Station	Drain cum Footpath with Railing hahs been proposed at Km 34.695 to Km 35.110 Both side.
2	Renovation of Bus Shed	Bus Shelter has been proposed at Ch. 34.750.
3	Footpath with Railings from Mawsawa Village to Phlangwanbroi Village for the safety of school going children.	Drain cum Footpath with Railing has been proposed at Km 45.850 to Km 47.320 Both side.
4	Street Lights at road junction to Balang Presbyterian Mawrapad, School, Community Hall, Lad Mawkasain-Mawrapad, Playground etc.	Street Lights have been proposed at Km 43.050 to Km 44.150 LHS side
5	Bus waiting shed for men & women	Bus Shelter have been proposed at Ch. 43.200, Ch. 43.880, Ch. 44.100
6	Protection in the form of Railings at the site where washing of clothes is carried out by the villagers in Kenbah Malai	Retaining wall have been provided at Ch. 44.450

7	Retaining walls where slopes may become unstable due to excavation work in Mawkasain	Breast wall have been proposed at Km 44.220 to 44.270, Km 44.320 to 44.370, Km 44.410 to 44.440
8	Spring Water Rehabilitation Near Mawlynnu	Spring Water Rehabilitation has been proposed at Km 27.000

E.6 MITIGATION MEASURES AND DESIGN INTERVENTIONS

To address these impacts, several mitigation measures have been integrated into the project design:

- **Erosion control measures** such as toe walls, gabion walls, stone pitching, and river training works at vulnerable chainages
- **Improved drainage systems** to prevent waterlogging and flooding
- **Slope stabilization techniques** including bio-engineering methods like turfing and vegetation
- **Climate-resilient pavement design** with durable materials and stress-absorbing layers
- **Safety measures** including curve improvements, junction design, and traffic calming features

Environmental management during construction will include dust suppression, proper waste management, noise control, and water protection measures.

E.7 SOCIAL SAFEGUARDS AND COMMUNITY ENGAGEMENT

The project follows the World Bank Environmental and Social Framework (ESF), ensuring compliance with national regulations and international standards. Free, Prior, and Informed Consent (FPIC) has been undertaken to engage tribal communities and incorporate their feedback into project design.

A Resettlement Action Plan (RAP) and Indigenous Peoples Development Plan (IPDP) have been prepared to address impacts on affected households and ensure fair compensation and livelihood restoration. A Grievance Redress Mechanism (GRM) is also established to address community concerns effectively.

E.8 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

The ESMP outlines mitigation measures, monitoring requirements, institutional responsibilities, and budget allocation. It includes:

- Environmental monitoring (air, water, noise, soil)
- Social monitoring (livelihood restoration, community safety)
- Occupational health and safety measures
- Capacity building for implementing agencies

An amount of Rs. 99,45,600 have been marked for ESMP budget.

E.9 STACKHOLDER CONSULTATIONS

During the ESIA, consultations were carried out with representatives from all three stakeholder categories, including government agencies, communities, and other organizations, with particular attention to vulnerable groups. Special focus was given to communities located in sub-project areas likely to experience significant impacts, such as effects on residential and commercial structures or on common property resources. Key common property resources identified include religious structures, public utilities, and other community assets critical to local livelihoods and cultural heritage.

Representatives from relevant stakeholders were consulted to incorporate their concerns and expertise, ensuring that the project aligns with broader developmental, economic, and environmental objectives. Key discussions focused on potential displacement, loss of livelihoods, environmental degradation, law and order issues, irrigation impacts, structural matters such as cross-drainage structures, and corresponding mitigation measures. These consultations helped document and integrate the priorities and concerns of affected communities, providing valuable input to shape strategies for minimizing adverse impacts.

Through public consultations, stakeholders' viewpoints and suggestions were captured and considered as inputs to the technical design. All suggestions were incorporated into the project design to the extent feasible and warranted.

The project has prepared a project-level Stakeholder Engagement Plan (SEP), which outlines the procedures for stakeholder engagement throughout the project cycle. The SEP details the process, methods, and frequency of engagement with various stakeholders and will be implemented accordingly during the project period.

Discloded Stakeholder Engagement Plan link on MPWD website is https://www.megpwd.gov.in/pdf/2025/MLCIP/DRAFT%20STAKEHOLDER%20ENGAGEMENT%20PLAN%20(SEP)%20MLCIP.pdf.

E.10 CONCLUSION

The proposed upgradation of the WMP road is a strategically important infrastructure intervention that will significantly enhance regional connectivity, accessibility, and socio-economic development in East Khasi Hills. The ESIA indicates that while the project traverses environmentally sensitive areas, the anticipated environmental impacts are site-specific, largely temporary, and manageable through appropriate design and mitigation measures.

Key environmental concerns such as drainage congestion, slope instability, vegetation loss, have been addressed through climate-resilient engineering solutions, including improved drainage systems, slope protection works, bio-engineering measures, and wildlife safety interventions. With the implementation of the Environmental and Social Management Plan (ESMP), impacts related to air, noise, soil, and water during construction will be effectively controlled, while long-term benefits such as reduced erosion, improved road durability, and safer movement are expected.

From a social perspective, the project involves no physical displacement and only minor, localized impacts, primarily related to temporary relocation of informal roadside livelihoods. A total of 10 Project Affected Households (PAHs) will be impacted, with mitigation measures outlined in the Resettlement Action Plan (RAP), including compensation, livelihood restoration, and advance notice for relocation. The project has received broad community support through FPIC consultations, with incorporation of community-prioritized features such as drainage, safety measures, and basic amenities.

Overall, the project is assessed to be environmentally sustainable and socially acceptable, consistent with the World Bank Environmental and Social Framework (ESF). The identified risks particularly related to hydrology, geotechnical stability, and biodiversity are adequately addressed through chainage-specific mitigation and robust management measures.

With effective implementation, monitoring, and stakeholder engagement, the project is expected to deliver long-term, climate-resilient, and inclusive development benefits, while maintaining environmental integrity and social equity.

1. INTRODUCTION

1.1 BACKGROUND

The Meghalaya Logistics and Connectivity Improvement Project (MLCIP), with a total investment of USD 300 million comprising USD 240 million from the World Bank and USD 60 million from the Government of Meghalaya (hereinafter refer to as the state government) aims to: a) enhance connectivity to key growth centers along identified road corridors; b) improved rural and district-level logistics infrastructure and services; c) provide greater market access and reduced average cost/time for select agriculture and horticulture products; and, d) strengthen institutional capacity for efficient, climate-resilient transport and logistics, West and East Meghalaya.

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The present sub-project would include upgradation of the existing pavement from a single lane carriageway to intermediate lane. It also includes climate-resilient design measures based on vulnerability assessment considering Meghalaya's high rainfall conditions. Drainage capacity has been improved through enlarged culverts, additional cross-drainage structures, and properly graded roadside drains to prevent flooding and waterlogging. Slope protection measures such as retaining walls, turfing, and bio-engineering using local grasses have been proposed to control erosion and landslides. Durable pavement layers (CTB/CTSB) and paved shoulders, along with safety features, ensure an all-weather, resilient and safe road infrastructure.

1.2 SCOPE FOR CONDUCTING THE ESIA STUDY

Overall risk category of the project is High. However, as per the screening study, the sub-project road has been classified as "High Risk", as it involves substantial cutting and filling operations and associated debris disposal, the presence of cultural resources (monoliths) along the alignment, location at elevations exceeding 1,000 m above mean sea level (AMSL). In addition, the project affects approximately 10 Project Affected Households (PAH), leading to livelihood concerns.[1]. Based on this assessment, the scope of the ESIA study was defined, and the following activities were undertaken for the detailed assessment.

- Collection of project information
- Literature review and data compilation
- Baseline environmental and social assessment
- Identification of potential impacts
- Stakeholder identification and consultation:
- Preliminary climate and cumulative impact assessment:
- Environmental and Social Management Plan (ESMP) preparation:
- Monitoring framework:

[1] The project has obtained a total score of 28 out of 32, corresponding to 87.5%. As per the screening matrix classification, the sub-project falls under the High Risk Category. The social risk is categorized as Moderate since the impact on affected households involves less than 10% loss of assets, including both land and structures, indicating limited displacement and manageable livelihood impacts.

1.3 APPROACH AND METHODOLOGY

The approach and methodology included impact identification through surveys, baseline data collection, impact assessment, and mitigation planning. The following table summarizes the approach adopted for undertaking the ESIA study.

Sl. No.	Stages	Activities Done
1.	Screening and Scoping	Identified key issues through primary and secondary surveys, assessed stakeholders, and analyzed potential impacts considered in the Environmental and Social Impact Assessment, following the Free, Prior, and Informed Consent (FPIC) process to ensure meaningful participation and consent of Indigenous Peoples and affected communities. The Divisional officers, PWD, GoM also interacted with the concerned DFO to understand the location of forest areas in these stretches.
2.	Public Consultation for Scoping Report	Identified key issues to understand stakeholder concerns and inform about sub-project design and build awareness on the project including the Free, Prior, and Informed Consent (FPIC) process. This involved engaging with affected Indigenous communities through meaningful consultations in a transparent and participatory manner in order to make them aware of the project activities. Consultations were held with the community representatives including village heads and community members to raise awareness about the project and the need for FPIC. These consultations allowed the community to be briefed on the role of the DPR, ESMF and ESIA consultants and seek permission to meet and discuss the different components of the project activities. During this period, liaison was initiated with the forest Department, GoM to understand the location and boundary of protected areas “Community Forest” and the wildlife corridors.
3.	Baseline Data Collection	Gathered and reviewed primary and secondary data on environmental and social conditions in and around the sub-project area, including air quality, water resources, biodiversity, cultural heritage, and socio-economic factors. Primary physical monitoring was carried out as per the EIA guidelines. For ecological monitoring, transect walks, quadrat analysis, community consultation were carried out. The Forest Department, GoM, provided the maps demarcating the legally protected forest including “community reserve”. Information was also provided about the Wildlife crossing/ wildlife corridors. Information was also collected for the Forest Department, GoM about the animal kills / collisions on these corridors. In addition to these data collection form secondary sources, primary data on natural environment was also collected. Potential areas of community health safety conflicts were also identified and the design team was informed about these.
4.	Impact Assessment	Using baseline data, the WMP Project road potential impacts on the environment and local communities were assessed, including direct and indirect effects, as well as short-term and long-term impacts. A targeted assessment was carried as a part of ESIA since the sub-project area falls under a Schedule VI region with the presence of tribal communities. The Second round of FPIC consultations were undertaken as part of the impact assessment to ensure meaningful engagement with Indigenous Peoples (IP) to further discuss the project design, benefits and impacts, and to provide the communities’ priorities and inputs to drafting of the mitigation plans and measures. During this consultation, IPs’ written consent to proceed with the Project has been recorded through a resolution and countersigned by the participants, with attendance sheets, photos, etc. and attached as Annexure in IPDP.

Sl. No.	Stages	Activities Done
5.	Mitigation and Management Measures	Based on the impact assessment, measures were proposed to mitigate or minimize adverse environmental and social impacts while enhancing positive outcomes. These included exploring Project-road design alternatives to reduce Involuntary resettlement and environmental degradation, community health safety conflicts etc were carried out. These measures have been integrated in the draft Environmental and Social Management Plan, Resettlement Action Plan, Indigenous People's Development Plan, including project-level Labor Management Procedures, Stakeholder Engagement Plan and SEA/SH Action Plan, among others.
6.	Draft ESIA Report	A draft report summarizing the findings of the Environmental and Social Impact Assessment (ESIA) has been prepared.
7.	Public Disclosure of ESIA	Public Consultations informed each stage of the ESIA development. In accordance with both GoM and WB requirements, the draft ESIA report and mitigation plans (ESMPs, RAP, IPDP) has been prepared for disclosure and public consultation. Stakeholders, including local communities, NGOs, government agencies, and experts, will be invited to provide feedback and the final report will be revised based on the feedback received. In addition, No Objection Certificates (NOCs) will be obtained from the village-level traditional institutions to ensure community consent and administrative approval before proceeding with the project in the proposed area.
8.	Final ESIA Report	The draft ESIA report and mitigation plans (ESMPs, RAP, IPDP) will be finalized by incorporating feedback from the public consultation. Comments received will be addressed, and the assessment or proposed measures/plans will be revised as necessary.
9.	Approval and Implementation	The final ESIA report along with mitigation plans will be submitted to the MPWD and the World Bank.
10.	Monitoring	Monitoring of ESIA implementation and management of risks throughout the project implementation

Table 1.3.1: Source and methodology for primary and secondary data collection

Parameters	Source
	Environment
Air	**Primary survey** Primary monitoring at three locations for parameters like (Particulate Matter (PM10), Particulate Matter (PM2.5), Sulphur dioxide (SO2), Nitrogen dioxide (NO2) and Carbon Monoxide (CO)) **Secondary Source** Central pollution control Board (CPCB, https://cpcb.nic.in/) / Meghalaya State Pollution Control Board (MSPCB, https://megspcb.gov.in/
Water	**Primary survey** Primary monitoring at three locations for parameters like colour, odour, taste, turbidity, pH, total hardness (as $CaCO_3$), iron (as Fe), chlorides (as Cl), fluoride (as F), total dissolved solids (TDS), calcium (as Ca^{2+}), magnesium (as Mg^{2+}), sulphate (as SO_4), total chromium (as Cr), alkalinity (as $CaCO_3$), aluminium (as Al), total arsenic (as As), copper (as Cu), manganese (as Mn), zinc (as Zn), ammonia (as NH_3-N), anionic detergents (as MBAS), boron (as B), mineral oil, phenolic compounds (as C_6H_5OH), cadmium (as Cd), cyanide (as CN), lead, mercury (as Hg), nickel (as Ni), residual free chlorine, molybdenum (Mo), polynuclear aromatic hydrocarbons, polychlorinated biphenyls, nitrate, sodium (as Na^+), potassium (as K^+), and microbiological parameters including total coliform and E. coli. **Secondary Source** 1. District Survey Report, East Khasi Hills District, 2024 (https://eastkhasihills.gov.in/event/district-survey-report/) 2. CGWB Data 2024 (https://www.cgwb.gov.in/old_website/AQM/NAQUIM_REPORT/Meghalaya/East%20Khasi%20hills_report.pdf)
Noise	**Primary survey** Primary monitoring at three locations for Day Time and Night Time. **Secondary Source** CPCB (https://cpcb.nic.in/regulation-control/)
Soil	**Primary survey** Primary monitoring at three locations for parameters like colour, textural class, bulk density, water holding capacity, sand, silt, clay, pH (1:2 suspension), electrical conductivity (1:2), organic matter, exchangeable calcium, exchangeable magnesium, copper, nickel, chromium, lead, sulphate, total nitrogen (as N), available phosphorus, and exchangeable potassium.

Parameters	Source
	Secondary Source 1. District Irrigation Plan 2016-2020 (https://pmksy.gov.in/mis/Uploads/2017/20170331050603829-1.pdf) 2. Mapping India's Climate Vulnerability A District Level Assessment (2021) (https://www.ceew.in/sites/default/files/ceew-study-on-climate-change-vulnerability-index-and-district-level-risk-assessment.pdf)
Biodiversity	**Primary survey** 1.Field observation 2.Vegetation assessment was conducted using Nested Quadrate method 3.Faunal assessment was conducted using Visual encounters, sign survey, line transect, and netting survey method 4.LULC analysis through ground truthing **Secondary Source** 1.Desktop study/secondary data collection - Govt. notified acts, peer review published scientific articles, Govt. reports, 2.Online open-source biodiversity databases such as Meghalaya Biodiversity Portal (https://megbiodiversity.nic.in/), PARIVESH Portal (MoEF&CC) (https://parivesh.nic.in/), Global Forest Watch (https://www.globalforestwatch.org/), IUCN Red List of Threatened Species (https://www.iucnredlist.org/) 3.Stakeholder consultation
Hazards and Vulnerability	**Primary survey** Field observation and Consultation with concerned departments and local community **Secondary Source** 1. District Disaster Management Plan for East Khasi Hills, 2024 (https://msdma.gov.in/ddmp/DDMP-Shillong.pdf) 2. Meghalaya State Disaster Management Authority (MSDMA) (https://msdma.gov.in/)
Natural Environment	**Secondary Source** 1. Customized Rainfall Information System, Hydromet Division, IMD (https://hydro.imd.gov.in/) 2. District Census Handbook, East Khasi Hills (https://eastkhasihills.gov.in/demography/) 3. Geological Survey of India (https://www.gsi.gov.in/webcenter/portal/OCBIS) 4. District Irrigation Plan 2016-2020 (https://pmksy.gov.in/mis/Uploads/2017/20170331050603829-1.pdf)5. Consultant's Analysis, Source IMD Gridded Data (https://www.imdpune.gov.in/cmpg/Griddata/Rainfall_25_NetCDF.html) 6. State Action Plan on Climate Change (SAPCC), Meghalaya (https://moef.gov.in/uploads/2017/08/Meghalaya.pdf)

Parameters	Source
	7. Statistical Handbook, Meghalaya 2023 (https://des.megplanning.gov.in/documents/SHB2023-as-on-02-05-24.pdf)
Climate	Secondary Source: India Meteorological Department – Shillong Climatological Normals, (1991–2020) (https://dsp.imdpune.gov.in/home_normals.php#)
	Land and Livelihood Impact
Land, Livelihood and Common Property Resources	**Primary survey** 1.Census/Household Survey (PAH: 10) 2.Focus Group Discussions (3) 3.Key Informants Interviews (10) 4.Field Observations **Secondary Source** Census 2011 (https://www.census2011.co.in/)
	Other Socio-Economic Parameters
Ethnicity	**Primary survey** Consultation Focus Group Discussions **Secondary Source** Census 2011 (https://www.census2011.co.in/)
Gender	**Primary survey** Focus Group Discussions (2) Interviews (2) **Secondary Source** Workforce Participation Rate as per Census 2011 (https://www.census2011.co.in/) National Family Heath Survey- 5 (https://mohfw.gov.in › files › NFHS-5_Phase-II_0)
Prevalence of GBV	**Primary survey**

Parameters	Source
	Focus Group Discussions with women group (Seng Longkmie, Seng Kynthei) **Secondary Source** Police records National Crime Records Bureau (NCRB) (https://ncrb.gov.in)

1.4 STRUCTURE OF THE ESIA REPORT

This Environmental and Social Impact Assessment (ESIA) report has been structured into ten chapters including this introduction chapter as follows.

CHAPTER	DESCRIPTION
Chapter 1	INTRODUCTION
Chapter 2	LEGAL AND INSTITUTIONAL FRAMEWORK
Chapter 3	SUB PROJECT ROAD DESCRIPTION
Chapter 4	ANALYSIS OF ALTERNATIVES
Chapter 5	BASELINE ENVIRONMENT
Chapter 6	ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS
Chapter 7	STAKEHOLDER CONSULTATION AND INFORMATION DISCLOSURE
Chapter 8	ENVIRONMENTAL AND SOCIAL MONITORING & REPORTING PROGRAMME
Chapter 9	GRIEVANCE REDRESSAL MECHANISM
Chapter 10	CONCLUSION AND RECOMMENDATIONS

2. LEGAL AND INSTITUTIONAL FRAMEWORK

This chapter presents a review of all relevant acts, rules, and policies applicable to the proposed road development project.

2.1 APPLICABLE ENVIRONMENTAL AND SOCIAL REGULATIONS/ ACTS/ POLICIES AT NATIONAL AND STATE LEVEL

To define the scope of the environmental and social assessment for the proposed road improvement works, relevant laws, legislation, and policies at both national and state levels were reviewed. The findings are summarized in Table 2.1, which also includes a review of the legal and institutional framework applicable to indigenous and tribal communities as part of a targeted assessment.

Table 2.1.1: Applicable Environmental and Social Regulations/ACTs/Policies

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
ENVIRONMENTAL REGULATIONS					
1	Environment Protection Act/ Rules 1986	The Environment Protection Act, 1986 (the "Environment Act") provides for the protection and improvement of the environment. Under the Environment Act, the Central Government issues notifications for the protection of ecologically sensitive areas or issues guidelines for matters under the Environment Act	The various environmental quality standards notified under this act apply to MPWD works.	--	Meghalaya State Pollution Control Board (MSPCB)
2	EIA Notification 14th Sep 2006 and 17 March 2025	Borrowing of minerals (earth, sand, aggregates, etc.) will require prior environment clearance under mining category	Borrowing of minerals (earth, sand, aggregates, etc.) for embankment, bridge, approach road construction	Environmental Clearance through Contractor	SEIAA Meghalaya
3	Air (Prevention and Control of Pollution) Act, 1981, 1987	To provide for the prevention, control and abatement of air pollution, and for the establishment of Boards to carry out these purposes.	Air pollution from proposed Batching Plant or Hot mix plants and DG set during construction stage	Consent to Establish before Construction and Consent to Operate (Before Operation) through Contractor	Meghalaya State Pollution Control Board (MSPCB)
4.	Water Prevention and Control of Pollution) Act, 1974, 1988	To provide for the prevention and control of water pollution and the maintaining or restoring of wholesomeness of water.	Water pollution during the construction stage from labour camp	Consent to Establish before Construction and Consent to Operate (Before Operation) through Contractor	Meghalaya State Pollution Control Board (MSPCB)
5.	Noise Pollution	The ambient noise standards for day	Noise emission from proposed activities	regulatory clearance not required	MSPCB

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
	(Regulation and Control Act) 2000 and amendment till date	and night across various land use categories were notified by the MoEF&CC under the Noise Pollution (Regulation and Control) Rules, 2000, based on recommendations of the CPCB	during construction stage like operation of DG sets, equipment and concrete mixers should be within applicable standards	but noise monitoring results should be below applicable standard as per CPCB.	
6	Hazardous & Other Wastes (Management and Trans-boundary Movement) Rules, 2016 and March, 2024	Protection against improper handling, storage and disposal of hazardous waste. The rules prescribe the management requirement of hazardous wastes from its generation to final disposal.	Hazardous waste generation from proposed activities like generation of paints waste, used oil/waste oil, bitumen waste, etc.	Contractor to obtain authorization for storage, transport, and disposal of hazardous and other wastes	MSPCB
7	Construction and Demolition Waste Management Rules, 2016	To manage the demolition and construction waste and prevent environmental degradation	Construction and demolition waste will be generated from proposed activities	Permission will be required by Contractor.	Village Council, Municipal Boards
8	Solid Waste management Rules, 2016 and amended thereof	To manage solid waste or semi-solid domestic waste, sanitary waste	Solid Waste will be generated from proposed activities due to influx of labour	Permission will be required Contractor needs to submit plan for reuse or safe disposal	Village Council, Municipal Boards
9	Vehicle Act 1988 Central Motor	To minimize the road accidents, penalizing the guilty, provision of	Transportation of manpower and material will involve vehicular	PUC and fitness certificates, Insurance. Driving License, Fitness	State Transport Authorities approved

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
	Vehicle Rules 1989	compensation to victim and family and check vehicular air and noise pollution.	movement. Vehicles must have valid Pollution Under Control (PUC) certificates, Insurance, Fitness Certificate. Driver should have valid Driving License.	Certificate should be submitted to the PMU before the vehicle is mobilized in the project.	PUC certificate providers
10	The Gas Cylinder Rules 2016	To regulate the storage of gas / possession of gas cylinder more than the exempted quantity.	Gas cylinders may be used during welding and other electromechanical work. Storage within threshold quantity and as per capability analysis. Handling with defined safe practices	Yes, Permission will be required by the Contractor if the storage of gas / possession of gas cylinder is more than the exempted quantity (i.e more than 25 cylinders of total weight exceeding 200 kg for flammable non-toxic gases).	Petroleum and Explosives Safety Organization (PESO)
11	The Mines and Minerals (Development and Regulation) Act, 1957	For development and regulation of mines and minerals in a sustainable manner. The rules regulate the mining of mineral and dealerships for mining and trading.	The construction of works will require stones, aggregates, sand, earth, etc.	The mining permit, EC and CTO has to be submitted to the PMU for clearance. No material shall be procured without the approval .For material procured during the construction the e-transit pass would be submitted along with IUFR.	Mines and Mineral Department
12	Meghalaya Forest Regulation (Application and Amendment) Act,	The Act provides a comprehensive legal framework for conservation and sustainable use of bio-resources, reflects a strict regime for access,	Provisions of this act will not be applicable since road will not adversely affect any biological diversity	No	Meghalaya State Biodiversity Board

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
	1973	control and benefit sharing. It restricts access and use of biological resources by outsiders and creates decentralized institutional structures (State Biodiversity Boards -SBB and GP level Biodiversity Management Committees) for conservation of biological diversity.			
	Meghalaya Biodiversity Rules, 2010	Conservation of biological diversity, sustainable use of its components and fair and equitable sharing of benefits arising out of the use of biological resources	Provisions of this act will not be applicable since road will not adversely affect any biological diversity	No	Meghalaya State Biodiversity Board
21	Meghalaya Tree (Preservation) Act, 1976, and the Meghalaya Tree Felling (Non-Forest Areas) Rules, 2006	Conservation of forest and controlled felling of trees	Approx. 30 nos. of tree are falling within the ROW.	Permission for felling of trees. No tree felling shall be felled without permission from the Forest Department.	State Forest Department
22	Disaster Management Act, 2005	The purpose is to have an effective management of disasters and for matters connected therewith or incidental thereto	The project area falls under the seismic (earthquake prone) zone VI and hence construction activities/ interventions will be under purview of this act	No. Contractor should be aware of Guidelines/SOPs/Advisory of MSDMA	Meghalaya State Disaster Management Authority (MSDMA)/MPWD
23	Meghalaya Disaster	The rule is to provide measures' to be	During implementation, setting of	No	Meghalaya State

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
	Management Rules, 2008	adopted for prevention and mitigation of disaster; mitigation measure to be integrated with development plans and projects; build capacity and preparedness measure; and specify roles and responsibilities to each dept. in relation to adopted measure	labour camps and capacity building of contractor staff	Contractor should be aware of Guidelines/SOPs/Advisory of MSDMA	Disaster Management Authority (MSDMA)/MPWD
24	Plastic waste management Rules, 2016	The Plastic Waste Management Rules, 2016 provide a framework for the effective management of plastic waste. They aim to minimize the adverse environmental impact of plastic waste and promote sustainable practices for its handling and disposal.	Plastic waste generation from proposed activities. Safe disposal as per Rules	No. Properly segregate plastic waste at source and hand it over to authorized waste collectors, local bodies, or MSPCB authorized agencies/Recyclers	Village Council/ Municipal Authority/MSPCB
25	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	This international convention, to which India is a signatory category, lists the endangered flora and fauna and regulates trade of these species	Project Intervention does not involve any trade of Endangered species	No	Meghalaya Forest Department and Wildlife Crime Control Bureau, MoEF&CC
26	Petroleum Act, 1934, Petroleum Rules, 2002 (under the Petroleum Act, 1934)	Regulates the storage, transport, handling, and use of petroleum and diesel. Requires licenses for storage of petroleum products beyond prescribed limits.	Storage of High Speed Diesel (HSD) at construction sites (above threshold limits of 2,500 liters underground or 1,000 liters aboveground in drums/tanks) requires license/approval.	License for storage from PESO (Petroleum and Explosives Safety Organization); NOC from District Authority/Fire Department.	PESO, Nagpur (through Regional Office) & District Magistrate/Chief Controller of

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
					Explosives.
27	Ground Water Regulation (Central Ground Water Authority – CGWA Guidelines, 2017, adopted by States)	Governs the extraction of groundwater for industrial, infrastructure, or commercial use. Requires NOC/permission prior to abstraction.	Applicable (if groundwater extraction proposed) Groundwater extraction for construction, camp use, or dust suppression requires prior permission.	NOC for groundwater abstraction.	CGWA or State Ground Water Authority (if notified).
28	The Meghalaya Water Act, 2011	State-level mandate for use of surface water from rivers, streams, ponds, lakes, etc. for non-domestic/commercial purposes.	Construction water requirements may involve use of surface water from nearby streams/rivers with state approval.	Permission/Allocation order for surface water abstraction.	Water Resources/Irrigation Department, Government of Meghalaya.
SOCIAL REGULATIONS					
1	Article 244(2) &275(1) of the Constitution of India - The Sixth Schedule	Article 244(2) establishes Autonomous District Councils (ADCs) in tribal areas, granting them legislative and administrative powers, empowering them to legislate on land, resources, and local governance. Article 275(1) provides financial grants for the welfare and development of Scheduled Tribes and Scheduled Areas	Applicable in designated tribal areas under the Sixth Schedule	No	Government of India, Autonomous District Councils

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
2	The Meghalaya Transfer of Land (Regulation) Act, 1971	The Act stipulates that no land (including immovable property of every description and any rights over such property) in Meghalaya can be transferred by a tribal to a non-tribal or by a non-tribal to another non-tribal except with the prior sanction of the competent authority.	Relevant to all project interventions involving land acquisition, leasing, or transfer. The project will ensure that all land-related activities including documentation, due diligence, and land management planning comply with this Act. No land transfer or use will be undertaken without approval from the competent authority, ensuring protection of tribal land rights and consistency with ESS5 (Land Acquisition, Restrictions on Land Use, and Involuntary Resettlement).	No	Revenue Department; Village Councils- Autonomous District Councils (ADCs)
3	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	The Act ensures transparent land acquisition with fair compensation, rehabilitation, and resettlement. It sets minimum compensation norms, R&R entitlements, and facilities for the displaced, allowing states to enhance benefits. The Act also includes special provisions to protect the interests of Scheduled Castes and Scheduled Tribes.	Yes, as the area falls under 6th schedule, A review of the legal and institutional framework applicable to indigenous/tribal communities.	No	Revenue Department, Government of Meghalaya, Khasi Hills Autonomous District Council The Sixth Schedule establishes the ADC or VC as institutional mechanisms for governing these areas.

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
4	Meghalaya Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2017	Aim to provide a fair, transparent, and participatory process for land acquisition while ensuring adequate compensation and rehabilitation for affected families. These rules align with the broader objectives of the RFCTLARR Act to minimize the adverse impact of land acquisition and promote the welfare of those affected by it.	Impact on private Assets and properties	Ensure fair compensation and Guarantee transparency in the acquisition process.	Revenue Department/ District Administration, Village Council
5	Street Vendors (Protection of Livelihood and Regulation of Street Vending) Act, 2014 & Meghalaya Street Vendors (Protection of Livelihood and Regulation of Street Vending) Rules, 2016	It regulates street vending and protects the rights of street vendors by legalizing their right; protects them from sudden eviction or relocation; spells their rights and obligations.	Applicable to all Project road corridors in case of economic displacement and relocation of street vendors.	No	District Administration/ District Municipal Authority, Village Councils under the Autonomous District Councils
6	Rights of Persons with Disabilities Act, 2016	Ensures that the Persons with Disability (PWD) enjoy the right to equality, life with dignity, and respect for his or her own integrity equally with others.	For the entire project road corridor where PWD are present and affected, and for designing the project in an inclusive manner.	No	Department of Social Welfare, Government of Meghalaya

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
7	Right to Information Act, 2005	The Act provides for setting out the practical regime of right to information for citizens to secure access to information under the control of public authorities, in order to promote transparency and accountability in the working of every public authority, the constitution of a Central Information Commission and State Information Commissions and for matters connected therewith or incidental thereto.	All documents pertaining to the project would be disclosed to public.	No	Public Information Officer (PIO)
8	The Cadastral Survey and Preparation of Records of Rights Act, 1980 (as amended in 1991)	The Act provides for cadastral survey of lands and preparation of land records in the state. The 1991 amendment enables the ADCs to undertake cadastral surveys with financial and technical assistance from the State Government.	Applicable for project activities involving detailed mapping and verification of land ownership or tenure. Under Project, cadastral mapping and systematic land documentation will support preparation of RAP and verification of community and private ownership. Prior clearance from the concerned village councils will be obtained for all project interventions located on or adjacent to community forest land, in line with ESS1 and ESS5.	Yes	Revenue and Disaster Management Department; Autonomous District Councils (ADCs)
LABOUR LAWS APPLICABLE TO ESTABLISHMENTS ENGAGED IN BUILDING AND OTHER CONSTRUCTION WORK					

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
1	Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996	It regulates the employment and conditions of service of building and other construction workers and provides for their safety, health and welfare.	Applicable for all building or other constructions works under the project that employs 10 or more workers.	Establishment Registration is required	Labour Commissioner, Meghalaya
2	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.	Construction workers will be involved in the Project road corridors	Workmen compensation Insurance Policy	Commissioner for Workmen's Compensation
3	ESI Act, 1948 (Employees State Insurance Act, 1948)	Employees State Insurance Act provides for health care and hospitalization benefits for construction work force	Construction workers will be involved in the Project Road corridors	Insurance Policy.	Commissioner for Workmen's Compensation
4	Inter-state Migrant Workers Act, 1979	It protects workers whose services are requisitioned outside their native states in India. A contractor who employs or who employed five or more Inter-State migrant workmen need to obtain registration under this act	Construction workers will be involved in the Project Road corridors	Registration/Labour license	Labour Commissioner, Meghalaya

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
5	The Child Labour (Prohibition & Regulation) Amendment Act, 2016	It prohibits employment of children in specified hazardous occupations and processes and regulates the working conditions in others.	There should not be any child labour (less than 14 years) in any project activity and adolescents (above 14 and less than 18 years) in any hazardous activity.	No	Labour Commissioner, Meghalaya/ Department of Social Welfare, Government of Meghalaya
6	Sexual Harassment of Women at the Workplace (Prevention, Prohibition and Redressal) Act, 2013 (POSH Act)	It mandates every organization having more than ten employees to constitute an Internal Complaints Committee (ICC) in the prescribed manner to receive and address the complaints of any sort of sexual harassment from women in a time-bound and extremely confidential manner	Applicable to all implementing agencies	No	District Officer (District Magistrate or Additional District Magistrate) District Social Welfare Officer, Gov of Meghalaya
7	Contract Labour (Regulation & Abolition) Act 1970	To provide proper and habitable working conditions. To regulate the functioning of the advisory boards. To lay down the rules and regulations regarding the registration procedure of the establishments employing contract labour	Applicable to all implementing agencies	Labour License Required	Labour Commissioner, Meghalaya

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
8	Payment of Wages Act, 1936 and the Minimum Wages Act, 1948	Lays down as to by what date, wages are to be paid, when it will be paid and what deductions be made from the wages of the workers, if any.	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
9	Payment of Gratuity Act, 1972 The payment of gratuity rules Meghalaya 1972	Gratuity is payable to an employee under the Act on satisfaction of certain conditions on separation, if an employee has completed 5 years of service with employer	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
10	Employees Provident Fund and Miscellaneous Provision Act, 1952	Provides for monthly contributions by the employer and as well as by workers with a provision as return of pension of a lump sum (principal and interest accrued) at the end of his/her service term).	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
11	Maternity Benefit Act, 1951 Meghalaya Maternity benefit Rules 1965	Provides for maternity leave for women, during pregnancy and after giving birth and some other benefits to women employees, in case of medical recommendation of bed rest or miscarriage etc.	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
12	Payment of Bonus Act, 1965 The Payment of Bonus Rules Meghalaya 1975	Provides payments of annual bonus subject to a minimum of 8.33% of wages and maximum of 20% of wages.	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
13	The Bonded Labour (Abolition) Act 1976 Bonded Labour System (Abolition) Rules 1976	An Act to provide for the abolition of bonded labour system, with a view to prevent economic and physical exploitation of the weaker sections of the people and for all matters connected there with or incidental thereto	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
14	The Trade Union Act, 1926	Lays down the procedure for registration of trade union of workers and employers. The trade unions registered under the Act have been given certain immunities for civil and criminal liabilities.	Applicable to all implementing agencies	No	Labour Commissioner, Meghalaya
15	Schedule Caste and Schedule Tribe (Prevention of Atrocities Act 1989)	Atrocity with SC and ST community is defined as an offense punishable under Section 3 of the Act	Project Area is protected under Sixth Schedule of the Constitution	No	Social Welfare Department, Meghalaya

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
16	Meghalaya Right to Public Services Act, 2020	Ensures timely delivery of notified public services to citizens by government departments, enhancing transparency, accountability, and efficiency in governance.	Applicable to all government departments and public service providers in Meghalaya	No	Meghalaya State Public Services Delivery Commission (MSPSDC)
17	Occupational Safety, Health & Working Conditions (OSH) Code, 2020 + Meghalaya Factories Rules, 2015	Site safety standards, PPE, welfare amenities, working hours, accident reporting, medical checks, registration of establishments.	Applicable to all construction, labour camps, work fronts, and site facilities	Yes*	Labour Commissioner, Meghalaya
18	Code on Wages, 2019 + Meghalaya Minimum Wages Notifications (latest revision)	Minimum wages (Skilled/Semiskilled/Unskilled), equal pay, wage slips, timely payment, prohibition of illegal deductions.	Applicable to all wage payments through contractors and subcontractors at MLCIP sites.	Yes*	Labour Commissioner, Meghalaya
19	Industrial Relations (IR) Code, 2020 + Meghalaya Industrial Disputes Rules, 1973	Conciliation, dispute settlement, prohibition of unfair labour practices, notice of changes in service conditions.	Applicable for grievance redress, worker disputes, conciliation and retrenchment-related issues.	Yes*	Labour Commissioner, Meghalaya

Sl. No.	Relevant Acts and Policies	Mandate of the Act/ Policy	Reason for applicability/ Non-Applicability	Regulatory Clearance Requirement	Authority
20	Code on Social Security, 2020 + Meghalaya BOCW Welfare Board Rules, 2006	Social security benefits, maternity benefits, PF/ESI, construction worker registration, insurance and disability benefits.	Applicable to EPF/ESI coverage (where notified), worker registration, welfare board benefits.	Yes*	Labour Commissioner, Meghalaya
• The labour codes shall be applicable in the State of Meghalaya upon receiving notification from the GoM.					

2.2 IRC AND MORTH CODES APPLICABLE TO THE SUB PROJECT

All road works in India must comply with the IRC, MoRTH guidelines and BIS Codes. Key relevant IRC codes that may directly or indirectly influence environmental and social management during the design, construction and operational phases are given in **Annexure 2.1.**

2.3 LAND REVENUE GOVERNANCE AND ADMINISTRATION IN KHADC

The Khasi Hills Autonomous District Council (KHADC), constituted under the Sixth Schedule of the Constitution of India, is empowered under Paragraph 8 of the Sixth Schedule, to assess and collect land revenue and levy taxes within its jurisdiction. Under Paragraph 3 of the Sixth Schedule, the Council also holds legislative authority over specified matters, including land allotment and land use. The jurisdiction of KHADC encompasses the entire East Khasi Hills District.

The sub-project falls in Khasi Hills Autonomous District Council (KHADC). The traditional land tenure management systems practiced by the Khasis are summarized in **Table 2.2**.

Table 2.1-2: Traditional systems for Land Tenure Management amongst Khasis

Category	***Khasis***
Basis of classification	Purpose or ownership of land
Type of land	2 types of ownership (Ri Kynti or private land; Ri Raid or communal lands) 15 sub- categories of ownership or use (Refer to Table 2.3)
Control and Management	Ri Kynti = Family-managed private land (individual or kur ownership). Ri Raid = Clan- or community-managed communal land (under Durbar Raid authority)
Inheritance	Women inherit and own property[2]: The ancestral property and other inheritable forms of property like self-acquired (if not alienated), are inherited by the daughters. Khatduh (youngest daughter) gets a major share of the property, though it is incumbent upon her to maintain other members of the family if they so need[3]
Records	The Khasis do not have any formal land records. There could be boundary marks for demarcating villages or parcels of land holdings. Hima Mylliem (in case of Shillong) has pattas which they issue to the landowners on request as evidence ownership of land. The Hima also maintains a record of such pattas. Sometimes, documents could be issued by the village Dorbar (*dulir*) which is also recognized by people as a form of land record as is the practice in this project area. Nature and form of *dulir* varies as it is not standardized by any authority.

[2] There do exist certain variances to this principle, like among the Wars, wherein sons have a share onto the property (Khongpai, 1974, p. 13)
[3] Bareh, 2016, pp. 326–330

Category	***Khasis***
Systems for sale/purchase/ mortgage	The decision to sell land is made by the family. The village headman stands as the witness to such transactions. The parties are at liberty to register the transaction with formal authorities. Conveyance of land is a practice when there is a need to mortgage land.
Managing private property	The authority to manage the property is vested in the Kni (maternal uncle)4.
Managing community property	For Clan lands or the community lands, it is the *Durbar* that oversees taking decisions for such lands. It is the *Durbar Kur* or the *Durbar raid* in charge of such decisions (Male dominant or only male group)

[4] Thus, it has been opined that amongst traditional Khasi societies, descent follows through the female while authority vests in the maternal uncles (Passah, 2017; Syiem, 2017).

3. SUB PROJECT DESCRIPTION

3.1 WMP SUB PROJECT ROAD

The Weiloi - Mawsynram Road up to Phlangwanbroi (WMP) is part of a state highway (SH4) which connects onwards to Shillong via NH 106. Mawsynram, in East Khasi Hills district is reportedly the wettest place on earth and is also an important tourist location. The proposed WMP sub project road has a total length of 27.858 km, starting from Weiloi at Chainage 22+500 and extending up to Phlangwanbroi at Chainage 48+881 including 1.547km bypass from Chainage 33+200 RHS to Chainage 35+100 RHS near Mawsynram Market. The Proposed Road existed before the formation of Meghalaya state as per discussions with the MPWD officials.

3.2 LOCATION DETAILS OF THE WMP SUB PROJECT ROAD

The project road traverses a diverse landscape, encompassing hilly terrains, agricultural fields, and built-up areas, while passing through nine villages along its alignment. This WMP road plays a vital role in enhancing regional connectivity by linking economic hubs and facilitating access to industrial centers as well as tourism destinations. **Table 3.1** presents the chainage-wise details of the corridor and the alignment of the road is shown in **Figure 3.1**.

Table 3.1: Chainage wise WMP Road stretches details

Sl. No.	Starting Chainage	End Chainage	Corridor No.	Project length
1	22+500	48+920	8	26.42
2	0+000	1+547		1.547

Source: DPR

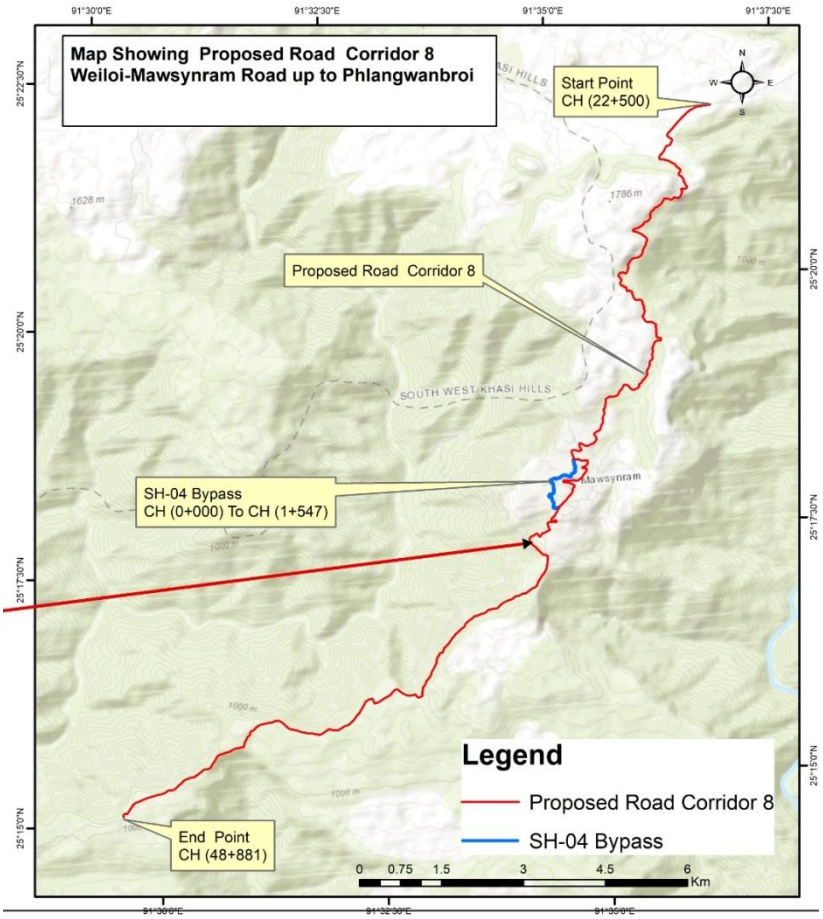


Figure 3.1: Road alignment map for WMP Road

3.3 PROJECT INFLUENCE AREA

For the purpose of this study, the Project Influence Area has been categorized in three tiers to facilitate a holistic environmental and social impact of the road stretch and to minimize potential environmental and social risks. Three tiers are given below

- 12 m of ROW for Direct Impact (6m from Centre line) i.e. Corridor of Direct Impact (CoI)
- 500 m buffer on either side of the RoW for indirect impact area [5]i.e. Corridor of Indirect Impact
- 10 km of study area (Project Influence Area)

The existing Right of Way (12 m) of the corridor has been considered adequate for characterizing baseline conditions and for assessing direct socio-economic impacts, including the profile of affected persons, religious structures, and common property resources. In stretches where the proposed RoW extends beyond the existing RoW to accommodate hill cutting or slope stabilization measures, the socio-economic assessment has been undertaken based on the actual proposed RoW.

The indirect impact area has been delineated as 0.5 km on either side of the proposed RoW from the Centre Line of the sub project road. This buffer has been considered adequate to cover drainage channels, biodiversity-rich zones, natural habitats, protected areas, agricultural land, landslide- and landslip-prone stretches, marshy areas, surface water bodies, physical features, and settlements, among others.

[5] Based on Earlier experiences it was observed that dust, noise and other environmental parameters would get attenuated/diluted to meet existing baseline conditions within 500 m from the source.

The project influence area has been delineated with a buffer of up to 10 km from the periphery of the proposed RoW to identify environmentally sensitive features such as protected areas, wildlife sanctuaries, national parks, wetlands, and wildlife corridors.

The following sections of this chapter provide details of the existing road characteristics, key project components, resource requirements and proposed improvements.

3.4 KEY EXISTING CONDITIONS AND PROPOSED IMPROVEMENTS OF THE WMP ROADS

The key existing conditions along the WMP project road, together with the proposed improvements, are outlined in the following sub-sections. These have been described based on findings from the primary field surveys as well as details provided in the Detailed Project Report (DPR).

3.4.1 RIGHT OF WAY, CARRIAGE WIDTH, PAVEMENT CONDITIONS AND JUNCTIONS

The existing Right of Way (RoW) for the project road is 12 m, while the existing carriage varies between 3.75 m and 5.5 m. Details of the existing and proposed carriageway (CW) are summarized in Table 3.2. The pavement along the project stretch is bituminous, with its overall condition ranging from fair to poor, and most sections being in poor condition. Earthen shoulders of about 0.5 to 1.0 m width are provided on both sides; however, their condition has also been observed to be poor.

Table 3.2: Details of Existing Carriage way

S. No.	Chainage in Km		Length in km	Existing Carriageway width in (m)	Proposed Carriageway width in (m)
1	22.500	22.600	0.100	5.500	5.5
2	22.600	34.700	12.100	3.750	5.5
3	34.700	35.000	0.300	5.500	5.5
4	35.000	46.600	11.600	3.750	5.5
5	46.600	47.300	0.700	5.500	5.5
6	47.300	48.920	1.620	3.750	5.5
7	0+000	1+547	1.547	3.750	5.5

Source: DPR

Pavement Details:

The existing pavement along the project stretch is bituminous. Its general condition ranges from fair to poor, with most sections observed to be in poor condition as per finding from the DPR and field observations. Earthen shoulders are provided on both sides, with a width of about 1.0 m; however, their condition is also assessed as poor.

For the MLCIP project, the pavement design adopts a multi-layered approach, utilizing materials of specified thicknesses to ensure durability and performance. The pavement layers consist of:

- Bituminous Concrete (BC): 30 mm
- Dense Bituminous Macadam (DBM): 50 mm

- Cement-Treated Base (CTB): 150 mm
- Cement-Treated Sub-Base (CTSB): 200 mm

This results in a total pavement thickness of 430 mm, providing a robust structure capable of withstanding diverse traffic loads and environmental conditions.

Junctions Details:

Along the project stretch, there are 2 major intersections and 14 minor intersections. The details of these junctions are provided in **Table 3.3**.

Table 3.3: List of Junctions Weiloi- Mawsynram Road upto Phlangwanbroi Section

Sr. No	Chainage	Side	Direction	Type of Junction
1	22.500	RHS	Mawkyrwat-Shillong Road	**Major**
2	22.900	RHS	Laitmawsiang	Minor
3	24.090	RHS	Wahmawpat	Minor
4	32.820	RHS	Jawahar Navodaya Vidhalaya	Minor
5	33.290	RHS	Convent Road	Minor
6	33.870	LHS	Mawjymbuin Road	Minor
7	34.800	LHS	Village Road	Minor
8	35.200	RHS	Village Road	Minor
9	35.580	LHS	Higher Secondary School Mawsynram	Minor
10	36.900	LHS	Phlang	Minor
11	37.510	LHS	Nonglait	**Major**
12	43.080	LHS	Village Road	Minor
13	44.220	RHS	Mawkasain	Minor
14	45.330	RHS	Mawkasain	Minor
15	45.840	LHS	Phlangwanbroi View Point	Minor
16	46.350	LHS	Phlangwanbroi View Point	Minor

3.4.2 PROPOSED ROAD CROSS SECTIONS

The Weiloi–Mawsynram Road up to Phlangwanbroi traverses' terrain ranging from 932 m to 1,963 m above mean sea level. Based on the earthwork analysis as presented in Table 5.2 in Chapter 5, the total quantity of material to be excavated (cut) along the project corridor is 202270 m^3, while the total fill requirement is 147965 m^3. After balancing the cut and fill volumes, there remains a surplus of approximately 54305 m^3 of excavated material that will need to be safely disposed of at designated muck disposal sites. This approach ensures effective earthwork management while minimizing environmental impacts and maintaining slope stability along the project corridor.

A total of seven Typical Cross-Sections (TCS) have been proposed in the DPR for the 27.858 km project road. These TCSs vary across the alignment, with certain sections incorporating intermediate lanes. Each cross-section has been designed to address the specific terrain and infrastructure requirements, including provisions for road widening, slope stabilization, drainage, and utility corridors. Implementation of these cross-sections may also lead to environmental and social impacts, such as tree cutting, alteration of natural landscapes, potential biodiversity loss, and disruption of local ecosystems.

The details of different cross-sections, along with the chainage-wise cross-section designs adopted, are provided in **Annexure 3.1. TCS-Wise Consolidated Chainage Table is presented in Table 3.4.** The TCS are presented in figure 3.2.

Table 3.4: TCS-Wise Consolidated Chainage

TCS	Chainage Stretches (Start–End km)	Total Length (km)
TCS-1	22.500–22.540; 34.695–34.930	0.275
TCS-2	22.540–22.780; 34.930–35.110; 43.050–44.150; 45.850–46.010; 46.130–47.320	2.870
TCS-3	23.540–25.930; 25.995–26.210; 26.585–26.885; 27.740–28.000; 28.100–28.770; 29.460–29.690; 29.790–30.000; 30.110–30.250; 30.620–31.298; 31.435–31.720; 31.750–33.206; 33.476–33.790; 35.110–35.400; 35.500–35.650; 35.750–36.050; 36.310–43.050; 44.150–45.850; 46.010–46.130; 47.320–48.811; 0.000–0.880	18.819
TCS-4	22.780–23.540	0.760
TCS-5	34.370–34.695; 35.400–35.500; 1.150–1.547	0.822
TCS-6	25.930–25.995; 26.210–26.585; 26.885–27.560; 27.660–27.740; 28.000–28.100; 29.110–29.460; 29.690–29.790; 30.000–30.110; 30.250–30.430; 31.298–31.435; 31.720–31.750; 33.206–33.476; 33.790–34.370; 35.650–35.750; 36.050–36.310; 0.880–1.150	3.682
TCS-7	27.560–27.660; 28.770–29.110; 30.430–30.620	0.630
Grand Total	—	**27.858 km**

3.4.3 SETTLEMENTS AND CORRIDOR CHARACTERISTICS

3.4.3.1 Settlements:

The WMP Road passes through hilly terrain, rural settlements and towns. The project incorporates a comprehensive drainage system to ensure proper surface runoff management along the corridor. The details of the settlements along the stretch are presented in **Table 3.5**.

Table 3.5: Chainage wise List of villages & towns along project road

S. No.	Village Name	Chainages in KM		Length	Block/district	Available ROW
		Start Point	End Point			
1	Weiloi	22.500	22.900	0.400	Mawsynram/ East Jantia Hills	12 m
2	Wahmawpat	24.000	24.200	0.200	Mawsynram/ East Jantia Hills	12 m
3	Mawsynram	31.400	37.600	0.200	Mawsynram/ East Jantia Hills	12 m
4	Laitsohum	38.300	38.500	0.200	Mawsynram/ East Jantia Hills	12 m
5	Mawrapad	43.000	45.300	0.300	Mawsynram/ East Jantia Hills	12 m
6	Mawkasain (RHS)	45.300	45.800	0.500	Mawsynram/ East Jantia Hills	12 m
7	Mawsawa (LHS)	46.500	47.000	0.500	Mawsynram/ East Jantia Hills	12 m
8	Kenbah Malai	47.500	48.000	0.500	Mawsynram/ East Jantia Hills	12 m
9	Phlangwanbroi (LHS)	47.500	48.000	0.500	Mawsynram/ East Jantia Hills	12 m

3.4.3.2 Cross Drainage Details

The cross-drainage details for the sub project are presented in Table 3.6.

Table 3.6: Cross drainage details for the sub project road

Sl. No.	Category	Description	Nos.
A	Major Bridge	—	Nil
B	Minor Bridge	Up to 30 m waterway	12
C	Minor Bridge	More than 30 m waterway	Nil
D	Culverts (Total)	—	260
(i)	Culverts	Pipe Culverts	32
(ii)	Culverts	Slab Culverts	5
(iii)	Culverts	Stone Masonry Culverts	223

3.4.3.3 Retaining Structure Details

The retaining structure details for the sub project are presented in Table 3.7.

Table 3.7: Retaining structure details for the sub project road

Sl. No.	Structure Type	Length (m)
A	Breast Wall	1,392
B	Gabion Wall	40
C	Retaining Wall	4,402
D	Toe Wall	630

3.4.3.4 Cutting Details

Earthwork details in the project area is presented in Table 3.8.

Table 3.8: Earthwork details in the project area

Sub Project Road	Fill (m^3)	Cut (m^3)
WMP	61265.620	120107.610

3.4.3.5 Bus Shelter and Street Lights

Bus Shelter & Public Toilet have been proposed at Ch. 34.750, Ch. 46.900, Ch. 38.320, Ch. 43.200, Ch. 43.880, Ch. 44.100, Ch. 42.980, Ch. 30.100, Ch. 48.000, Ch. 44.460, Km 24.050 and Km 24.450. In addition, Street Lights have been proposed from Km 34.695 to Km 35.110 on both sides, at Ch. 46.900, Ch. 38.320, Ch. 30.100, and along with Bus Shelter/Public Toilet provisions at Ch. 48.000, Ch. 44.460, Km 24.050 and Km 24. These have been proposed based on discussions with the community and is an outcome of the FPIC process.

3.4.3.6 Bio engineering Works

Bioengineering using local broom grass, vetiver/local grasses has been proposed. Turfing will be provided on embankment slopes for erosion control, and jute netting is also proposed. Bioengineering measures have been provided at the Table 3.9.

Table 3.9: Details of Bioengineering measures

Sr. No.	Proposed Chainage		Length in (kms.)	SIDE
	Start	End		
1	25.910	25.970	0.060	RHS
2	26.050	26.150	0.100	RHS
3	26.270	26.450	0.180	RHS
4	34.270	34.695	0.425	RHS
5	35.400	35.500	0.100	LHS
6	44.220	44.270	0.050	LHS
7	44.320	44.370	0.050	LHS
8	44.410	44.440	0.030	LHS
9	1.150	1.547	0.397	LHS
		Total Length	**1.392**	

Details of Cutting are provided in Table 3.10.

Table 3.10: *Details of Cutting*

Sr. No.	Start Chainage (km)	End Chainage (km)	Length (km)	Side
1	35.400	35.500	0.100	LHS
2	44.220	44.270	0.050	LHS
3	44.320	44.370	0.050	LHS
4	44.410	44.440	0.030	LHS
5	1.150	1.547	0.397	LHS
6	25.910	25.970	0.060	RHS
7	26.050	26.150	0.100	RHS
8	26.270	26.450	0.180	RHS
9	34.270	34.695	0.425	RHS
		Total	1.392	

3.4.3.7 Corridor Characteristics

The salient features of the WMP road are presented in **Table 3.11**.

Table 3.11: Salient features of the Existing WMP Road

Sl. No.	Characteristics	Details
1	Name of Road	Weiloi - Mawsynram Road upto Phlangwanbroi
2	Project road corridor road Length	27.858 km
3	District	East Khasi Hills
4	Villages/settlements enroute	09 villages
5	Terrain	Hilly
	Existing	The present configuration of the road varies from Single Lane Road to Intermediate Lane. The road is affected by various surface damages including potholes, cracks and other forms of deterioration.
6	Proposed treatment	Improvement of sharp curves within the RoW, reconstruction of weak and damaged/ new culverts and bridges, rehabilitation and strengthening of existing pavement to intermediate lane and protection works.
7	Bridges	No. of Major Bridge – 0 No. of Minor Bridges – 12
8	Culverts	260
9	Forests / environmentally sensitive areas	Within 0.5 km of the project road, habitats include a mix of natural and modified ecosystems influenced by hilly terrain and human activities. Natural habitats feature with bamboo and degraded grasslands.
10	Religious Structures Affected	No religious structure is affected, however there are 04 nos. of churches and one memorial ground along the project road.
11	Fifth/Sixth Scheduled Areas	Sixth Schedule Area
12	River crossings	River crossing at 22+800
13	Water bodies / ponds	1 River (Wah Umkynrem)
14	Sensitive receptors	04 nos. of churches and 03 nos. of School and one memorial ground
15	Common Property Resources	There is no direct impact on any of these CPR. Refer Table 5.25 for chainage wise details of CPR.
16	Transshipment areas/truck parking locations	Nil

Sl. No.	Characteristics	Details
17	Other features / issues if any	Nil
18	Land requirement	No additional land requirement is anticipated for the proposed road project, however for spoil disposal, 4.466 ha of land is required which will be taken on lease and will be returned to the landowner after project completion. Refer to Table 3.15

3.4.4 TREES

Approximately 30 trees and 5 non-trees are situated within the existing Right of Way (RoW) on both sides of the road. The chainage wise details of trees are presented in Table 3.12.

Table 3.12: Chainage wise list of Trees

Sl. No.	Chainage (km)	LHS/RHS	Common Name	Botanical Name	Girth at Breast Height (cm)
1.	23+634	LHS	Dieng-rang	*Schima wallichii*	62
2.	23+634	RHS	Dieng-soh-lang	*Castanopsis* spp.	58
3.	24+045	LHS	Dieng-sher	*Alnus nepalensis*	54
4.	24+624	RHS	Dieng-sher	*Alnus nepalensis*	48
5.	24+952	RHS	Dieng-soh-long	*Michelia champaca*	52
6.	25+260	RHS	Sohphie	*Myrica esculenta*	28
7.	27+359	RHS	Dieng-soh-lam	*Sterculia villosa*	55
8.	28+507	LHS	Sohphie	*Myrica esculenta*	72
9.	28+507	LHS	Dieng-sher	*Alnus nepalensis*	50
10.	29+085	RHS	Dieng-sher	*Alnus nepalensis*	45
11.	29+051	LHS	Dieng-soh-long	*Michelia champaca*	47
12.	29+051	RHS	Dieng-soh-long	*Michelia champaca*	56
13.	29+036	RHS	Dieng-sher	*Alnus nepalensis*	38
14.	28+982	RHS	Dieng-soh-long	*Michelia champaca*	50
15.	29+788	RHS	Sohphie	*Myrica esculenta*	25
16.	33+239	LHS	Dieng-soh-lam	*Sterculia villosa*	60
17.	33+262	LHS	Sohphie	*Myrica esculenta*	68
18.	33+396	LHS	Dieng-sher	*Alnus nepalensis*	52
19.	33+373	LHS	Dieng-sher	*Alnus nepalensis*	42
20.	33+700	RHS	Sohphie	*Myrica esculenta*	26
21.	33+700	RHS	Dieng-soh-lam	*Sterculia villosa*	58

22.	33+708	RHS	Sohphie	*Myrica esculenta*	74
23.	33+708	RHS	Dieng-rang	*Schima wallichii*	57
24.	38+682	LHS	Dieng-sher	*Alnus nepalensis*	44
25.	39+019	LHS	Dieng-rang	*Schima wallichii*	70
26.	39+569	LHS	Dieng-soh-lang	*Castanopsis* spp.	62
27.	42+722	LHS	Dieng-sher	*Alnus nepalensis*	59
28.	43+900	LHS	Dieng-sher	*Alnus nepalensis*	41
29.	43+900	RHS	Dieng-soh-long	*Michelia champaca*	48
30.	43+964	LHS	Sohphie	*Myrica esculenta*	24
Non Tree					
31.	26+699	RHS	Bamboo	*Bambusa* spp.	20
32.	29+828	RHS	Bamboo	*Bambusa* spp.	28
33.	33+700	RHS	Bamboo	*Bambusa* spp.	24
34.	44+455	LHS	Bamboo	*Bambusa* spp.	29
35.	44+455	LHS	Bamboo	*Bambusa* spp.	27

To mitigate the ecological impact of tree felling, compensatory plantation (@1:10) would be carried out, in accordance with applicable environmental regulations and guidelines. These measures, along with their implementation strategies, are comprehensively detailed in the Environmental and Social Management Plan (ESMP).

3.4.5 Utility Details

A total of 720 nos. of electric poles is identified along the WMP road corridor for shifting. Of these, 512 poles are on the LHS and 208 on the RHS. Details of utilities are given in Annexure 6.2.

3.5 COMPONENTS & ACTIVITIES OF THE PROPOSED PROJECT

The development of the road would necessarily entail the following three stages. Each of the stages would have several activities and sub-activities. The three stages are

3.5.1 DETAILED DESIGN AND PRE-CONSTRUCTION STAGE

- Carrying out ESIA studies & preparation of ESMP and other Environmental and Social management instruments such as RAP, IPDP, LMP, SEA/SH plan and OHS plan
- Finalization of alignment with incorporation of environmental, social and community concerns in addition to the design and safety aspects

- Community consultation for land identification for borrow areas, disposal sites, water availability, siting of camps, tree felling permission
- Identification of sources of construction material
- Contractor mobilization
- Setting of Construction Camp

3.5.2 CONSTRUCTION STAGE

- Site clearing & construction camp establishment
- Construction Material procurement & transportation
- Earthwork, hillside cutting, if required, embankment construction, GSB, WBM, operation of equipment, plant and machinery
- Structure demolition & construction work, if required
- Disposal site management
- Surfacing and shoulder protection & road furniture

3.5.3 POST-CONSTRUCTION, OPERATIONS & MAINTENANCE STAGE

- Decommissioning and restoration of camp area, removal of Construction & demolition waste, Restoration of borrow area, disposal sites.
- Operation of vehicles and safety of road users

3.6 RESOURCE REQUIREMENTS

For the proposed road project, assessing the availability of suitable construction materials in the vicinity of the project road is essential. The major materials required include soil, sand, aggregates, bitumen, steel, and cement. Surface water will be utilized for construction purposes, subject to prior permission from the Irrigation/Water Resources Department. Details of the construction materials, their sources, and corresponding lead distances are provided in **Table 3.13**.

Table 3.13: Details of construction material, sources along with the lead

Material	Unit	Quantity	Quarry / Source Location	Lead (in km)	Surfaced Road	Unsurfaced Gravelled Road
Building Stone/ Boulders	Cum	22304	5th Km of Mawphlang-Balat Road	36.00	31.000	5.00
Stone Metal/ Aggregates/ GSB/ Stone Chip/ Filter Material/	Cum	104284	5th Km of Mawphlang-Balat Road	36.00	31.000	5.00
Sand/ Blindage/ Binding Materials	Cum	61280	20th Km of Mawphlang-Balat Road	36.00	16.000	20.00
Cement	MT	10223	Shillong	77.00	76.000	1.00
HYSD bar	MT	603.55	Shillong	77.00	76.000	1.00

Assessing the availability of suitable construction materials near the project road is crucial for a road project. Surface water from the Wah Umkynrem can be used for road construction with prior permission from the concerned authority.

3.6.1 VOLUME OF CIVIL WORKS

The volume of civil works for MLCIP will depend on the construction methods employed, the typical cross-sections, and the specific materials used within the sub-project area. These civil works are critical to ensuring the highway's stability, safety, and environmental sustainability, thereby contributing to the long-term success of the road project. Details of the materials used including Bituminous Concrete (BC), Dense Bituminous Macadam (DBM), Prime Coat (PC), Tack Coat (TC), Granular Sub Base (GSB), and Wet Mix Macadam (WMM) treatments are provided in **Annexure 3.3**. The use of this comprehensive range of materials ensures the road's strength, durability, and overall performance.

The total quantity of material to be excavated (cut) along the project corridor is 202270 m^3, while the total fill requirement is 147965 m^3. After balancing the cut and fill volumes, there remains a surplus of approximately 54305 m^3 of excavated material. This excess earthwork shall be disposed of or utilized by the contractor only at designated and pre-approved disposal sites identified by the Meghalaya Public Works Department (MPWD), in accordance with environmental management and safety norms. Details for the muck disposal site is presented in **Table 3.14**.

Table 3.14: Details for the Spoil disposal site

S.No.	Location	Distance from WMP road (m)	Area of disposal site (ha)	Quantity of Spoil to be disposed (cu.m)	Environment Sensitivity (If any)
1	Umnongrim village at Ch 24+600 km	400	1.665	20594.696	No specific environmental sensitivity noted
2	Mawsynram at Ch 37+300 km	10	2.49	33539.934	To minimize environmental impacts, all efforts will be made to avoid cutting trees, and the site will be managed to preserve existing vegetation.
3	Phlangwanbroi at Ch 48+100	10	0.311	4707.36	No specific environmental sensitivity noted

Further, recycling and reuse of existing pavement materials shall be carried out as per MoRTH Specifications for Road Works (latest revision) and IRC: 120 guidelines. This approach promotes cut-and-fill optimization, reduces the requirement for fresh borrow materials, minimizes construction waste, and ensures compliance with the Solid Waste Management Rules, 2016 and Environmental (Protection) Act, 1986.

3.7 LAND REQUIREMENTS

No additional land requirement is anticipated for the proposed road project, as all construction activities are planned to be carried out entirely within the existing 12-metre Right of Way (RoW). However, for spoil disposal, 4.466 ha of land is required. The land required for spoil disposal sites will be used on a temporary basis through lease arrangements and will be returned to the landowner upon completion of the project, after restoration and redevelopment in accordance with their requirements. The Consultants along with the officials of the PWD and

members of the Village Community including the Rangbah Shnong jointly identified 3 locations for dumping of spoils. The Details for the same is presented in **Table 3.15**.

Table 3.15: Details of land requirement for dumping yard

Sl No	Location	Ownership	Area in Ha	Volume (Cum)	Latitude	Longitude
1	37.300	Community Land	2.490	29868	25.285833°	91.573711°
2	24.600	Community Land	1.665	19550	25.350478°	91.610545°
3	48.100	Community Land	0.311	4887	25.248979°	91.489376°
Total			4.466	54305		

Further, recycling and reuse of existing pavement materials shall be carried out as per MoRTH Specifications for Road and Bridge Works (latest revision) and IRC:120 guidelines. This approach promotes cut-and-fill optimization, reduces the requirement for fresh borrow materials, minimizes construction waste, and ensures compliance with the Solid Waste Management Rules, 2016 and Environmental (Protection) Act, 1986.

3.8 WATER REQUIREMENTS

The overall water requirement of the project is 72.1 KLD, of which 64.1 KLD will be used for construction activities and 8 KLD is required for domestic purposes. Details of the water requirement assessed for the project road are presented in **Table 3.16**. The source for the same is River Umkynrem.

Table 3.16: Water Requirement for Construction Works

Activity	Daily Demand (Liters/km)	Total for 27.858 Km (Liters/day)	Remarks
Concreting and curing	1009.52	28123.21	Concrete mixing, compaction, culverts, drains.
Dust Suppression at Work Zone	82.19	2289.64	Reduced due to frequent rain; use only on dry days.
Domestic Purpose	-------	5400	For 60 workers (drinking, cooking, sanitation).
Total	—	**35812.85 Liters/day**	—

3.9 MANPOWER REQUIREMENT AND IMPLEMENTATION SCHEDULE FOR THE SUB PROJECT

The workforce requirement, as per consultations with the DPR, will vary during different stages of construction, with peak manpower estimated at about 60 persons. Around 65–70% of the labour force is expected to be sourced locally, while skilled personnel such as machine operators, concrete casting crews, supervisors, and engineers may be engaged from outside the project area and accommodated in construction camps. The construction of the 27.858 km project stretch is planned to be completed within a period of 36 months. The total estimated cost of the project as per the DPR is approximately INR 124.01 crore.

4 ANALYSIS OF ALTERNATIVES

4.1 INTRODUCTION

In line with best practices for managing environmental and social impacts, several alternative approaches have been considered for the proposed road widening and upgrade project. The design is being refined to enhance safety, improve the road structure, and accommodate both current and future traffic demands. This chapter presents an analysis of the potential impacts under the "With Project" and "Without Project" scenarios.

4.2 WITH AND WITHOUT SUB PROJECT ALTERNATIVES

An alternative analysis was conducted for the project stretch, considering various design scenarios as well as a "Without Project" scenario. These are described in the following sections.

4.2.1 WITHOUT SUB PROJECT SCENARIO

The road traverses' areas with high population densities, particularly in Mawsynram, as well as hilly and rural stretches where traffic is frequently disrupted due to poor road conditions and the demand for efficient through-traffic movement. This situation is further exacerbated by land-use conflicts, including uncontrolled development along the route and encroachments within the designated right-of-way.

The continued growth in population, rising traffic volumes, and expanding economic activity along the corridor are likely to exacerbate the existing challenges. Without the proposed upgrades, current road safety hazards and adverse environmental impacts along the route are expected to persist and worsen. Additionally, the limited socioeconomic development of these remote and underdeveloped areas would remain constrained. Therefore, halting the project would not be practical or justified, as it would impede essential improvements and limit the potential for economic growth in the region.

4.2.2 WITH SUB PROJECT SCENARIO

The "With Sub Project" scenario is expected to generate positive long-term impacts across social, environmental, economic, and financial dimensions. Key interventions include widening the existing roadway to intermediate lanes, in line with the project's objectives.

From an economic perspective, the project is viable and is anticipated to substantially improve current conditions, supporting the development goals set by the Government of Meghalaya and enhancing the region's growth potential.

While the project promises multiple developmental benefits, it is important to recognize that, like all infrastructure initiatives, it may also result in certain impacts on the environment and local communities.

Potential environmental and social impacts can be mitigated through the adoption of best environmental management and social development practices. Where impacts cannot be fully avoided, suitable mitigation measures will be implemented to minimize and offset adverse effects. A detailed comparison of the "With Sub Project" and "Without Sub Project" scenarios, along with the anticipated benefits of the proposed project, is presented in **Table 4-1**.

Table 4.1: "With and Without" Sub Project Scenarios – A Comparative Assessment

Component	"With" Sub Project Scenario	'Without" Sub Project Scenario
Highway Geometry	Intermediate lane with shoulder and paved surface is being developed with geometric improvements	Existing Single/Intermediate Lane carriageway with poor geometry
Design Speed	(30-50 kmph for Intermediate Lane)	30-40 kmph entire project section.
Congestion in	Improved carriageways with good	Lack of road or lack of good road surface

Component	"With" Sub Project Scenario	'Without" Sub Project Scenario
Settlements	surface and separated footpath with railing in built-up area reduces interaction of pedestrians with through traffic resulting in reduction of vehicular emissions, reducing travel time and vehicle operating cost. This in turn contributes to lowering of GHG emission; and may improve people/public health due to no or low exposure period.	with shoulder and foot path, congestion and frequent vehicle stoppage due to mixing of local, pedestrian and through traffic will increase localized accumulation of vehicular emission with potential impacts on human health and contribute to generation of GHG emission.
Felling of roadside trees	Felling of both old and young trees. Old and weak trees near the road edge shall be a road hazard and shall be felled. Ten times of felled trees, the number of new young and healthy saplings to be planted as compensatory afforestation.	No Felling of trees hence maintaining the healthy local ecology.
Pedestrian safety	Pedestrian facilities in the form of footpath, street lights, etc. are to be provided in built-up area locations.	Lack of dedicated pedestrian facilities such as footpaths and adequate lighting making it unsafe for pedestrians.
Road Safety Measures	Provision of proper road markings, zebra crossings, crash barriers and improvement of geometry to reduce accidents.	Accident incidents will rise with an increased traffic volume.
Environmental Quality	Development of roads in hilly and urban settlements improves environmental quality within the urban areas due to lowered pollution levels and relieving of congestion. Besides, an aggressive tree plantation and provision of enhancement features shall not only provide aesthetics but also improve the quality of air.	Poor in settlement areas due to non-motorable road conditions, congestion and high emission levels because of slow movement of traffic. A further deterioration is expected due to Increase in traffic volumes and further congestion.
Drainage	Will be improved due to reconstruction of culverts / bridges/ side drains with adequate hydraulics.	These issues remain un-addressed without the project
Roadside Amenities	Appropriate roadside amenities to be provided at various locations along the corridor.	Not adequate in the present scenario.
Wayside Facilities	Wayside facilities are proposed at several locations, where necessary like rest areas, with appropriate facilities for recreation, road public toilets, street lights etc.	Not of adequate standards, quality and number in present scenario.
Environmental Enhancement	Enhancement of landslides/water bodies, community and cultural properties	No enhancement measures involved.
Social Development	Higher potential for social development due to improvement in access and consequent increase in connectivity.	Social development activities are likely to be significantly constrained due to the severe inadequacy of infrastructure.
Financial and	Project financially viable for upgrading	The cost of maintenance while catering to

Component	"With" Sub Project Scenario	'Without" Sub Project Scenario
Economic Analysis	from existing lane configuration to intermediate lane configuration.	the projected higher traffic, accident cost, Vehicle operating cost & travel time cost shall be higher.

4.3 ENVIRONMENTAL AND SOCIAL ALTERNATIVES CONSIDERED FOR THE PROPOSED STRETCH

Various avoidance measures have been developed to minimize environmental and social impacts and to protect sensitive features along the proposed sub-project road. **Table 4.2** summarizes the measures adopted to offset these impacts, and a detailed description of each measure is presented in the following sections.

Table 4.2: Alternative considerations for Minimization of Environmental and Social Impacts

Chainage (km)	Type of Structure / Location	Proposed / Mitigation Measures Adopted	Purpose / Environmental and social consideration
23+100 (RHS)	Monolith	No construction camp shall be established within 100 m on either side of the Monolith. Provision has been made for parking areas, carriageway widening, steel railing with fencing, landscaping based on site conditions, and installation of two sacred site information boards.	To preserve the cultural and heritage significance of the Monolith and prevent impacts from vibration, dust, noise, and pollution.
27+000	Spring Water Source near Mawlynnu	Spring water rehabilitation measures have been proposed.	To protect and restore community water sources affected by project activities.
29+650	Hairpin Bend	Appropriate speed reduction measures and warning signage shall be installed at the hairpin bend.	To enhance road safety and reduce accident risks at sharp curves.
31+700 to 31+900 (RHS)	Jawahar Navodaya Vidyalaya (under construction)	Safety measures shall be implemented to avoid damage to school infrastructure and to ensure the safety of students, staff, and nearby residents during all phases of construction. Measures include pedestrian crossings, table-top crossings, speed reduction measures, temporary protective barriers, regulated construction hours, dust and noise control, proper signage, and coordination with school authorities.	To reduce vehicular speed and ensure the safety and accessibility of school children, pedestrians, and the surrounding community.
33+740 (LHS)	Mawjyngbuin Cave	Access roads to the cave shall not be damaged or obstructed during construction activities. Necessary precautions shall be taken to maintain uninterrupted access for local residents, visitors, and emergency services.	To preserve tourism access and protect the cultural and ecological significance of the cave area.
34+695 to 35+110 (Both Sides)	Mawsynram Station Area	Drain-cum-footpath with railings has been proposed on both sides. A bus shelter has also been proposed at Ch. 34.750.	To improve pedestrian safety, drainage management, and public transport accessibility in the market/station area.
39+160 (LHS)	Krem Puri Cave	Access stairs shall not be damaged or obstructed during construction activities. Necessary precautions shall be taken to maintain uninterrupted access for local residents and visitors. Additional road widening has been incorporated within the available	To maintain uninterrupted access and safeguard the tourism and heritage value of the site.

		ROW.	
41+500 (RHS)	Monolith	No construction camp shall be established within 100 m on either side of the Monolith. Provision has been made for parking areas, carriageway widening, steel railing with fencing, landscaping based on site conditions, and installation of two sacred site information boards.	To protect the cultural and historical significance of the Monolith.
43+000 to 44+150 (LHS)	Church and Community Area	Access roads to the church and community facilities shall not be damaged or obstructed during construction activities. Necessary precautions shall be taken to maintain uninterrupted access for local residents and emergency services. Pedestrian crossings, table-top crossings, speed reduction measures, and street lighting have been incorporated between Km 43.050 to Km 44.150 (LHS). Bus shelters have also been proposed at Ch. 43.200, Ch. 43.880, and Ch. 44.100.	To maintain community access, improve pedestrian and road safety, and enhance public convenience near religious and community infrastructure.
43+520 (LHS)	SSA School	Safety measures shall be implemented to avoid damage to school infrastructure and to ensure the safety of students, staff, and nearby residents during all phases of construction. Measures include pedestrian crossings, table-top crossings, speed reduction measures, temporary protective barriers, regulated construction hours, dust and noise control, proper signage, and coordination with school authorities.	To ensure safe access and mobility for school children and pedestrians and to reduce vehicular speed in the area.
44+220 to 44+450	Mawkasain / Kenbah Malai Area	Breast walls have been proposed at vulnerable slope sections between Km 44.220–44.270, Km 44.320–44.370, and Km 44.410–44.440. Protective measures, including retaining wall protection and safety railings, have been provided at Ch. 44.450 near Kenbah Malai, where villagers undertake washing activities.	To stabilize excavation-prone slopes, prevent erosion and slope failure, and enhance community safety at roadside activity areas.
45+850 to 47+320 (Both Sides)	Mawsawa Village to Phlangwanbroi Village	Drain-cum-footpath with railings has been proposed on both sides of the road corridor.	To improve pedestrian safety, particularly for school-going children and local residents.
46+600 (RHS)	SSA School	Safety measures shall be implemented to avoid damage to school infrastructure and to ensure the safety of students, staff, and nearby residents during all phases of construction. Measures include pedestrian crossings, table-top crossings, speed reduction measures, temporary protective barriers, regulated construction hours, dust and noise control, proper signage, and coordination with school authorities.	To ensure the safety of students and pedestrians and reduce vehicle speed near the school.

The Environmental and Social Impact Assessment conducted during the pre-design stage helped identify and mitigate potential negative impacts of the project. While the project is expected to provide numerous benefits, the assessment highlighted potential adverse effects associated with widening the road within the proposed 12 m

right-of-way. Along these stretches, roadside communities are likely to be directly and immediately affected by construction activities, potentially experiencing losses of land, assets, and livelihoods. In line with the mitigation hierarchy for managing environmental and social risks, alternative analyses were conducted to minimize direct negative impacts. Based on these analyses, the design team was advised to limit road widening to within the existing right-of-way.

Mitigation measures primarily focus on settlements along the project road, particularly villages and towns or areas with the highest potential impacts. Stakeholder recommendations have been incorporated into the designs wherever feasible.

The following is a summary of the considerations incorporated into the road design to mitigate environmental and social impacts:

- The design incorporates utility ducts for underground pipelines and GI (Galvanized Iron) pipe crossovers to ensure safe and organized routing of essential services, minimize future excavation, and enable maintenance without disrupting the road infrastructure.
- No construction camps will be established within 100 m of the Monolith. Instead, the DPR proposes beautification measures around the Monolith to enhance its cultural and aesthetic value. The layout for the improvement is presented in figure 4.1.

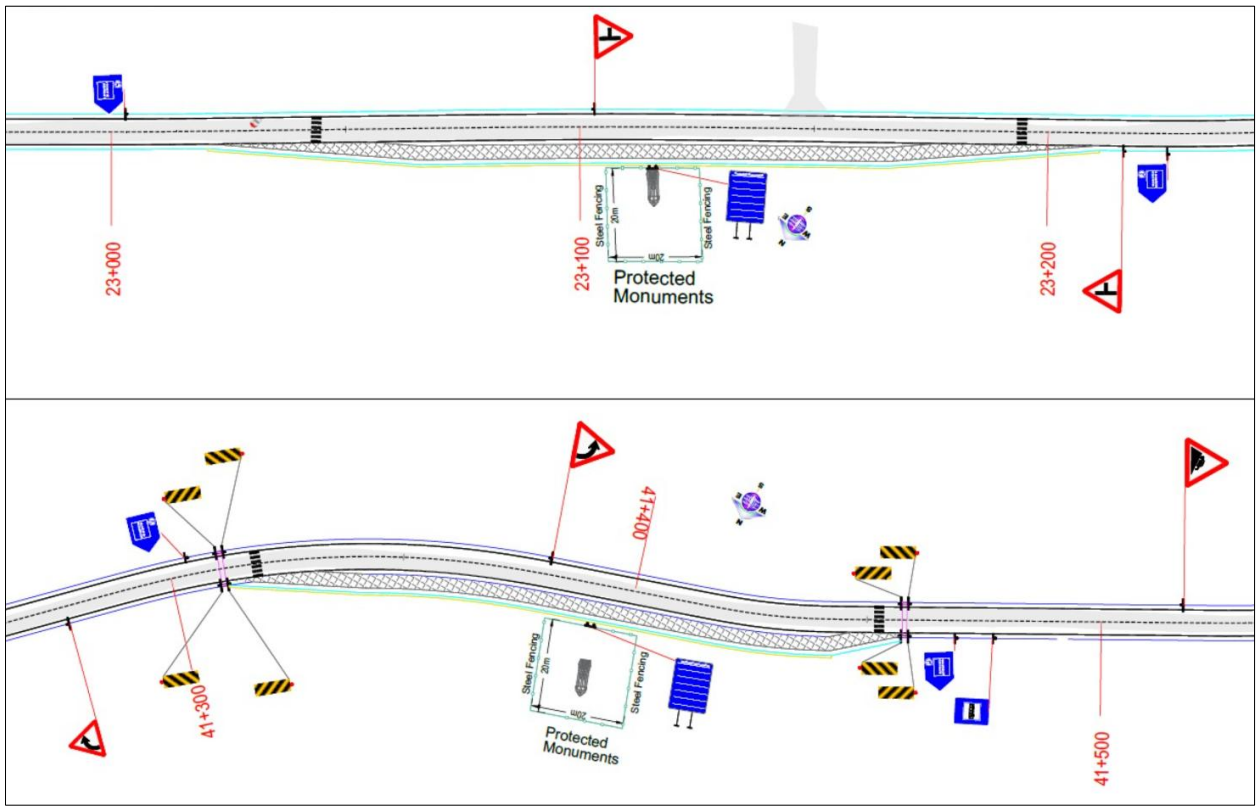


Figure 4.1: Layout for the improvement works along the Monolith

- Curves and bends will be smoothed to improve geometric design; where adjustments may affect local settlements, road realignment has been proposed.
- Paved shoulders will be provided wherever possible to accommodate non-motorized traffic.
- Displacement will be avoided by adjusting the alignment, narrowing the impact zone, or tailoring designs to meet both rural and urban cross-section requirements.

- Design speed will be reduced in densely populated areas to enhance safety.
- Safety features, including speed control measures near schools and healthcare facilities, will be incorporated.
- Road elevation in settlement areas will be minimized to prevent water seepage into adjacent properties.
- Ensure continuous access to businesses and residential properties throughout the construction period.

Minimize land clearance to reduce the loss of public and private assets, including wells, tree plantations, and other community resources within the project area.

5 BASELINE ENVIRONMENT

5.1 GENERAL

This chapter provides an overview of the existing environmental and social conditions of the project area, covering natural, physical, biological, cultural, and socio-economic components. Based on this baseline scenario, the potential impacts of the proposed sub-project have been identified. The approach and methodology adopted for baseline data collection are outlined in Section 1.3 of Chapter 1.

5.2 NATURAL ENVIRONMENT (METEOROLOGY)

This section describes the present meteorological conditions of the area like climate, temperature, rainfall and relative humidity.

5.2.1 CLIMATIC CONDITIONS

The climate of East Khasi Hills District is marked by moderate temperatures and high humidity. The district experiences three distinct seasons: summer, monsoon, and winter. The summer season extends from March to May, followed by the Southwest (SW) monsoon, which generally lasts until September. Winter sets in by November and continues until the end of February.

5.2.2 TEMPERATURE

In East Khasi Hills, winter generally begins in November, with January being the coldest month. During this period, the maximum temperature typically ranges from 18–20°C, while the minimum can drop to around 4–6°C. Summer starts around March and lasts until May, with May being the hottest month. During the summer, maximum temperatures range from 25–28°C, and minimum temperatures are around 18–20°C. The region also experiences a significant amount of rainfall during the Southwest monsoon from June to September.

Table 5.1 below presents the monthly mean maximum and minimum temperatures recorded at Shillong (IMD data), which has been considered as the nearest representative location for the project area.

Table 5.2.1: Monthly Mean Maximum and Minimum Temperature

Month	Maximum Temperature (°C)	Minimum Temperature (°C)
January	18.6	2.2
February	21.2	3.7
March	25.6	6.8
April	27.1	10.1
May	27.0	11.8
June	27.1	14.7
July	27.4	16.3
August	27.3	16.2

September	26.9	14.8
October	25.2	10.9
November	22.8	7.1
December	20.1	4.0

Source: India Meteorological Department – Shillong Climatological Normals, (1991–2020)

Temperature projection and implications for project road

According to the Meghalaya State Climate Action Plan, the East Khasi Hills District is projected to experience a rise in average annual temperature of approximately 1.6°C to 1.7°C by 2050 (relative to the 1970s baseline), accompanied by increasing variability in rainfall and a higher frequency of extreme weather events. Such climatic shifts may exacerbate slope instability, drainage congestion, and pavement deterioration along the project corridor, particularly in the hilly terrain around Mawsynram. To enhance resilience, the project design incorporates adequate drainage capacity, strengthened retaining and breast walls, climate-appropriate pavement materials, and improved slope stabilization measures. These interventions aim to reduce vulnerability to heat- and rain-related stresses, safeguard the structural integrity of the road, and ensure long-term serviceability under changing climatic conditions.

Source: Meghalaya State Climate Action Plan

5.2.3 RAINFALL AND HUMIDITY

The East Khasi Hills district experiences a humid subtropical to temperate monsoon climate, significantly influenced by its elevation and south-facing escarpments. Pre-monsoon showers occur in April and May, often accompanied by thunderstorms and occasional hailstorms, followed by a brief dry spell. The southwest monsoon generally sets in by late May or early June, bringing extremely heavy rainfall, with June to August being the wettest months. The southern parts of the district, particularly around Mawsynram and Cherrapunji, record some of the highest rainfall levels in the world, resulting in frequent slope failures, flash floods, and elevated landslide risks along the road corridor.

The average annual rainfall in East Khasi Hills District, as recorded at the Shillong IMD station, is presented in **Table 5.2**, which provides the year-wise rainfall distribution.

Table 5.2-2: Monthly Rainfall Data

Month	**Average rainfall (mm)**
January	12.6
February	15.4
March	42.7
April	131.4
May	244.5
June	423.7

July	402.0
August	328.4
September	270.1
October	197.2
November	24.7
December	7.2
Annual total	**2,099.9**

Source: India Meteorological Department – Shillong Climatological Normals, (1991–2020)

Rainfall projection and implications for sub project road

According to the Meghalaya State Climate Action Plan (2022) and the study *"Identification of Climate Vulnerability Hotspots in Meghalaya using High Resolution Climate Projections (2017)"*, the East Khasi Hills District is expected to experience increasing climate variability in the coming decades. Climate projections based on the IPCC AR6 CMIP6 multi-model ensemble under Scenario SSP5-8.5 indicate a rise in mean temperature by about 1.9°C by 2060 and up to 4.5°C by 2100, along with a significant increase in rainfall intensity. The projections suggest that annual average rainfall may increase by about 16–23%, while extreme rainfall events such as 1-day maximum rainfall could increase by up to 34.7% by 2100. Considering these projections, the project design for the Weiloi–Mawsynram Road up to Phlangwanbroi has incorporated climate-resilient engineering measures.

These include enhanced drainage systems, increased hydraulic capacity of culverts and cross-drainage structures, slope stabilization through bio-engineering measures, and climate-resilient pavement materials such as polymer-modified bitumen. Additionally, hydrological design parameters have been adjusted using climate change factors (approximately +15% for drainage systems, +25% for culverts and minor bridges, and up to +35% for major bridge design rainfall) to account for projected increases in rainfall intensity. These measures aim to improve stormwater management, reduce erosion and slope instability, and ensure long-term resilience of the road infrastructure under future climate variability and extreme weather conditions.
For bridge/cross drainage hydrology analysis, observed hourly rainfall records and local IDF (Intensity–Duration–Frequency) curves are presently unavailable for the project area. Therefore, in the absence of observed short-duration rainfall records, shorter-duration rainfall estimates required for hydrological assessment have been derived using standard hydrological conversion procedures and provisions of IRC SP:13-2022, together with conservative engineering assumptions.

District wise Daily Rainfall Data in the project corridor

A number of rain gauge stations are installed in Meghalaya under the hydrometeorological modernization programme of IMD. Daily rainfall data from stations in the project area (East Meghalaya) were analysed and the maximum observed one-day rainfall values are summarized below:

District / Region	**1-Day (24 hr) Max Rainfall (mm)**
East Meghalaya	440 (CWC Subzone 2b, 50-year)

The IMD Gridded Rainfall Data (0.25° × 0.25° resolution), available for approximately 110 years, was also studied for regional assessment. However, a major limitation of the IMD gridded rainfall data in Meghalaya is the highly complex topography and localized microclimatic conditions. Due to steep terrain and orographic effects, adjacent regions often experience significantly different rainfall intensities. Consequently, regional-scale gridded rainfall

data may not accurately represent localized extreme rainfall events required for hydrological design.

IMD Data

Station / Location	Station Index	Years of Data	Overall Highest MAXRF (mm)	Date & Hour of Peak
SHILLONG	42516	39	**108.3 mm**	17-07-2007 | 08–09 hrs IST
MAWSYNRAM	42514	2	**80.0 mm**	21-06-1969 | 19–20 hrs IST
SOHRA (CHERRAPUNJI)	42515	26	**207.0 mm**	10-10-1994 | 08–09 hrs IST

Considering the above, the design rainfall corresponding to 24-hour duration and the relevant return period has been adopted from the CWC Flood Estimation Report, which represents standard engineering practice for hydrological design of bridges and cross-drainage structures in ungauged catchments in India.

Further, historical IMD daily rainfall observations from nearby districts indicate that observed extreme one-day rainfall events are generally lower than the adopted regional design rainfall values, supporting the conservative nature of the selected design rainfall for hydrological assessment.

As per the CLIMATE CHANGE VULNERABILITY AND PROJECTIONS FOR PROJECT MITP (MEGHALAYA) annex1, it is recommended that the climate change factors shall be applied to "increase *in 1-day maximum rainfall (Rx1day) is a critical hydrological variable for calculating design discharge, flood levels, and flow velocity, and must therefore be used as the climate change adjustment factor in the design of road and bridge infrastructure."*

The MITP report recommends climate adjustment factors of approximately:

- +15% for drainage systems,
- +25% for culverts and minor bridges, and
- up to +35% for major bridge hydrological design parameters,

Accordingly, climate resilience considerations have been incorporated in the adopted design rainfall through application of the recommended climate adjustment factor, enhanced hydraulic capacity, additional freeboard above expected flood levels, and sensitivity assessment for future extreme rainfall scenarios.

Estimation of One Hour Rainfall for hydraulic assessment

100 Year Return Period rainfall for 24 hr,	=	440	mm
(CWC Flood Estimation Report for Sub Zone 2b)			
As per MITP Report Climate change factor for rainfall	=	1.252	
Considering Climate Change 100 year 24 hr Rainfall	=	550.88	mm
Adopted 100 year 24 hr Rainfall	=	560	mm
Intensity of Rainfall Ic for tc=24hr (Considering 100 year 24 hr rainfall)			
Ic = (F/T) x((T+1)/(tc+1))	=	291.667	mm/hr
Conversion ratio for 1 hrs as per CWC Flood Estimation Report	=	0.48	
100 years maximum 1 Hr Rainfall	=	268.80	mm/hr

The project catchments are steep and hilly with short flow paths, resulting in low time of concentration, generally less than one hour. Such catchments respond rapidly to intense rainfall and generate high peak runoff within a short duration. Therefore, the Critical Intensity Method as per IRC SP:13–2022, Clause 4.7.6 has been adopted for estimation of design discharge.

The critical intensity is given by:

$$I_c = \frac{F}{T}\left(\frac{T+1}{t_c+1}\right)$$

$$I_c = I_o\left(\frac{2}{t_c+1}\right)$$

The time of concentration is calculated using:

$$t_c = 0.87\left(\frac{L^3}{H}\right)^{0.385}$$

The calculated 1-hour rainfall intensity of 268.80 mm/hr is more than the maximum observed 24-hour district rainfall of approximately 207mm (Sohra) ,108.3mm (Shillong) & 80mm (Mawsynram) reflecting a highly conservative design approach. Accordingly, the adopted short-duration rainfall values and supplementary hydraulic safety provisions adequately account for extreme rainfall conditions, future climate variability, and uncertainties associated with projected extreme storm events. The incorporation of these conservative hydraulic and climate resilience measures is expected to enhance the long-term safety, reliability, and performance of the infrastructure under future hydrological extremes.

Adequacy Check as per IRC SP 13:2022

After incorporating the resilience factor into the design rainfall, the adequacy of both existing and proposed bridges was evaluated using the methodology explained below. Bridges found to be inadequate have been proposed for reconstruction, while those meeting the required capacity criteria have been recommended for retention.

Considering that the average catchment area is ranging maximum up to 4 sq.km and the existing bridge widths range between 7 m and 15 m, a detailed adequacy check was performed. The analysis indicated that at many locations, the existing bridge sizes were adequate; accordingly, the proposed bridge dimensions have been kept the same and revised accordingly. The details are provided in the inventory.

The detailed adequacy check is given below:

	Hydrology of Culvert at CA CH-44+851			
	Input Data			
	HYDROLOGY OF Culvert AT KM 0+600			
1	Name of River / Stream / Nala	=	Local	
2	Catchment Area (A)	=	0.007	SQKM
3	Length of Longest stream (L)	=	0.035	KM
4	Point Rainfall in mm	=	44	cm
5	CWC Subzone	=	2b	
6	**Modified rainfall after application of Climate resilience factor 1.252**	=	56	cm
A	**Estimation of Design Discharge by Empirical Formula as per**			
	IRC SP-13-2004, Article 4			
1	**Dickens Formula**			
	Q	**=**	**CA^ (3/4)**	
	C =14-19 where annual rainfall is more than 120cm			
	For 1500mm rainfall	=	19	
			=19x0.007^ (3/4)	
	Q	=	0.46	Cumecs
B	**Rational Formula**			
	Design Discharge Q_{100}	=	0.028 x Px f xA xI_c	
	Rational can be used for small culverts with basin upto 15 Sqkm			
		=	0.7	Ha
	H- Elevation Difference between critical point to the structure=		16.576	m
	Time of Concentration tc is given by Eq 4.9	=	$(0.87 \times L^3/H)^{0.385}$	
			= (0.87 x 0.035^3x16.576) ^0.385	
		=	0.007	hrs
	100 years return period rainfall for 24hrs as per			

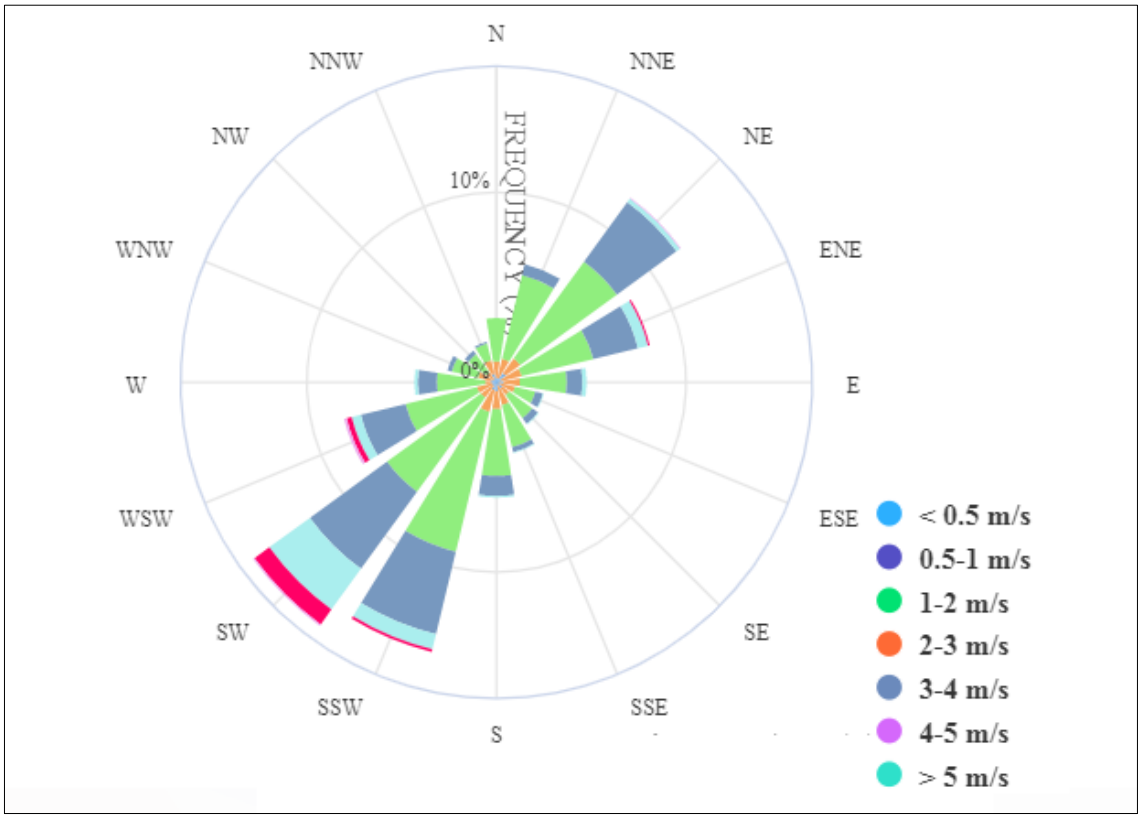
	CWC flood estimation report Subzone 2b and application of climate resilience factor	=	56	cm
	From IRC SP 13 eq. 4.10a Intensity of rainfall, Ic	=	56/ 24 x (24+1)/0.007+1)	
		=	57.927	cm/hr
	From IRC SP 13, Spread Factor **"f" from** f curve fig 4.2	=	0.95	
	From IRC SP 13, table 4.1, coefficient of runoff for the catchment characteristics			
	P	=	0.8	
	Design Discharge Q_{100}	=	0.028 x Px f xA xI_c	
		=	**0.86**	Cumecs
D	**Design Discharge: (Refer IRC - SP: 13 - 2004, Clause: 6.2)**			
	Discharge by Dicken's Formula =	0.46	m^3/s	
	Discharge by Rational Formula =	0.86	m^3/s	
	Maximum Discharge =	0.86	m^3/s	
	Hence, Design Discharge =	**0.86**	m^3/s	
	Design discharge from observed flood	0.86	Cumecs	
	Dimension of Culvert	1.0	m dia.	
	Area of flow (A)	3.14	m^2	
	Perimeter of flow	3.14	m	
	Slope of flow	0.0001		
	Hydraulic mean depth (R) = A/P	1	m	
	Rugosity coefficient (n)	0.014		
	Conveyance factor (λ) = (A. R^2/3)/n	76.923		
	Capacity of culvert	0.714	m^3/s	
		Revise		
	Revised section of Culvert due to lower capacity of Culvert. Revision in design discharge calculation are mentioned below			
	Dimension of Culvert	1.5x1.5	m Box	
	Area of flow (A)	2.25	m^2	
	Perimeter of flow	4.5	m	
	Slope of flow	0.0001		
	Hydraulic mean depth (R) = A/P	0.5	m	
	Rugosity coefficient (n)	0.013		
	Conveyance factor (λ) = (A. R^2/3)/n	109.0316		
	Capacity of culvert	1.090	m^3/s	
		Safe		

	Hydrology of Slab Culvert at CA CH-40+900			
	Input Data			
	HYDROLOGY OF Culvert AT KM 0+600			
1	Name of River / Stream / Nala	=	Local	
2	Catchment Area (A**)**	=	0.090	SQKM
3	Length of Longest stream (L)	=	0.100	KM
4	Point Rainfall in mm	=	44	cm
5	CWC Subzone	=	2b	
6	**Modified rainfall after application of Climate resilience factor 1.252**	=	56	cm
A	**Estimation of Design Discharge by Empirical Formula as per**			
	IRC SP-13-2004, Article 4			
1	**Dickens Formula**			
	Q	**=**	**CA^(3/4)**	
	C =14-19 where annual rainfall is more than 120cm			
	For 1500mm rainfall	=	19	
			=19x0.090^ (3/4)	
	Q	=	3.122	Cumecs
B	**Rational Formula**			
	Design Discharge Q_{100}	=	0.028 x Px f xA xI_c	
	Rational can be used for small culverts with basin upto 15 Sqkm			
		=	9	Ha
	H- Elevation Difference between critical point to the structure=		10	m
	Time of Concentration tc is given by Eq 4.9	=	$(0.87 \times L^3/H)^{0.385}$	
			= (0.87 x 0.1^3x10) ^0.385	
		=	0.0027	hrs
	100 years return period rainfall for 24hrs as per CWC flood estimation report Subzone 2b and application of climate resilience factor	=	56	cm
	From IRC SP 13 eq. 4.10a Intensity of rainfall, Ic	=	56/ 24 x (24+1)/0.027+1)	
		=	58.176	cm/hr
	From IRC SP 13, Spread Factor **"f" from** f curve fig 4.2	=	0.9	
	From IRC SP 13, table 4.1, coefficient of runoff for the catchment characteristics			
	P	=	0.5	
	Design Discharge Q_{100}	=	0.028 x Px f xA xI_c	
		=	**7.256**	Cumecs
D	**Design Discharge: (Refer IRC - SP: 13 - 2004, Clause: 6.2)**			
	Discharge by Dicken's Formula =	3.122	m^3/s	
	Discharge by Rational Formula =	7.256	m^3/s	
	Maximum Discharge =	7.256	m^3/s	
	Hence, Design Discharge =	**7.256**	m^3/s	

	Design discharge from observed flood	7.256	Cumecs	
	Culvert Span	2X2	m (Poor Condition)	
	Area of flow (A)	4	m^2	
	Perimeter of flow	6	m	
	Slope of flow	0.001		
	Hydraulic mean depth (R) = A/P	0.66	m	
	Rugosity coefficient (n)	0.013		
	Conveyance factor (λ) = (A. R^2/3)/n	155		
	Capacity of culvert	4.93	m^3/s	
		Revise		
	Culvert Span	3X3	m slab	
	Area of flow (A)	9	m^2	
	Perimeter of flow	9	m	
	Slope of flow	0.001		
	Hydraulic mean depth (R) = A/P	1	m	
	Rugosity coefficient (n)	0.013		
	Conveyance factor (λ) = (A. R^2/3)/n	461.538		
	Capacity of culvert	14.59	m^3/s	
		Safe		

5.2.4 WIND SPEED AND DIRECTION

The annual Windrose diagram for Shillong (nearest IMD station) is presented in **Figure 5.1**. The average wind speed is about 4.9 km/hr, predominantly blowing from the southwest direction.



Source: IMD Climatological Tables for 1991–2020

Figure 5.2.1: Wind rose Diagram for Shillong (IMD)

5.3 LAND ENVIRONMENT

This section describes the key characteristics of the project area including its Physiography, Elevation, Geology, Geomorphology and soils, land use pattern, agriculture and soil.

5.3.1 PHYSIOGRAPHY AND ELEVATION

East Khasi Hills district in Meghalaya is characterized by rugged, forested hills with deep valleys and numerous perennial rivers, including the Umkhrah, Umshyrpi, and Umiam, which support agriculture and local water supply. Elevations range from approximately 80 m in low-lying areas to over 1,400 m in Shillong and Cherrapunji. The region receives extremely high rainfall, particularly in Mawsynram and Cherrapunji, resulting in frequent landslides and significant surface runoff—key factors to consider in road alignment and infrastructure planning.

Source: CGWB District Profile – East Khasi Hills

Baseline Scenario for WMP Road

According to the elevation map, the Weiloi–Mawsynram Road up to Phlangwanbroi traverses terrain ranging from 932 m to 1,963 m above mean sea level. The elevation profile of the project stretch is shown in **Figure**

5.2. Total length of the project is 27.858Km. Project have 473.56 m steep slope Longitudinally where vertical profile has been improved with cutting and filling & 1392m length have cross sectional steep slopes where protection structure has been proposed. steep slopes are located at various location the details are presented in **Table 5.3**.

Table 5.3-1: Detail of Longitudinal slopes

Sr. no.	Chainage in Mtr.		Length in Mtr.	Grade In	Grade Out	Remarks
	Start	End				
1	23478.516	23543.651	65.135	1.61%	7.98%	Hill Top Area
2	34062.696	34089.217	26.521	-7.50%	-4.29%	Built-Up
3	40195.58	40245.58	50	-7.11%	-7.67%	Existing Gradient 8.4% Hill Area
4	40455.8	40500.8	45	-7.67%	-8.39%	Existing Gradient 10.8% Hill Area
5	40751.1	40796.1	45	-8.39%	-7.55%	Existing Gradient 9.5% Hill Area
6	45577.54	45618.09	40.55	-7.68%	-5.67%	Existing Gradient 10.70% Hill
7	45747.71	45783.17	35.46	-7.33%	-3.52%	Existing Gradient 10.70% Hill
8	46484.08	46524.08	40	-9.19%	-2.89%	Phlangwanbroi Village Built-up
9	47472.59	47536.79	64.2	-7.37%	-5.32%	Existing Gradient 8.0% Hill Top
10	47473.927	47535.587	61.66	-8.03%	-7.29%	Existing Gradient 10.80% Hill
Total Length =			473.526			

Table 5.3-2: Detail of Cross-sectional steep slopes

Sr. No.	Proposed Chainage		Length in (kms.)	SIDE
	Start	End		
1	25.910	25.970	0.060	RHS
2	26.050	26.150	0.100	RHS
3	26.270	26.450	0.180	RHS
4	34.270	34.695	0.425	RHS
5	35.400	35.500	0.100	LHS
6	44.220	44.270	0.050	RHS
7	44.320	44.370	0.050	RHS
8	44.420	44.450	0.030	RHS
9	1.150	1.547	0.397	LHS (Bypass)
Total Length			**1.392**	

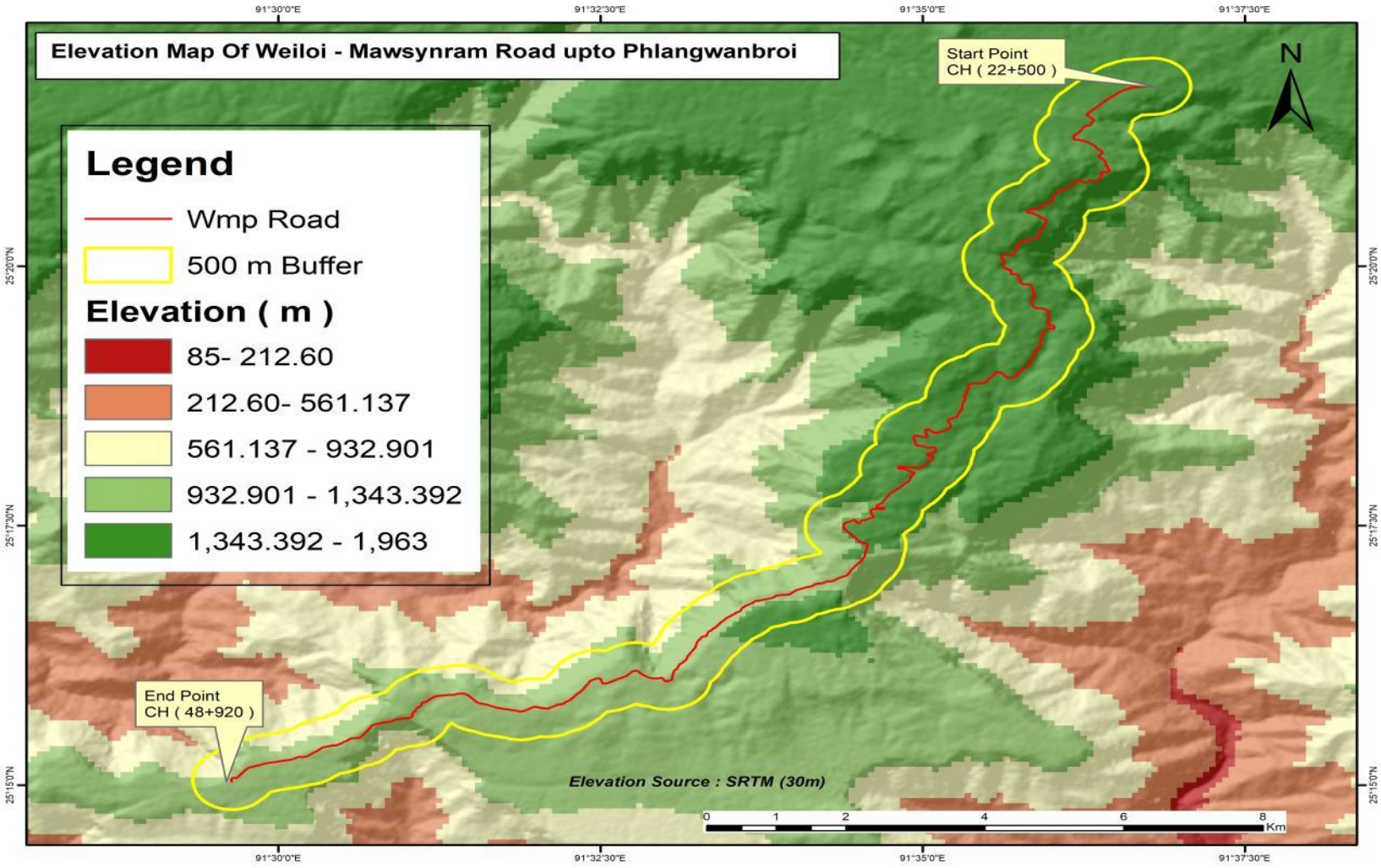


Figure 5.3-1: Elevation map of the project road (Elevation Source: SRTM (30m)

5.3.2 GEOLOGY

Baseline Scenario for Project Road

The initial section of the corridor in East Khasi Hills district is underlain by Proterozoic rocks of the Assam–Meghalaya Gneissic Complex. These rocks predominantly consist of biotite gneiss, forming a rugged and stable basement that shapes the topography of this stretch.

Further along the corridor, most of the alignment traverses' rocks of Paleocene–Eocene age, characterized by limestone, calcareous shale, and sandstone lithologies, indicative of sedimentary deposition during the early Cenozoic era. This section often exhibits undulating terrain, plateaus, and karst features, which significantly influence drainage patterns, slope stability, and construction planning.

The geology of the project road is depicted in **Figure 5.3**.

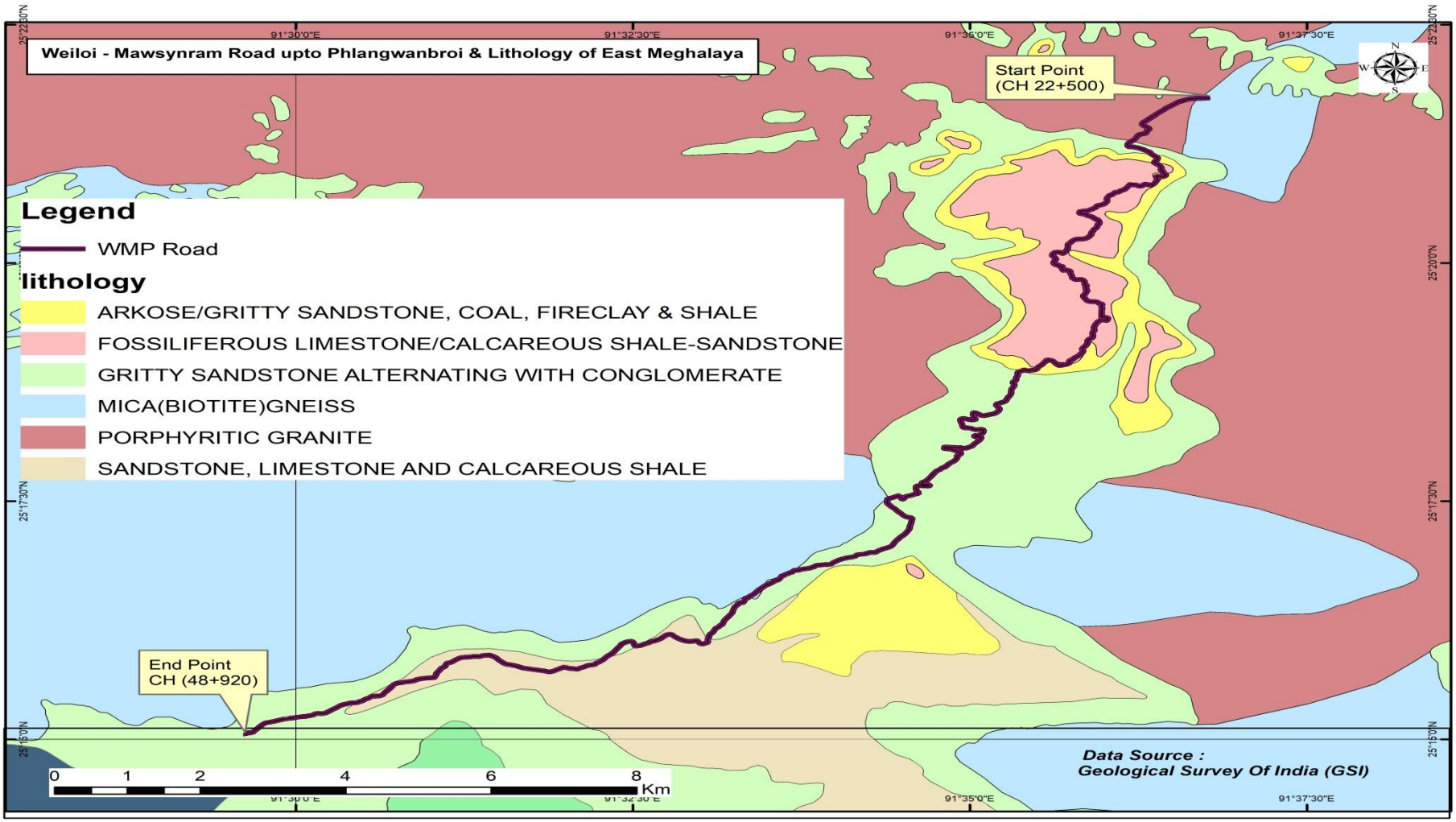


Figure 5.3-2 Local geology of the project road

5.3.3 GEO-MORPHOLOGY AND SOILS

Geomorphologically, East Khasi Hills district is characterized by rugged hills, undulating plateaus, valleys, and riverine floodplains. The terrain is predominantly hilly, with steep slopes in upland areas gradually transitioning into plateau regions and low-lying valleys in certain stretches.

Soils in the district are mainly lateritic and acidic, formed from the weathering of Shillong Group rocks under high rainfall. In the hilly sections, soils are highly acidic, with textures ranging from sandy loam to clay loam, and patches of lateritic red soil. These soils are rich in organic matter and nitrogen but are prone to erosion and leaching during heavy monsoon rains, which can lead to slope instability.

Given the terrain and soil conditions, road and infrastructure projects in East Khasi Hills require:

- Adequate **slope stabilization**
- Proper **drainage and erosion control**
- Use of **check walls, bioengineering techniques, and roadside plantations** to minimize soil loss and maintain stability

The block-wise soil type and land slope is given in below **Table 5-5**.

Table 5.3-3: Block wise major soil area and Land Slope for Mawsynram

Block	Major Soil Type	Area (Ha)	0–3% Slope	3–8% Slope	8–25% Slope	>25% Slope
Mawsynram Development Block	Red lateritic loam	68,000	4,800	11,500	19,500	32,200

***Source**: District Irrigation Plan 2016–2020, East Khasi Hills, Government of Meghalaya*

Baseline Scenario for Sub- Project Road

The Weiloi–Mawsynram–Phlangwanbroi road section in East Khasi Hills district is predominantly underlain by laterite and lateritic soils, formed from the weathering of Shillong Group rocks. These soils are acidic, with textures ranging from sandy loam to clay loam, and are highly susceptible to erosion and leaching under heavy rainfall. Of the district's total area of 2,74,000 ha, approximately 1,35,700 ha consists of steep slopes (>25%), 76,000 ha of moderate slopes (8–25%), 45,600 ha of gentle slopes (3–8%), and only 16,700 ha of flat land (0–3%). Given the fragile terrain, careful slope stabilization, drainage management, and bioengineering measures are essential for the design and construction of roads and associated infrastructure.

Geomorphological map of the project road is depicted in the **Figure 5.4**.

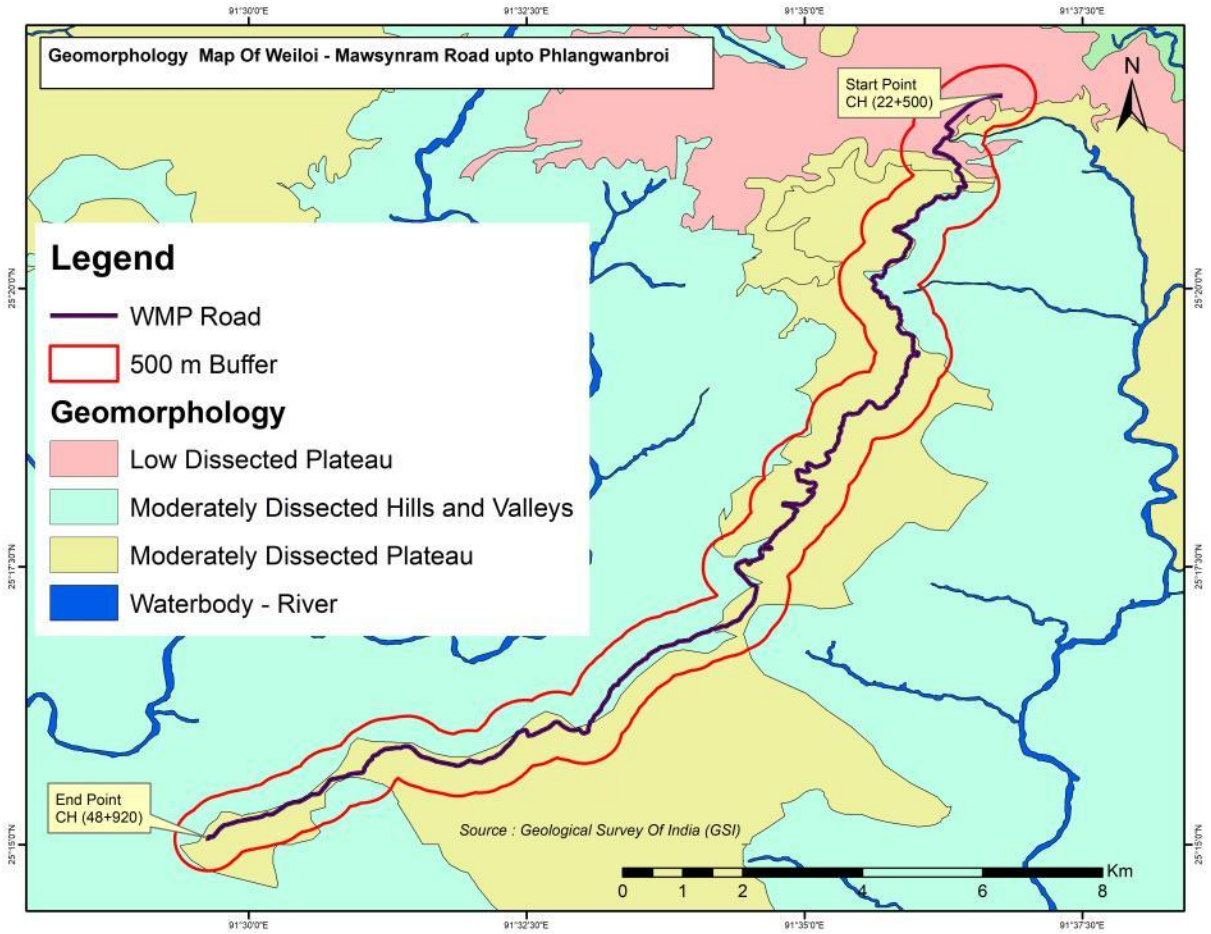


Figure 5.3-3: Geomorphological map of East Khasi Hills

5.3.4 LAND USE PATTERN

Baseline Scenario of the WMP Road

The Land Use and Land Cover (LULC) within 500 m of the Weiloi–Mawsynram–Phlangwanbroi road is dominated by barren land (39%), followed by unclassed forest (36%), forest plantation (16%), settlements (5%), cropland (2%), and water bodies (2%), which include cropland, water bodies, shifting cultivation, and fallow areas. There are no National Parks, Wildlife Sanctuaries, Wildlife Corridors, or other officially notified Eco-Sensitive Zones within a 10 km radius of the project road. However, the cliffs, gorges, and sacred groves of Cherrapunji identified as a Key Biodiversity Area (KBA) under the IUCN-convened KBA Programme are located approximately 5 km from the project alignment. The Land Use/Land Cover map of the project road corridor is presented in **Figure 5.5**.

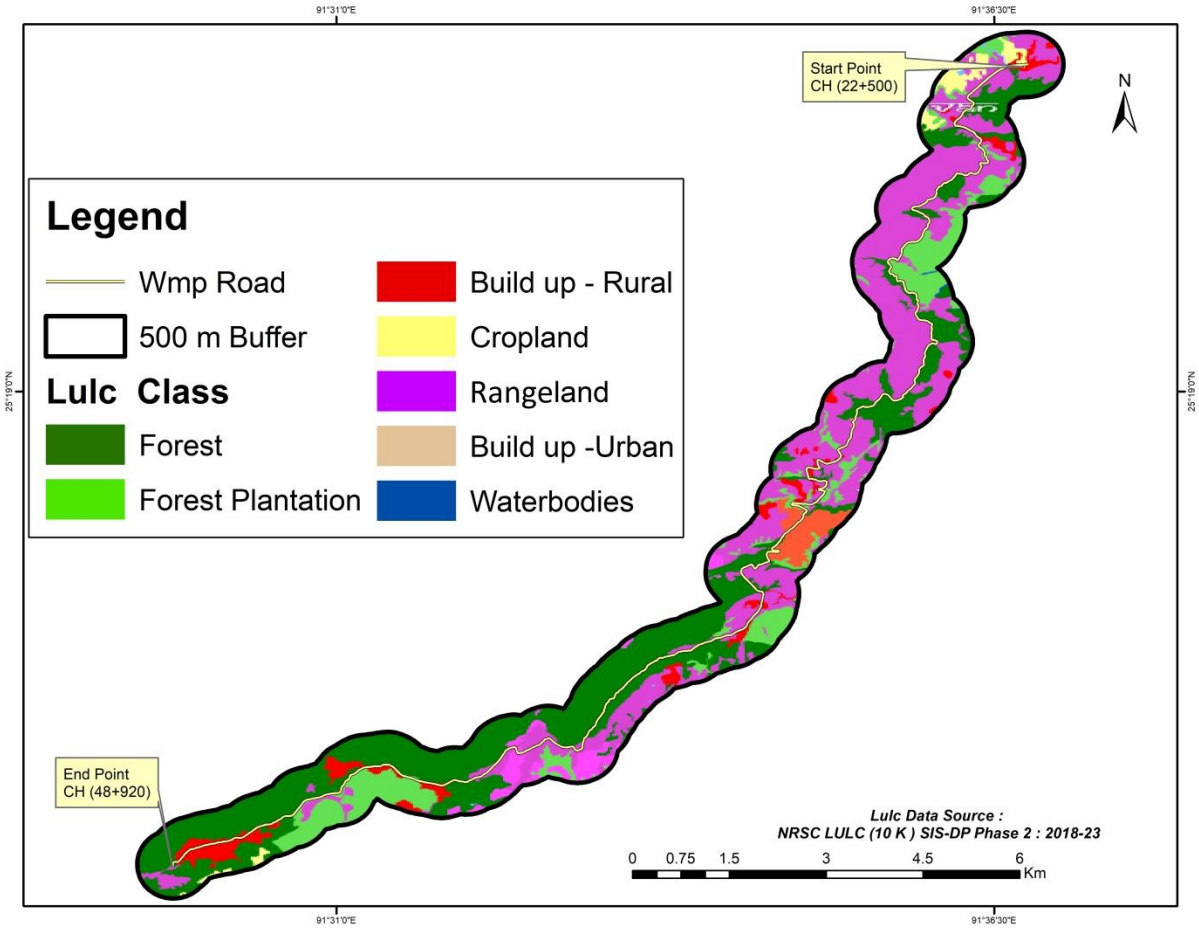


Figure 5.3.4: Land Use/Land Cover map of project road corridor

5.3.5 AGRICULTURE

Baseline Scenario in Project Corridor Area

According to the consultations that was organized with the Indigenous communities, it was found that agriculture remains the main livelihood practice. The traditional practice of shifting cultivation (jhum) is still present among local households, particularly on steeper slopes and marginal lands, though it is not the dominant or primary form of farming for the majority of households in the area. Key crops grown in the WMP road area include paddy, maize, sesame, millet, jowar, cauliflower, cabbage, chilli, bitter gourd, tomatoes, lettuce, pumpkin, betel nut, betel leaf, pineapple, and banana. Farmers primarily sell their products in local markets, while surplus yields are supplied to other districts or states through vendors.

5.3.6 SOIL QUALITY

Details of the soil sampling locations are presented in **Table 5.6** and shown in **Figure 5.6**. The collected soil samples were analyzed for various parameters in an NABL-accredited laboratory. The soil monitoring results are presented in the **Table 5.7.**

Table 5.3.4: Soil Monitoring Locations

Sl. No.	Project Area	Monitoring Location	Sample Code	Geographical Coordinate	
				Latitude	Longitude
1	Corridor 8	Weiloi (Agriculture field)	SQ1	25.362159°	91.613071°
2		Mawsynram (paddy field)	SQ2	25.297922°	91.580456°
3		Phlangwanbroi (Agriculture Field)	SQ3	25.253353°	91.497891°

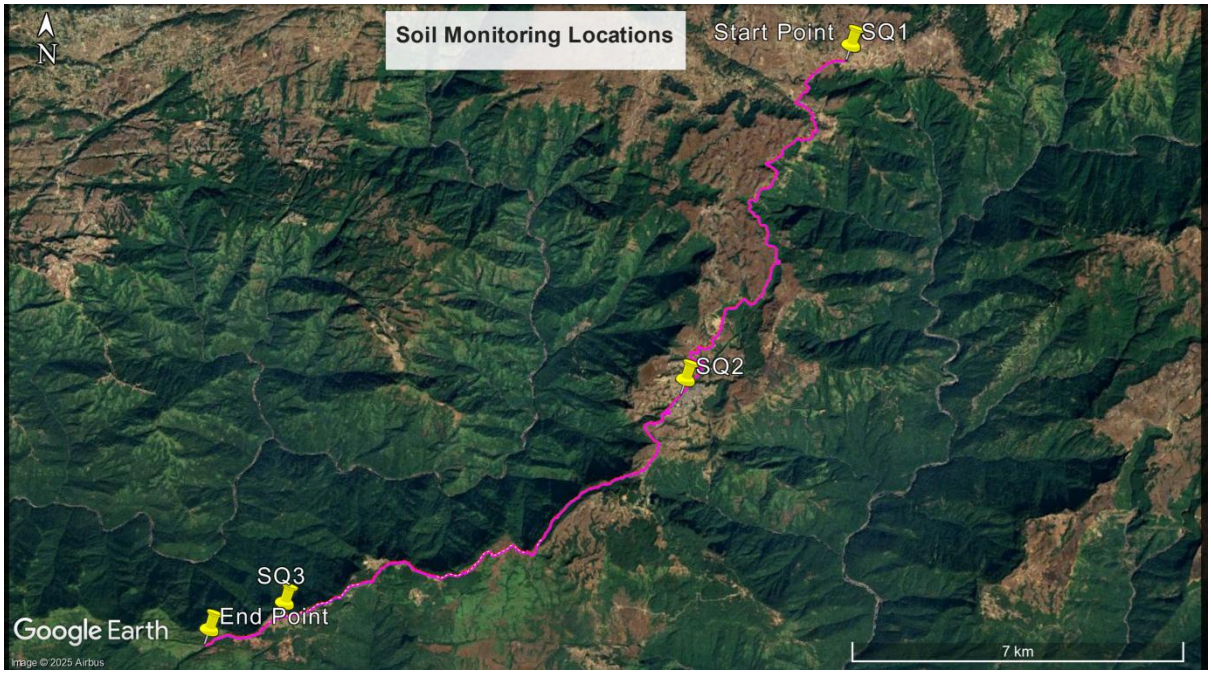


Figure 5.3.5: Soil monitoring locations

Table 5.3.5: Soil Monitoring Results in the sub-project road

Sl. No.	Parameters	Units	SQ1	SQ2	SQ3	Test Method
1	Colour		Brown	Brown	Brown	STRL/STP/SOIL/01
2	Textural Class		Sandy Loam	Sandy Loam	Sandy Loam	IS2720 (P-4),1985 (Reaff: 2015)
3	Bulk Density	gm/cm^3	1.42	1.52	1.37	IS 14765: 2000, RA 2010
4	Water Holding Capacity	%	23.4	27.5	25.2	STRL/STP/SOIL/01

Sl. No.	Parameters	Units	SQ1	SQ2	SQ3	Test Method
5	Sand	%	53.0	54.2	57.0	IS2720 (P-4),1985 (Reaff: 2015)
6	Silt	%	26.2	25.4	24.8	IS2720 (P-4),1985 (Reaff: 2015)
7	Clay	%	20.8	20.4	18.2	IS2720 (P-4),1985 (Reaff: 2015)
8	pH (1:2 Suspension)	-	5.2	5.6	5.5	IS:2720 (P-26), 1987 (Reaff:2011)
9	Electrical Conductivity(1:2)	µmhos/cm	221.0	234.3	243.9	4767(2000), RA 2016
10	Organic Matter	%W/W	2.2	2.4	2.5	STRL/STP/SOIL/01
11	Exchangeable Calcium	mg/kg	815.0	845.0	739.0	IS 2720 (Part 24): 1976, RA 2010
12	Exchangeable Magnesium	mg/kg	240.0	210.0	290.0	IS 2720 (Part 24): 1976, RA 2010
13	Copper	mg/kg	3.8	4.2	2.9	IS 2720(Part-27): 1977
14	Nickel	mg/kg	2.1	2.7	1.4	IS 2720(Part-27): 1977
15	Chromium	mg/kg	3.5	2.9	2.6	IS 2720(Part-27): 1977
16	Lead	mg/kg	0.2	0.3	0.4	IS 2720(Part-27): 1977
17	Sulphate	mg/kg	15.6	16.3	18.8	IS 2720(Part-27): 1977
18	Total Nitrogen (as N)	%	0.27	0.22	0.24	IS:10158:1982, RA 2009
19	Available Phosphorous	mg/kg	10.0	11.0	9.0	IS:10158:1982, RA 2009
20	Exchangeable Potassium	mg/kg	95.0	88.0	81.0	STRL/STP/SOIL/01

Soils along the Road corridor are sandy loam, well-drained and moderately acidic (pH 5.2–5.6), which is typical for the region's high rainfall conditions. Organic matter levels are moderately high, reflecting good natural

leaf-litter enrichment. Major nutrients (N & P) are moderate, whereas Potassium is slightly low due to natural leaching.

5.4 WATER ENVIRONMENT

Water bodies along the 27.858 km project road corridor are primarily represented by River Umkynrem, as observed during field studies. Surface water quality testing will be conducted in the river and other key sensitive ponds and streams to ensure water safety and identify any potential contamination. If required, the contractor will be instructed to implement appropriate mitigation measures to maintain water quality during construction (refer to ESMP and Section 6.4.2.8).

As per the notification No. FOR/CC/18/2022/Pt/395 issued by the Government of Meghalaya (Forests & Environment Department), the river rejuvenation initiative specifically focuses on the rivers Wah Umkhrah, Wah Umshyrpi, and Wah Umkhen in Shillong, for which an Apex Committee and sub-committees were constituted to prepare and implement restoration and rejuvenation actions. The notification does not include the River Umkynrem under this particular rejuvenation plan. Therefore, based on the available government notification, the River Umkynrem is not part of the river rejuvenation plan mentioned in FOR/CC/18/2022/Pt/395.

Road construction projects are water-intensive, requiring a substantial volume of water throughout the construction period. As discussed with the DPR team, surface water is proposed as the primary source for construction purposes, subject to prior permission from the competent authority. In exceptional cases where surface water is unavailable, groundwater resources may be utilized. The project area has been classified as 'safe' by the CGWB; therefore, no further detailed groundwater assessment is required within the scope of this ESIA study.

5.4.1 WATER QUALITY:

Three ground and surface water samples have been collected in the month of October along the sub-project road to ascertain the baseline conditions of the ground water quality. The sampling locations were selected based on the land-use pattern and competitive uses in the sub-project area. Location details of the groundwater samples are presented in **Table 5.8** and shown in **Figure 5.7** and results are presented in **Table 5.9 and Table 5.10.** Ground water samples have been analysed in accordance with the Drinking Water Quality Standards of IS 10500:2012.

Table 5.4.1.1: Water Sample Locations in the sub-project area

Sl. No.	Project Area	Monitoring Location	Sample Code	Geographical Coordinate	
				Latitude	Longitude
1	Corridor 8	Weiloi	GW1	25.361905°	91.612002°
2		Mawsynram	GW2	25.297114°	91.580281°
3		Phlangwanbroi	GW3	25.252391°	91.496826°
4		River Umkynrem	SW1	25.361727°	91.610294°

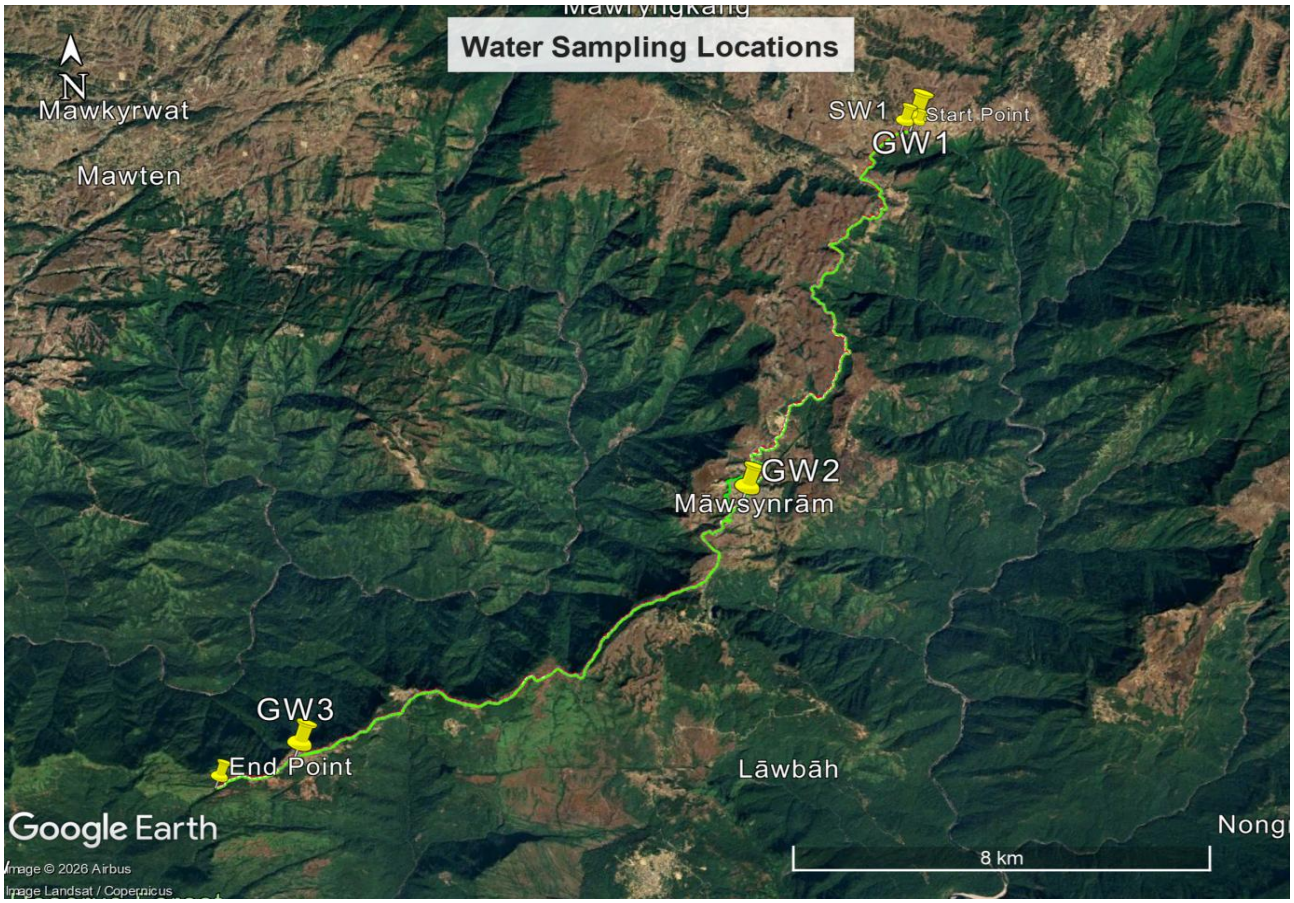


Figure 5.4.1.1: Ground Water monitoring locations

Groundwater samples GW-1, GW-2 and GW-3 were found to be clear, odourless and with acceptable taste, and turbidity remained below 1 NTU. The pH was within the desirable range (6.7–7.2). Total Hardness (108–133 mg/L), TDS (176–189 mg/L), Calcium, Magnesium, Chloride, Sulphate, Iron were all well within desirable limits of IS 10500:2012. All heavy metals such as Chromium, Arsenic, Aluminium, and Copper were below detectable limits, indicating no contamination from industrial or geogenic sources. Overall, the groundwater quality is suitable for drinking purposes after minimal treatment for iron removal.

Table 5.4.1.2: Ground Water monitoring results in the project area

S. No.	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	GW-3	Test method
			Desirable Limit	Permissible Limit				
1	Color	Hazen	5	15	<5	<5	<5	IS: 3025(Pt-4)
2	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-5)
3	Taste	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	IS: 3025(Pt-8)
4	Turbidity	NTU	1	5	<1	<1	<1	IS 3025(Part-10)

S. No.	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	GW-3	Test method
			Desirable Limit	Permissible Limit				
5	pH		6.5-8.5	No Relaxation	6.7	7.1	7.2	IS: 3025(Pt-11)
6	Total Hardness (as $CaCO_3$)	mg/l	200	600	133	126	108	IS 3025(Part-21)
7	Iron (as Fe)	mg/l	0.3	No Relaxation	0.10	0.21	0.25	3500-Fe- B, APHA 23nd Ed.2017
8	Chlorides (as Cl)	mg/l	250	1000	18.4	22.1	21.6	IS 3025(Part-32)
9	Fluoride (as F)	mg/l	1	1.5	BDL	BDL	BDL	4500-F-(D), APHA 23st Ed.2017
10	TDS	mg/l	500	2000	176	189	186.8	IS 3025(Part-16)
11	CALCIUM (as Ca2+)	mg/l	f75	200	23.2	24.9	21.7	IS 3025(Part-40)
12	MAGNESIUM (as Mg2+)	mg/l	30	100	18.5	16.3	13.2	3500- Mg B, APHA 23nd Ed.2017
13	Sulphate (as SO_4)	mg/l	200	400	10.4	14.7	12.9	IS 3025(Part-24)
14	Total Chromium (as Cr)	mg/l	0.05	No Relaxation	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed.2017
15	Alkalinity as $CaCO_3$	mg/l	200	600	132.6	129.5	128.7	IS 3025(Part-23)
16	Aluminium (as Al)	mg/l	0.03	0.2	<0.01	<0.01	<0.01	IS 3025(Part-55)
17	Total Arsenic (as As)	mg/l	0.01	No Relaxation	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed2017
18	Copper (as Cu)	mg/l	0.05	1.5	<0.05	0.05	0.05	3110- B, APHA 23nd Ed2017
19	Manganese (as Mn)	mg/l	0.1	0.3	<0.01	0.01	0.01	3110- B, APHA 23nd Ed2017
20	Zinc (as Zn)	mg/l	5	15	0.22	0.16	0.22	3110- B, APHA 23nd Ed2017

S. No.	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	GW-3	Test method
			Desirable Limit	Permissible Limit				
21	Ammonia (as NH3-N)	mg/l	0.5	No Relaxation	<0.1	<0.1	<0.1	4500-NH3-B &C, APHA 23rd ED2017
22	Anionic Detergents (as MBAS)	mg/l	0.2	1	<0.1	<0.1	<0.1	Annexure K of IS-13428
23	Boron (as B)	mg/l	0.5	1	<0.5(BDL)	<0.5(BDL)	<0.5(BDL)	IS: 3025 (Pt-57)
24	Mineral Oil	mg/l	0.5	No Relaxation	<0.1	<0.1	<0.1	IS 3025(Part-39)
25	Phenolic Compound (as C6H5OH)	mg/l	0.001	0.002	<0.001	<0.001	<0.001	IS 3025(Part-44)
26	Cadmium (as Cd)	mg/l	0.003	No Relaxation	<0.002	<0.002	<0.002	3110- B, APHA 23nd Ed2017
27	Cyanide (as CN)	mg/l	0.05	No Relaxation	<0.1	<0.1	<0.1	4500- CN-B, C & E, APHA 23nd Ed2017
28	Lead	mg/l	0.01	No Relaxation	<0.01	<0.01	<0.01	3110- B, APHA 23nd Ed2017
29	Mercury (as Hg)	mg/l	0.001	No Relaxation	<0.001	<0.001	<0.001	3110- B, APHA 23nd Ed.2017
30	Nickel (as Ni)	mg/l	0.02	No Relaxation	<0.02	<0.001	<0.001	3110- B, APHA 23nd Ed.2017
31	Residual Free Chlorine	mg/l	0.2	1.0	<0.2	<0.02	<0.02	4500-Cl-B, APHA 23nd Ed2017
32	Molybdenum (Mo)	mg/l	<0.05	0.07	No Relaxation	<0.2	<0.2	3110- B, APHA 23nd Ed.2017
33	Polynuclear Aromatic Hydrocarbons	mg/l	<0.0001	0.0001	No Relaxation	No Relaxation	No Relaxation	APHA 6440,23nd Ed.2017

S. No.	Parameters	Unit	Limit (IS-10500:2012)		GW-1	GW-2	GW-3	Test method
			Desirable Limit	Permissible Limit				
34	Poly chlorinated biphenyl	mg/l	<0.0001	0.0005	No Relaxation	No Relaxation	No Relaxation	APHA 6430,23nd Ed.2017
35	Nitrate	mg/l	45	No Relaxation	9.1	8.9	12.4	IS: 3025(Pt-34)
36	Sodium (as Na^+)	mg/l	-	-	24.2	18.6	21.3	APHA 4500-Na B / IS 3025 (Part 45): 1993
37	Potassium (as K^+)	mg/l	-	-	4.7	5.5	6.8	APHA 4500-K B / IS 3025 (Part 45): 1993
Microbiological Parameters								
36	Total Coli form	MPN/ 100ml	Shall not be detectable in any 100 ml of sample		<1	<1	<1	IS: 1622-1981
37	E.Coli	E.Coli/ 100ml	t be detectable in any 100 ml of sample		Absent	Absent	Absent	IS: 1622-1981

The surface water sample for River Umkynrem has been analysed and compared with the standards of IS 2296:1992 for Class C water, which is suitable for drinking water source after conventional treatment and disinfection.

The results indicate that pH (7.16), dissolved oxygen (6.4 mg/l), and BOD (4.18 mg/l) are well within the prescribed limits, indicating good oxygenation and low organic pollution. Total Dissolved Solids (232.8 mg/l), chlorides (28.4 mg/l), sulphates (35.7 mg/l), nitrate (2.4 mg/l), and fluoride (0.41 mg/l) are also significantly below the permissible limits. The total coliform count (932 MPN/100 ml) is below the permissible limit of 5000 MPN/100 ml for Class C waters. Overall, the results suggest that the surface water quality at the sampling location is within acceptable limits and does not indicate significant contamination.

Table 5.4.1.3: Surface Water monitoring results in the project area

Sl. No.	Parameters	Unit	IS: 2296 - 1992 (Class C)	SW-1	Test method
			Tolerance Limit		
1	pH	-	6.5 -8.5	7.16	IS: 3025(Pt-11)1983, RA. 2002

Sl. No.	Parameters	Unit	IS: 2296 - 1992 (Class C) Tolerance Limit	SW-1	Test method
2	Temperature	°C	-	19.8	APHA 23nd Edn.2017-2550 B
3	D.O	mg/l	Minimum -4	6.4	IS 3025(Part-38): 2006
4	BOD	mg/l	30	4.18	IS 3025(Part-44):1993, RA 2009
5	Colour	Hazen	300	5	IS: 3025 (Pt-4) 1983, RA 2017
6	Odour	-	-	Agreeable	IS: 3025(Pt-5)
7	TDS	mg/l	1500	232.8	IS 3025(Part-16): 1984, RA 2006
8	TSS	mg/l	-	19.2	IS 3025(Part-17)
9	TKN	mg/l		2.4	IS: 3025(Pt-34)1988, RA. 2003
10	Ammonical Nitrogen	mg/l		0.42	IS: 3025(Pt-34)1988, RA. 2003
11	Nitrate (as NO_3)	mg/l	50	2.4	IS: 3025(Pt-34)1988, RA. 2003
12	Free Ammonia	mg/l		<0.1	IS: 3025(Pt-34)1988, RA. 2003
13	Chlorides (as Cl)	mg/l	600	28.4	IS 3025(Part-32): 1988
14	Sulphates (as SO_4)	mg/l	400	35.7	IS 3025(Part-24):1986, RA 2003
15	Fluoride (as F)	mg/l	1.5	0.41	APHA 21st Ed., 4500F(D)
16	Oil & Grease	mg/l	0.1	<0.1	IS 3025(Part-39):1991, RA 2009
17	Phenolic Compound (as C_6H_5OH)	mg/l	0.005	<0.001	5530-B, C&E, APHA 23nd 2017
18.	Arsenic	mg/l	0.2	<0.1	3110- B, APHA 23nd Ed. 2017 (AAS)
19	Mercury (as Hg)	mg/l	-	<0.001	3110- B, APHA 23nd Ed.2017
20	Lead (as Pb)	mg/l	0.1	0.01	3110- B, APHA 23nd Ed. 2017 (AAS)
21	Cadmium (as Cd)	mg/l	0.01	0.001	3110- B, APHA 23nd Ed. 2017 (AAS)
22.	Chromium (as Cr^{+6})	mg/l	0.05	0.02	IS 3025(Part-52): 200
23.	Copper (as Cu)	mg/l	1.5	0.10	3110- B, APHA 23nd Ed. 2017 (AAS)
24.	Zinc (as Zn)	mg/l	15	0.12	3110- B, APHA 23nd Ed. 2017 (AAS)
25	Selenium (as Se)	mg/l	-	<0.1	IS: 3025 (P- 56)
26.	Anionic detergents (as MBAS)	mg/l	1.0	<0.1	Annexure K Of IS 13428
27.	Iron (as Fe)	mg/l	50	0.32	3500-Fe- B, APHA 23nd Ed. 2017
28.	Sulphide (as H_2S)	mg/l	-	0.16	IS-3025 (P-29)
29.	Phosphate (as PO_4)	mg/l	-	5.12	APHA 22nd Edn.2012-4500-P C
30.	Cyanide (as CN)	mg/l	0.05	<0.1	4500-CN-B, C & E, APHA 23nd Ed.2017
31.	Manganese (as	mg/l	-	0.03	3110- B, APHA 23nd Ed.2017

Sl. No.	Parameters	Unit	IS: 2296 - 1992 (Class C) Tolerance Limit	SW-1	Test method
	Mn)				
32.	COD	mg/l	-	15.7	IS 3025(Part-58): 2006
33.	Total Coli form	MPN/100ml	5000	932	IS: 1622-1981

5.5 AIR ENVIRONMENT

5.5.1 AIR QUALITY

There are no major industries along the project road, and vehicular movement is the primary source of emissions. Based on site observations and public consultations, no noticeable deterioration in ambient air quality was observed. Ambient air quality monitoring has been conducted at three locations during the month of October. Parameters like Particulate Matter (PM_{10}), Particulate Matter ($PM_{2.5}$), Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2) and Carbon Monoxide (CO) were monitored. Monitoring locations are given in **Table 5.11** & **Figure 5.8.**

Table 5.5.1: Ambient Air Quality monitoring locations in the sub-project area

Sl. No.	Project Area	Monitoring Location	Sample Code	Geographical Coordinate	
				Latitude	Longitude
1	WMP	Weiloi	AAQ1	25.361905°	91.612002°
2		Mawsynram	AAQ2	25.297114°	91.580281°
3		Phlangwanbroi	AAQ3	25.252391°	91.496826°

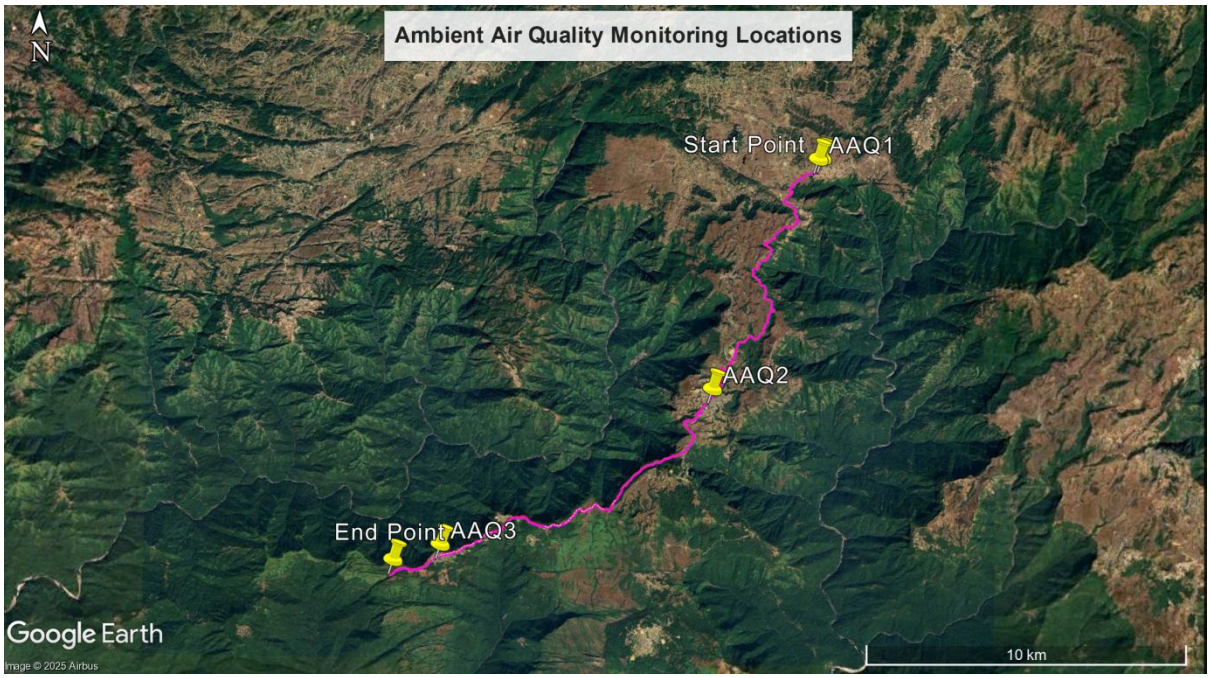


Figure 5.5.1: Air Quality monitoring locations

The monitored ambient air quality along the project corridor covering Weiloi, Mawsynram, and Phlangwanbroi indicates that concentrations of key air pollutants are well within the permissible limits prescribed under the National Ambient Air Quality Standards (NAAQS, CPCB 2009). The recorded PM_{10} levels range from 51.2 to 59.8 µg/m³ and $PM_{2.5}$ from 27.8 to 30.2 µg/m³, which are significantly below the respective limits of 100 µg/m³ and 60 µg/m³. Similarly, Sulphur Dioxide (SO_2) and Nitrogen Dioxide (NO_2) concentrations vary between 6.3–6.9 µg/m³ and 7.1–7.7 µg/m³, respectively, much lower than the prescribed standard of 80 µg/m³. Carbon Monoxide (CO) levels were observed between 0.230–0.290 µg/m³, far below the permissible limit of 2000 µg/m³. Overall, the air quality in the project corridor is good and within National Ambient Air Quality Standards, suggesting no immediate air pollution concerns in the area. Ambient Air Quality Monitoring Results is presented in Table 5.12.

Table 5.5.2: Ambient Air Quality Monitoring Results

Sl. No.	Project Area	Location	Sample Code	PM_{10} (µg/m³)	$PM_{2.5}$ (µg/m³)	Sulphur Dioxide (SO_2) (µg/m³)	Nitrogen Dioxide (NO_2) (µg/m³)	Carbon Monoxide (CO) (µg/m³)
1	WMP	Weiloi	AQ1	51.2	27.8	6.3	7.1	0.250
2		Mawsynram	AQ2	59.8	30.2	6.9	7.7	0.290
3		Phlangwanbroi	AQ3	52.7	28.6	6.5	7.3	0.230
National Ambient Air Quality Standards, Central Pollution Control Board, 2009				100	60	80	80	2000

5.6 NOISE ENVIRONMENT

There are no major industries along the project road, and the primary source of noise is vehicular traffic. Based on site observations and public consultations, no significant noise levels were observed.

The noise level monitoring was carried out at three locations. A noise level meter has been used to measure noise levels as instant values which are integrated over a mentioned period to give Leq values as "A" weighted average. The detail of noise quality monitoring stations are mentioned in Table 5.13 and Figure 5.9. Analysis of the noise data collected from the site is mentioned in Table 5.14.

Table 5.6.1: Location of Noise Level Monitoring

Sl. No.	Project Area	Monitoring Location	Sample Code	Geographical Coordinate	
				Latitude	Longitude
1	Corridor 8	Weiloi	NQ1	25.361905°	91.612002°
2		Mawsynram	NQ2	25.297114°	91.580281°
3		Phlangwanbroi	NQ3	25.252391°	91.496826°

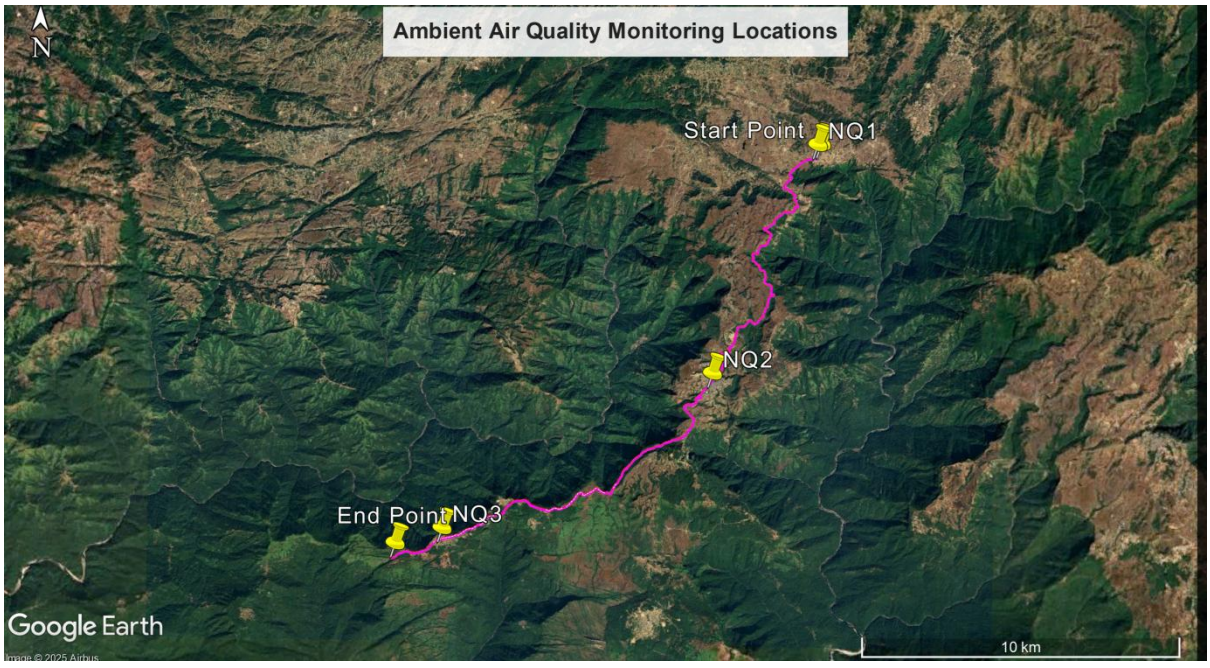


Figure 5.6.1: Noise Quality monitoring locations

Table 5.6.2: Analysis of Noise Level Monitoring

Location	Land Use	Standards dB(A)		Day Time Leq (dB(A))	Night Time- Leq (dB(A))
		Day	Night		
Weiloi	Commercial	65	55	52.7	37.4
Mawsynram	Commercial	65	55	53.4	39.5
Phlangwanbroi	Residential	55	45	51.2	36.7

As per the baseline monitoring, it was found that Noise level (Leq) was meeting the standards at all the three monitoring locations. In Weiloi, which is classified as a commercial area, the recorded daytime noise level is 52.7 dB(A) and the nighttime level is 37.4 dB(A). In Mawsynram, another commercial area, the recorded daytime noise level is Leq is 53.4 dB(A) and nighttime Leq is 39.5 dB(A) and in Phlangwanbroi, recorded daytime noise level is 51.2 dB(A) and 36.7 dB(A).

5.7 BIOLOGICAL ENVIRONMENT

5.7.1 BIODIVERSITY IN THE SUB PROJECT DISTRICT

The biodiversity within 10 km radius of the WMP Roads were studied based on the secondary sources followed by primary data collection in the direct impact area. Project Influence Area with 10 km buffer area is presented in **Figure 5.10**. The methodology adopted for biodiversity assessment is attached as **Annexure 5.1.**

A primary biodiversity survey was conducted during the field visit in October 2025. The primary survey specifically recorded 32 tree species, 3 shrub species, 5 herb species, and 7 grass species. In terms of fauna, the primary survey documented 4 bird species, 1 amphibian species, and 5 butterfly species.

The biodiversity survey from both Primary and secondary source documented a total of 91 species of flora (40 Tree species, 7 Shrubs, 17 Herbs, 20 Fern, and 7 Grass species), 10 mammal species, 46 bird species, 8 reptile

pecies, 5 amphibians and 11 butterfly species were recorded during the field survey.

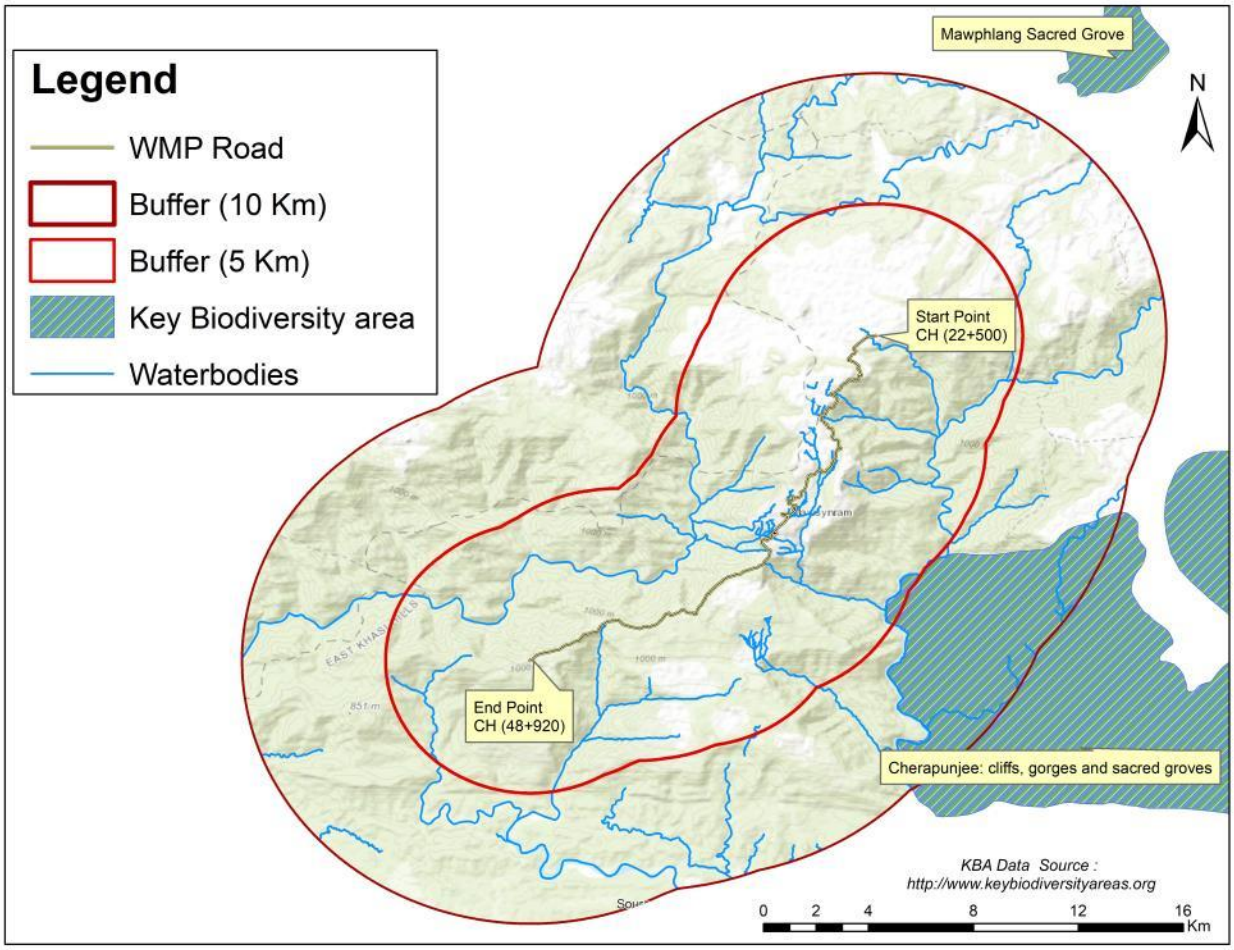


Figure 5.7.1: Project Influence Area with 10km buffer area for WMP road

5.7.2 BIODIVERSITY AND CRITICAL HABITAT IN PROJECT ROAD

A species wise screening was carried out and it was assessed that none of the identified species meet the threshold for Critical Habitat criteria under IFC PS6 or World Bank ESS6. Hence, all species have been screened out from further critical habitat assessment was not carried out.

Critical Habitat Screening for the Weiloi–Mawsynram–Phlangwanbroi Road Project is presented in Table 5-15.

Table 5.7.1: Critical Habitat Screening for the Weiloi–Mawsynram–Phlangwanbroi Road Project

Name	IUCN Status	Restricted Range	Migratory / Congregatory	Habitat & Distribution	Likelihood of Occurrence in Project Area	Rationale for Critical Habitat Screening	Screened In / Out
Bufoides meghalayanus (Khasi Hills Toad)	Critically Endangered (CR)	Yes – endemic to Khasi Hills (Meghalaya	No	Found in rocky outcrops, forest	Low	Although endemic to the Khasi Hills, no	Screened Out

Name	IUCN Status	Restricted Range	Migratory / Congregatory	Habitat & Distribution	Likelihood of Occurrence in Project Area	Rationale for Critical Habitat Screening	Screened In / Out
		only)		streams, and moist crevices near Mawsynram– Cherrapunjee plateau		habitat alteration or widening is proposed. The road lies within an existing RoW. This area is already disturbed the possibility of a habitat within the RoW is low.	
Hoolock hoolock (Western Hoolock Gibbon)	Endangered (EN)	NE India & Bangladesh	No	Evergreen and semi-evergreen forests of Meghalaya, prefers canopy continuity	Low	Since this is an existing road there is no chances of disturbing the canopy cover. Further the tree felling will only be done in case of absolute necessity. Road upgrading within available RoW; no direct	Screened Out

Name	IUCN Status	Restricted Range	Migratory / Congregatory	Habitat & Distribution	Likelihood of Occurrence in Project Area	Rationale for Critical Habitat Screening	Screened In / Out
						impact on forest habitat.	
Nycticebus bengalensis (Bengal Slow Loris)	Endangered (EN)	NE India, SE Asia	No	Nocturnal primate inhabiting secondary and primary forests	Low	Simialr to the Hollock Gibbon these are also arbeoral species and will not be affected	Screened Out
Neofelis nebulosa (Clouded Leopard)	Vulnerable (VU)	NE India, SE Asia	No	Dense evergreen and semi-evergreen forests	Low	No forest diversion or habitat loss; no potential for significant impact.	Screened Out
Manis pentadactyla (Chinese Pangolin)	Critically Endangered (CR)	NE India and SE Asia	No	Forested slopes with termite mounds	Low	No new forest clearance is proposed. so habitat destruction / impact is unlikely.	Screened Out
Manis crassicaudata (Indian Pangolin)	Endangered (EN)	Indian subcontinent	No	Forest edges and cultivated land mosaics	Low	Most of the development would happen within the Row, which is a modified	Screened Out

Name	IUCN Status	Restricted Range	Migratory / Congregatory	Habitat & Distribution	Likelihood of Occurrence in Project Area	Rationale for Critical Habitat Screening	Screened In / Out
						habitat and disturbed. Possible presence in surrounding areas; however, no direct impact expected within RoW.	
Anthracoceros albirostris (Oriental Pied Hornbill)	Near Threatened (NT)	No	Possible local congregations	Evergreen and moist deciduous forests; nests in tree cavities	Low	Further the tree felling will only be done in case of absolute necessity. There are only small number of trees which will be felled. No mature nesting trees or canopy removal within the project stretch.	Screened Out
Rhyticeros undulatus (Wreathed Hornbill)	Vulnerable (VU)	No	Yes – breeding congregations	Montane forests of NE India; forms colonies	Low	No nesting colonies or forest removal along the	Screened Out

Name	IUCN Status	Restricted Range	Migratory / Congregatory	Habitat & Distribution	Likelihood of Occurrence in Project Area	Rationale for Critical Habitat Screening	Screened In / Out
				during nesting		existing road alignment. The forest type in region are primarily Tropical and sub-tropical	
Rucervus unicolor (Sambar Deer)	Vulnerable (VU)	No	No	Forested valleys and hill slopes	Low	The alignment will not pass through any forested area so no impact on habitat is expected	Screened Out
Macaca assamensis (Assam Macaque)	Near Threatened (NT)	No	No	Forest edges and secondary forests	Moderate	Common in the region but not restricted or dependent on habitats impacted by the project because the forest are more than 500m away.	Screened Out
Pavo cristatus	Least	No	Congregator	Scrub and	Low	Common	Screene

Name	IUCN Status	Restricted Range	Migratory / Congregatory	Habitat & Distribution	Likelihood of Occurrence in Project Area	Rationale for Critical Habitat Screening	Screened In / Out
(Indian Peafowl)	Concern (LC)		y locally	forest edges		species with no conservation concern in the project zone.	d Out

Project Influence Area (Within 10 km): Critical habitat assessment was conducted based on the "Critical Habitat" criteria outlined by World Bank's ESF (ESS 1 & 6). The details of the presence of critical habitat within PIA are summarized in **Table 5.16**.

Table 5.7.2: Biodiversity and critical habitat assessment-based on field survey and GIS analysis for the 500 m buffer

Sl. No.	Habitat (includes natural or modified)	Observation	Remarks
I.	(a) Habitats protected by national and state legal regulations		
	(i) PAs - Wildlife Sanctuary, National Park, conservation reserve or community reserve, Tiger reserve and corridor and Eco-sensitive zone (As notified under the Wildlife Protection Act, 1972)	Not present	
	(ii) Reserve Forest (As notified under India Forest Act, 1927)	Not Present	
	(iii) Protected wetland of Meghalaya	Not Present	
II.	b) Habitat of significant importance to Critically Endangered or Endangered species		
	(i) Species listed under Schedule I of the Wildlife (Protection) Act, 2022	Not sighted during the survey	A total of 28 species are listed under Schedule I of the Wildlife Protection Act, 2022. Although none of these species were sighted during the field surveys conducted in the study area, their presence has been indicated through secondary information sourced from the IBAT Tool. Details are

Sl. No.	Habitat (includes natural or modified)	Observation	Remarks
			provided in Annexure 5.2
	(ii) Species listed under Schedule III of the Wildlife (Protection) Act, 2022	Not present	
	(ii) Species notified as "threatened species" by the Govt. of Meghalaya under the Meghalaya Biodiversity Rules 2010	Not Present	
	(iii) Critically Endangered/Endangered species as listed by the IUCN Red List of Threatened species	Not Present	
III.	c) Habitats of significant importance to endemic or restricted-range species d) Habitats that support globally or nationally significant concentrations of migratory or congregatory species e) Highly threatened or unique ecosystems		
	(i) Biosphere Reserve (Core Area)	Not present	
	(ii) Ramsar Site	Not present	
	(iii) Important fish & Key Biodiversity Area	No	
	(iv) Habitat of Appendix I – Endangered migratory species as per the Convention on the Conservation of Migratory Species (CMS)	Not present	
	(v) Notified Elephant Reserve and Corridor	Not present	
	(vi) Natural habitats	Not Present	The habitats in the project area are modified for agricultural purposes, and the degraded forest is primarily dominated by bamboo species, Sohphie,

5.7.3 SUMMARY OF BIODIVERSITY ASSESSMENT AND RISKS

A transect walk was conducted during the month of October 2025 along the entire sub-project road to document the existing biological environment, including vegetation types, floral composition, and habitat conditions, and to identify ecologically sensitive areas along the project corridor. A total of 91 species of flora (40 Tree species, 7 Shrubs, 17 Herbs, 20 Fern, and 7 Grass species), 10 mammal species, 46 bird species, 8 reptile species, 5 amphibians and 11 butterfly species were recorded during the field survey. The detailed list of flora and fauna is attached as **Annexure 5.2.** As per National Tiger Conservation Authority, the sub project road does not passing through any tiger corridor.

The presence of 06 Schedule-I species identified through the Integrated Biodiversity Assessment Tool (IBAT) indicates the potential distribution range of these species within the broader landscape based on global biodiversity databases such as the International Union for Conservation of Nature (IUCN) and World Database on Protected Areas (WDPA). However, IBAT outputs represent modelled habitat suitability or regional occurrence data, not necessarily confirmed site-specific presence along the exact project corridor. During the field reconnaissance and ecological assessment conducted for the DPR/EIA study, no direct evidence such as sightings, tracks, nests, or habitat use of Schedule-I wildlife species was recorded within the immediate project influence area. Therefore, while IBAT highlights that the wider landscape may support Schedule-I species, the absence of confirmed field observations within the project stretch indicates that critical wildlife habitat is not directly present within the road alignment.

As per the Champion and Seth (1968) classification, vegetation along the Weiloi–Mawsynram Road up to Phlangwanbroi in East Khasi Hills is dominated by Sub-tropical Wet Hill Forest, reflecting the region's very high rainfall and hilly terrain. These forests comprise dense evergreen and semi-evergreen broad-leaved species with a well-developed understory. In transitional and disturbed stretches, the vegetation grades into East Himalayan Moist Mixed Deciduous Forest, along with secondary bamboo brakes and scrub vegetation near settlements and road edges. Overall, the corridor passes through a mosaic of natural forest and secondary vegetation typical of the wet hill ecosystems of the Khasi Hills.

5.8 SOCIO ECONOMIC PROFILE

The baseline study assessed the socio- economic profile of households and families within the Project Influence Area that may be affected by the project. The assessment covered various parameters including education levels, ethnicity, religion, source of livelihood and income levels of affected families.
The project corridor is predominantly inhabited by Scheduled Tribe communities, who constitute the majority of the population across all districts. The Khasi tribe, along with the Khynriam, War and Maram Sub tribes, each with a distinct dialect reside along the project corridor.

Socio-Economic baseline of the Sub Project Road

The sub project road provides a vital link for numerous settlements, supporting communities that depend on the corridor for daily mobility, economic activities, and access to essential services. The region's socio-economic activities are closely intertwined with the natural and cultural landscape, making the road a critical component of local livelihoods and overall development.

Population:

The project corridor passes through nine villages namely Mawsynram, Weiloi, Wahmawpat,
Laitsohum, Mawrapat, Mawkasain, Mawsawa, Kenbah Malai, Phlangwanbroi. Based on the population size, it may be mentioned that smaller rural settlements such as Laitsohum (216) and Mawsawa (206), have a relatively low population. Gender distribution is generally balanced, though some areas such as Mawsynram, Weiloi, and Phlangwanbroi have a higher proportion of females. Larger settlements, including Mawsynram (1,337) and Phlangwanbroi (939), significantly influence the region's demographics, reflecting the variation in population density along the corridor. The population distribution of the sub-project affected villages is presented in **Table 5.17**.

Table 5.8-1: Population Distribution in Villages along the WMP Road

Total Population			
Village Name	**Male**	**Female**	**Total**
Mawsynram	635	702	1337
Weiloi	366	387	753
Wahmawpat	400	386	786
Laitsohum	107	109	216
Mawrapat	198	183	381
Mawkasain	347	351	698
Mawsawa	100	106	206
Kenbah Malai	402	377	779
Phlangwanbroi	437	502	939

Source: Census 2011

SEX RATIO

The sex ratio along the project road varies from 924 to 1,149[6]. Most villages, including Phlangwanbroi (1,149), Mawsynram (1,106), and Mawsawa (1,060), have more females than males, while Mawrapat (924) and Kenbah Malai (938) have a male-biased population. Overall, the corridor shows a predominantly female-biased demographic with notable inter-village variation. Detailed sex ratio data for the project-affected villages and two towns are presented in **Table 5.18**.

Table 5.8-2: Sex Ratio in the villages along the WMP road

Village Name	Sex Ratio
Mawsynram	1106
Weiloi	1057
Wahmawpat	965
Laitsohum	1019
Mawrapat	924
Mawkasain	1012

[6] *Source: Census 2011*

Village Name	Sex Ratio
Mawsawa	1060
Kenbah Malai	938
Phlangwanbroi	1149

Source: Census 2011

Scheduled Tribe population:

The district is predominantly inhabited by Scheduled Tribe (ST) populations such as Khynriam, War and Maram. Along the project road corridor, ST communities are mainly concentrated in smaller rural villages, with Mawsynram (1,325) and Phlangwanbroi (931) recording the highest ST populations. Medium-sized settlements such as Weiloi (744) and Mawkasain (697) also have a notable ST presence, while smaller villages like Laitsohum (216) and Mawsawa (205) have comparatively lower ST populations. A detailed distribution of the ST population along the project corridor is provided in **Table 5.19**.

Table 5.8-3: ST Population in the Villages along the sub project road

ST Population				
Village Name	**Male**	**Female**	**Total**	**Percentage**
Mawsynram	629	696	1325	99.10
Weiloi	360	384	744	98.80
Wahmawpat	398	384	782	99.49
Laitsohum	107	109	216	100.00
Mawrapat	198	182	380	99.74
Mawkasain	346	351	697	99.86
Mawsawa	99	106	205	99.51
Kenbah Malai	400	376	776	99.61
Phlangwanbroi	431	500	931	99.15

Source: Census 2011

Education:

The educational scenario along the project corridor shows notable variations in literacy levels across rural settlements. Mawsynram and Phlangwanbroi exhibit the highest literacy rates, whereas villages such as Laitsohum and Mawsawa have comparatively low literacy levels. Gender disparities persist, with males generally showing higher literacy rates; however, certain villages such as Weiloi and Mawrapat demonstrate more balanced gender participation. The detailed distribution of literate populations in the sub-project affected villages is provided in **Tables 5.20.**

Table 5.8-4: Literate Population in Villages along the sub project road

Literate Population				
Village Name	Male	Female	Total	Percentage
Mawsynram	515	568	1083	81.00
Weiloi	248	250	498	66.14
Wahmawpat	324	297	621	79.01
Laitsohum	76	78	154	71.30
Mawrapat	123	121	244	64.04
Mawkasain	240	207	447	64.04
Mawsawa	53	56	109	52.91
Kenbah Malai	199	205	404	51.86
Phlangwanbroi	245	290	535	56.98

Source: Census 2011

Total workforce:

Among the nine villages, Mawsynram has the highest total workforce with 436 workers (273 males and 163 females), while Laitsohum has the lowest workforce with 62 workers (49 males and 13 females). In terms of main workers, Mawsynram again leads with 425, and Mawrapat has the lowest main workforce at 17 workers. For marginal workers, Mawrapat shows the highest number with 112, whereas Wahmawpat, Laitsohum, and Mawsawa have the lowest, each with only 1–2 marginal workers. The tribal communities residing along the WMP road are primarily engaged in agriculture and horticulture activities, including cultivation of paddy, maize, millets, and pulses. In addition, some households are involved in livestock rearing, wage labour, and small-scale local trade for supplementary income. This indicates that while larger villages have more stable employment (main workers), smaller villages rely more on marginal or seasonal work. The detailed workforce of the project affected villages is given in **Table 5.21**.

Table 5.8-5: Workforce Population of Village along the sub Project road

Area	Main Workers (No.)			Marginal Workers (No.)			Total Workforce (No.)			Percentage
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
Mawsynram	269	156	425	4	7	11	273	163	436	32.61
Weiloi	119	70	189	23	29	52	142	99	241	32.01
Wahmawpat	163	132	295	1	0	1	164	132	296	37.66

Area	Main Workers (No.)			Marginal Workers (No.)			Total Workforce (No.)			Percentage
	Male	Female	Total	Male	Female	Total	Male	Female	Total	
Laitsohum	49	12	61	0	1	1	49	13	62	28.70
Mawrapat	14	3	17	67	45	112	81	48	129	33.86
Mawkasain	83	18	101	66	21	87	149	39	188	26.93
Mawsawa	49	7	56	1	1	2	50	8	58	28.16
Kenbah Malai	178	48	226	16	16	32	194	64	258	33.12
Phlangwanbroi	192	116	308	10	82	92	202	198	400	42.60

Source: Census 2011

5.8.1 WAGES AND BENEFITS

Public consultations with local communities revealed that wages in the project area are lower than in urban centers, and workers often do not receive benefits such as healthcare, pensions, or paid leave. According to the Department of Rural Development (2023–24), the notified wage rate for unskilled labor in these corridors is Rs. 541, as per the latest Meghalaya notification effective from 1 April 2025 (dated 21st July 2025). While the lower cost of living partially offsets these lower wages, achieving financial stability remains a challenge for many workers.

5.8.2 SEASONAL EMPLOYMENT

Initial consultations with communities along the WMP road in East Khasi Hills indicated that agriculture and allied activities remain the primary sources of livelihood, including shifting cultivation, horticulture and livestock rearing. Community members reported that employment opportunities are largely seasonal, linked mainly to agricultural cycles and occasional local wage labour. During lean agricultural periods, households often experience underemployment and income fluctuations, prompting some individuals to seek temporary work in nearby towns or other districts. Improved road connectivity under the project is expected to enhance access to markets, services, and alternative livelihood opportunities for these settlements.

5.8.3 POVERTY

In this sub project road, poverty rates are higher in rural areas compared to urban centers. Households in remote villages, where road connectivity is still developing, largely depend on subsistence farming. Limited access to markets, credit, and financial services further constrains their economic opportunities, contributing to the higher prevalence of poverty in these areas.

5.8.4 SOCIAL VULNERABILITIES

5.8.4.1 MIGRATION

Consultations with villagers indicate that residents prefer to remain within their local areas, primarily engaging in agriculture and commercial activities within their villages. Community members noted that while some individuals occasionally seek temporary or seasonal employment outside the village, long-term migration is limited, and livelihoods continue to be largely locally anchored.

5.8.4.2 CRIME

In the WMP road most cases in the villages are resolved through traditional mechanism, with the village defence party and the intervention of the Rangbah Shnong (village headman) playing a central role in dispute resolution. Only cases that cannot be settle as the level of the Shnong (village) or require legal intervention are usally escalated and reported to the police. Crime cases in East Khasi District for year 2023. Crime cases in East Khasi District is presented in Table 5.22.

Table 5.8-6: Crime cases in East Khasi District

Sl. No	Head of Crime	2023[7]
1	Murder	14
2	Culpable Homicide (Not Amounting to Murder)	0
3	Causing Death by Negligence	27
4	Dowry Deaths	0
5	Attempt to Commit Murder	20
6	Miscarriage / Infanticide / Foeticide / Abandonment	2
7	Hurt	109
8	Assault on Women (Modesty)	28
9	Kidnapping & Abduction	34
10	Human Trafficking	0
11	Rape	19
12	Attempt to Commit Rape	4
13	Unnatural Offences	0
14	Offences Against State	0
15	Riots	0
16	Promoting Enmity Between Groups	4
17	Theft	456
18	Burglary	132
19	Extortion & Blackmailing	13
20	Robbery	20
21	Dacoity	4
22	Criminal Breach of Trust	19
23	Counterfeiting	0
24	Forgery, Cheating & Fraud	164
25	Rash Driving (Public Way)	26
26	Arson	20
27	Criminal Trespass	13
28	Cruelty by Husband / Relatives	9
29	Criminal Intimidation	36
30	Insult to Modesty of Women	8
31	Other IPC Crimes	46
—	**Total Cognizable IPC Crimes**	**1227**

[7] Meghalaya Police

5.8.4.3 GENDER BASED VIOLENCE

NCRB-based crime data for *East Khasi Hills District* specifically on crimes against women from **2019 to 2023** (based on Meghalaya Police's Crime in East Khasi Hills district report compiled from NCRB records) is shown below in **Table 5.23**.

Table 5.8.7: Crime against Women in Khasi Hills district:

Sl	Crime Head	Reported				
		2019	2020	2021	2022	2023
A	Crimes against Women	194	160	228	201	180
B	East Khasi Hills Total IPC and SLL Crime	1549	1516	1441	1404	1452

* https://megpolice.gov.in/

5.9 SOCIO-ECONOMIC PROFILE OF PROJECT AFFECTED HOUSEHOLDS

Socio-economic data of project-affected households were collected through census and socio-economic surveys, systematically tabulated, and analyzed to assess the extent of adverse impacts on structures and livelihoods. A structured, pre-tested questionnaire served as the primary tool for these surveys, which were conducted in September 2025.

5.9.1 DEMOGRAPHY

The total number of project-affected households is 10, comprising of a total of 66 PAPs. The **Table 5.24** summarizes the Chainage wise details of likely affected structures as these structures are within the RoW. Among these, 8 households (80%) are male-headed, while 2 households (20%) are female-headed. **Table 5.25** below summarizes the gender distribution of the heads of households. **Table 5.32** summarizes on the type of impact on structures.

Table 5.9-1: Chainage wise details of likely affected structures

Sl No	Chainage	Village name	LHS	RHS	Distance from center line (In m)	Type of structure
1.	22+620	Weiloi	✓		5.5	(Concrete) Compound wall of house
2.	34+630	Mawsynram		✓	5.0	Shade (GI Sheet) of shop
3.	34+635	Mawsynram	✓		5.0	Shade (GI Sheet) of shop
4.	43+890	Mawrapad		✓	5.0	Shed (GI Sheet) of shop
5.	45+690	Mawkasain	✓		4.5	(Concrete) Compound wall of house
6.	45+700	Mawkasain	✓		5.0	(Concrete) Compound wall of house

Sl No	Chainage	Village name	LHS	RHS	Distance from center line (In m)	Type of structure
7.	45+720	Mawkasain		✓	5.0	(Concrete) Stairs of house
8.	45+730	Mawkasain	✓		3.5	(Concrete) Stairs of house
9.	46+550	Mawsawa	✓		5.5	Shade (GI Sheet) of Temperory Shops (4 shops)
10.	46+560	Mawsawa	✓		5.5	(Concrete) Compound wall of house

Table 5.9.2: Gender Distribution of PAHs

Gender	Project Road	Percentage
Male	8	80.0
Female	2	20.0
Total	**10**	100.0

Source: EIS primary survey – 2025

5.9.1.1 GENDER DISTRIBUTION OF PROJECT-AFFECTED PERSONS

The gender distribution of Project-Affected Persons (PAPs) of 10 project-affected households shows a nearly balanced composition, with a slightly higher proportion of males. Out of a total of 66 PAPs, 37 individuals (56%) are male, while 29 individuals (44%) are female. The gender distribution of PAPs is presented in **Table 5.26**.

Table 5.9.3: Gender Distribution of Project-Affected Persons (PAPs)

Gender	Project Road	
	Project Affected Persons	Percentage
Male	37	56.0
Female	29	44.0
Total	**66**	**100.0**

Source: EIS primary survey – 2025

5.9.1.2 ETHNICITY

Along the project road, all PAHs belong to the Khasi tribe falling under either of the following sub-groups: Khynriam, War and Maram. The Khynriam community constitutes the majority, representing 60% of settlements, followed by the War community at 30%, and the Maram community at 10%. The detailed distribution of ethnic groups along the project road is provided in **Table 5.27**.

Table 5.9.4: Community Wise Distribution of PAHs

Communities	Project Road	Percentage
Khynriam	6	60%
War	3	30%
Maram	1	10%

5.9.2 IMPACT TO VULNERABLE HOUSEHOLDS

Census and socio-economic surveys identified vulnerable groups among the households, including women-headed households, below-poverty-line families, and the elderly population (60+ years). **Table 5.28** presents the distribution of these vulnerable groups within the study area.

Table 5.9.5: Distribution of Vulnerable Group

Vulnerable Category	PAH
Aged persons above 60 years	2
Below Poverty Line	2
Woman Headed Household	2
Total	**6**

5.9.3 ECONOMIC PROFILE

EMPLOYMENT PATTERNS

5.9.3.1 AGRICULTURAL DOMINANCE

Along the project road, the majority of people are engaged in agriculture (6), business (3), and service sector (1) play a smaller role, reflecting a predominantly agrarian and informal local economy. The occupational pattern of project-affected households (PAHs) in the area is presented in **Table 5.29**.

Table 5.9.6: Occupation pattern of PAHs in project area

Sl. No.	Occupation	Project Road
1	Agriculture	7
2	Business	3
3	Service Sector	1
Total		**10**

5.9.3.2 INCOME

Along the project road, 60% of households earn less than ₹25,000 per month, while 20% earn between ₹25,000–50,000, and another 20% earn between ₹50,000–1,00,000. The monthly income range of project-affected households (PAHs) is presented in **Table 5.30**.

Table 5.9-7: Monthly Income Range of PAHs

Sl. No.	Monthly Income Range of HH	Project Road	
		No. of PAHs	Percentage
1	less than 25000	6	60
2	25000- 50000	2	20
3	50000-100000	2	20
4	More than 100000	0	0
Total		**10**	**100**

5.9.4 EDUCATION

Along the project road, out of 66 individuals, most have attained primary (24) or high school education (23). Fewer individuals have completed higher secondary (3) or graduate and above levels (11), while 5 individuals are illiterate. This indicates a moderate overall educational attainment, with particular scope for improvement among women. The education levels of Project-Affected Persons (PAPs) are presented in **Table 5.31**.

Table 5.9.8: Education Level of PAPs

Sl. No	Education	Project Road		
		Male	Female	Total
1	Primary (Class 1 to 4)	17	7	24
2	High School (Class 5-10)	9	14	23
3	Higher Secondary (Class 11-12)	1	2	3
4	Graduate and Above	8	3	11
5	Illiterate	2	3	5
	Total	**37**	**29**	**66**

5.9.5 HEALTH STATUS

The health status of East Khasi Hills District has improved over the years due to targeted government initiatives; however, significant challenges remain. Rural-urban disparities, limited healthcare infrastructure, and the increasing prevalence of lifestyle-related diseases are major concerns. The district continues to face a dual burden of communicable diseases, such as malaria, dengue, and diarrheal illnesses, alongside a rising incidence of non-communicable diseases (NCDs), including hypertension, diabetes, and cardiovascular

conditions. Improving overall health outcomes requires a multi-pronged approach that emphasizes healthcare accessibility, nutritional support, health education, disease prevention, and early diagnosis across both rural and urban areas.

The Mawsynram Community Health Centre (CHC) serves as the main hub, acting as a referral point for 4 Primary Health Centres (PHCs) and sub-centres. Outreach efforts are also made via Mobile clinics and weekly outreach sessions (e.g., at Kenmynsaw village community halls) deliver routine care, vaccinations, and maternal services despite 1–2-hour hikes in rain. The National Health Mission (NHM) Meghalaya supports these via the 108-ambulance helpline and 14410 health query line.

5.9.6 TYPE OF LOSS

Approximately thirteen structures are expected to be affected by the project and they are present within the RoW, including seven kuchha shops and six residential-related structures such. Details are given above in **Table 5.19**.

5.9.7 IMPACT TO STRUCTURES

The proposed improvements along the project corridor are expected to partially impact (less than 10% of the structure) approximately thirteen structures, including seven shops and six residential-related structures, such as one stairs and compound walls. There are 6 nos. of Residential Structures (Concrete staircase and concrete compound walls) and 7 nos. of Commercial Structures (G I Sheet, Shed, Shades and Gate). A 30-day notice period will be provided to all Project Affected Persons (PAPs) whose structures fall within the project ROW, allowing them sufficient time to salvage materials and relocate. Details of the impacted structures by project corridor are presented in **Table 5.32**.

Table 5.9.9: Type of Structure Impact on Project Affected Household

Type of Structure	Type of Impact	PAH Category	No of structure	No of PAHs	No of PAPs	% of impact
Commercial Structures (Such as G I Sheet, Shed, Shades and Gate)	Loss of structure (partial impact)	Encroachers	7	4	27	<10
Residential Structures (Such staircase and compound walls)	Loss of structure (partial impact)	Encroachers	6	6	39	<10
Total				**10**	**66**	

5.9.8 LOSS OF TREES

Approximately 23 trees (excluding 7 fruit-bearing trees which belong to the community) are located within the existing Right of Way (RoW) on both sides of the road. To mitigate the ecological impact of tree felling, compensatory plantation (@1:10)/ as suggested by Forest Department should be carried out, in accordance with applicable environmental regulations and guidelines. Taking a cue from the MITP the survival of the trees should be monitored. These measures, along with their implementation strategies, are comprehensively detailed in the Environmental and Social Management Plan (ESMP).

5.9.9 COMMON PROPERTY RESOURCES

The Common Property Resources (CPRs) assessment classifies structures into government and community/public facilities. Construction induced Impacts on these CPRs will be limited to the construction phase**. There is no direct impact on these CPRs**. Details of the CPRs along the project road are presented in **Table 5.33.**

Table 5.9.10: Common Property Resources

CPR Structures	Number

Churches	**04 Churches** (Ch 43+000, LHS; Ch 46+800 RHS; Ch 46+300 LHS; 46+600 RHS) 01 Church at Ch 0+000 (Bypass)
School	**03 Schools** (Ch 32+100 LHS, 43+520 LHS, 46+600 RHS)
Memorial ground	1 Memorial ground at Ch 22+560
Grave Yard	1 at Ch 1+200 (Bypass)
TOTAL	**10**
Shrines/ Tree Shrines	0
Memory Stone	2 Monoliths (Ch 23+200 and Ch41+500)
Cave	2 Caves (Ch 34+000 and 41+000)
TOTAL	**4**
Grand Total	**14**

5.10 ARCHAEOLOGICAL AND HISTORICAL MONUMENTS

No ASI-protected monuments are located within 0.5 km of the project site. However, monoliths (at chainages 23+200 and 41+500) and caves (at chainages 34+000 and 41+000) are present within 500 m of the project road. Therefore, no baseline archaeological sites of direct significance are associated with the proposed WMP road corridor. The access to these Monolith will not be impacted. No construction camps will be established within 100 m of the Monolith. Instead, the DPR proposes beautification measures around the Monolith to enhance its cultural and aesthetic value. The layout for the improvement is presented in figure 4.1 of Chapter 4.

5.11 HAZARD AND VULNERABILITY PROFILE

The hazard and vulnerability profile of the WMP road area and East Khasi Hills district includes landslides, flash floods, earthquakes, among others. Other hazards such as droughts, group clashes, and fire incidents also occur in the district. A seasonal hazard analysis of East Khasi Hills district is presented in **Table 5.34**.

Table 5.9.11: Hazard analysis

Type of Hazards	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Landslide			◄	----	----	----	----	----	----	►		
Earthquake	◄	----	----	----	----	----	----	----	----	----	----	►
Flash flood		◄	----	----	----	----	----	----	----	►		
Storm			◄	----	----	►						

Fire Accident	◄											►
River Erosion				◄					►			
Industrial Hazard	◄											►
Road Accident	◄											►

5.11.1 LANDSLIDE PRONE AREAS

The list of landslide-prone areas in East Khasi Hills district is provided in **Table 5.35**. Notably, no landslide-prone areas have been identified along the project road corridor.

Table 5.9.12: List of landslide prone areas in East Khasi Hills District

S. No.	Block / Sub-Division	Landslide Prone Locations
1	Pynursla	Saitsohpen, Nongjri
2	Mawkynrew	Mawkynrew, Pynden
3	Sohra (Cherrapunjee)	Cherrapunjee, Nohsngithiang, Laitkynsew
4	Mawsynram Area	Mawsmai, Thangkharang

According to the landslide density map of East Khasi Hills district, the WMP road passes through areas of high to moderate landslide density, except for the initial stretches.

5.11.2 FLOOD ZONES

The list of flash flood-prone areas in East Khasi Hills district is provided in **Table 5.36**. Notably, no flood-prone areas have been identified along the project road.

Table 5.9.13: List of flash flood prone areas in East Khasi Hills District

S. No.	**Block / Sub-Division**	**Flash Flood Prone Locations**
1	Mawphlang	Mawphlang Village, Nongkynrih, Mawkyndeng
2	Pynursla	Nongkseh, Saitsohpen
3	Sohra (Cherrapunjee)	Cherrapunjee Town, Nongthymmai, Nohwet
4	Mawkynrew	Nongtyngur, Pynursla

5.11.3 EARTHQUAKE ZONES

Earthquakes

- **High Seismic Risk**: The region falls under **Seismic Zone V**, the most severe category in India.
- Caused by the region's location near the Himalayan tectonic plate boundary and Shillong Plateau faults.

The project road stretches fall under Zone – V, which is at Very High risk and intensity is IX. Seismic Zone details of East Khasi Hills is presented in **Table 5.37.**

Table 5.9.14: Seismic Zone details of East Khasi Hills

District	Seismic Zone	Notable Faults	Recent Earthquakes
East Khasi Hills	Zone V (Very High Damage Risk Zone)	Dudhani Fault, Darugiri Fault, Dapsi Fault, and other internal shear zones influencing Shillong Plateau tectonics	The district has experienced several low to moderate earthquakes (Magnitude 4.0–5.2), with notable tremors recorded in 2011 (Mw 4.2, Shillong) and 2021 (Mw 5.2, near Mawphlang–Shillong region)

Source: Meghalaya State Disaster Management Authority

5.11.4 CLIMATE RESLIENT FEATURES

Climate projections based on the IPCC AR6 CMIP6 multi-model ensemble under Scenario SSP5-8.5 indicate a rise in mean temperature by about 1.9°C by 2060 and up to 4.5°C by 2100, along with a significant increase in rainfall intensity. The projections suggest that annual average rainfall may increase by about 16–23%, while extreme rainfall events such as 1-day maximum rainfall could increase by up to 34.7% by 2100. Considering these projections, the project design for the Weiloi–Mawsynram Road up to Phlangwanbroi has incorporated climate-resilient engineering measures. These include enhanced drainage systems, increased hydraulic capacity of culverts and cross-drainage structures, slope stabilization through bio-engineering measures, and climate-resilient pavement materials such as polymer-modified bitumen. Additionally, hydrological design parameters have been adjusted using climate change factors (approximately +15% for drainage systems, +25% for culverts and minor bridges, and up to +35% for major bridge design rainfall) to account for projected increases in rainfall intensity. These measures aim to improve stormwater management, reduce erosion and slope instability, and ensure long-term resilience of the road infrastructure under future climate variability and extreme weather conditions.

6 ENVIRONMENTAL AND SOCIAL RISKS AND IMPACTS

6.1 INTRODUCTION

The project is expected to generate both positive and adverse environmental and social impacts along the road corridor. This chapter presents an analysis of the potential impacts arising from the implementation of project activities. These impacts vary in type, nature, magnitude, extent, timing, duration, certainty, and reversibility. The assessment takes into account the nature of the project, the types of activities involved, and the scale of potential impacts across various environmental and social components, including:

- Physical Environment: Air quality, water resources, noise levels, and soil
- Biological Environment: Flora and Fauna
- Socio-economic components: Property removal, Land Acquisition, ASI sites, Influx of labour, impact on Indigenous People

6.2 IMPACTS IDENTIFICATION AND EVALUATION

The potential impacts were identified through a three-step process:

1. Identification of project activities/aspects that could generate impacts;
2. Establishing the affected environmental and social components (valued receptors), which include vegetation, water bodies, soil, land stability, water quality and quantity, ambient air quality, employment and livelihoods, vulnerable groups, infrastructure, public safety, and occupational health and safety;
3. Determination of potential impacts through the preparation of an Impact Identification Matrix.

Based on the project information presented in Chapter 3 and the baseline environmental conditions described in Chapter 4, the anticipated impacts of the MLCIP project were identified and analyzed. The potential environmental and social impacts—both adverse and positive—arising from project activities during the Design, Construction, and Operational Phases were evaluated using the Leopold Matrix. This approach considered the interactions between project activities and both natural/physical environmental components and social components to determine whether such interactions could result in potential impacts.

6.3 IMPACT ANALYSIS USING LEOPOLD MATRIX (MAGNITUDE/IMPORTANCE CLASSIFICATION)

The Leopold Matrix is a comprehensive checklist designed for the identification, evaluation, assessment and analysis of environmental impacts on the development project following the interaction matrix analysis approach by Leopold. The Leopold Matrix developed for the road upgradation project is provided as **Table 6.1**. The checklist interaction matrix for environmental impact assessment was obtained by placing identified existing environmental components in the columns and the proposed project activities in the rows of the matrix. The process is summarized as follow:

6.3.1 IMPACT EVALUATION MATRIX

In order to assess the impacts of the proposed project, the impacts analysis across the project phases was done as follows.

1. Pre-Construction Phase
2. Construction Phase
3. Operational Phase

The description of the project activities and magnitude of the impacts for the various environments and social components for this project are presented in the below table. These impacts further have been categorized as per the World Bank's Environmental and Social Standards (ESSs) applicable to the project.

Interpretation of Impact Assessment Matrix

As per the impact evaluation matrix the environmental and social screening indicates that during the pre-construction phase, potential impacts are expected to be low to moderate, mainly due to site clearance, vegetation removal, and establishment of labour camps or material storage areas. These may temporarily affect air quality, noise levels, and local soil stability, but impacts will remain localized and reversible if proper site selection, vegetation management, and waste disposal measures are followed.

During the construction phase, impacts may intensify, particularly concerning air and noise pollution, waste generation. Activities such as excavation, grading, and drainage could also temporarily affect water resources and slope stability. However, these impacts are temporary and manageable through effective implementation of the Environmental and Social Management Plan (ESMP), including dust suppression, proper waste and fuel handling, and strong occupational health and safety (OHS) protocols.

In the operational phase, environmental and social risks are expected to be low to moderate, mainly linked to traffic movement, community safety, and road drainage maintenance. The project will also yield positive benefits, including improved road safety, slope stability, drainage efficiency, and local accessibility, along with biodiversity gains through compensatory plantation.

Table 6.1: Impact Evaluation Matrix

Project Activity	Relevant WB ESS	Air Quality	Noise	Water Resources	Soil Stability	Flora & Fauna	Public Health	Community Safety	Cultural Heritage	Hazardous Material Risk	Drainage
Pre-Construction Phase											
Site Clearance (Tree Felling, Vegetation removal, utility relocation)	MN	MN	N	MN	MN	LN	LN	MN	N	N	LN
Labour Camp Siting & Mobilization	MN	MN	MN	N	Low	MN	MN	MN	MN	LN	N
Site identification for construction plants, quarrying, material storage	HN	HN	HN	MN	HN	HN	HN	HN	HN	HN	HN
Earthworks (Excavation, Filling)	MN	HN	MN	HN	MN	MN	LN	MN	MN	MN	MN
Grading, Levelling and Surface laying	HN	HN	MN	MP (Improved Stability)	MN	MN	LN	MN	MN	MN	MN
Drainage & Culvert Installation	N	LN	MP (Improved Drainage)	MP (Improved Stability)	LP	LP	LP	HN	N	MP	LP

Slope Stabilization & Bioengineering	N	N	LN	N	MP	LP	LP	N	N	MP	LP
Construction Water Usage	LN	N	MN	LN	LN	LN	LN	N	N	LN	LN
Operation of Construction Plants	HN	HN	HN	N	MN	MN	MN	N	HN	MN	MN
Waste Generation and Disposal	MN	N	MN	MN	MN	HN	MN	N	HN	HN	MN
Fuel and Hazardous Material Handling	MN	N	MN	N	LN	HN	MN	N	HN	N	N
Construction Traffic & Machinery	HN	HN	LN	LN	LN	MN	MN	N	MN	N	HN
Health & Safety Training and OHS Implementation	HP	HP	HP	N	N	HP	MP	N	MP	N	MP
Decommissioning of Construction Sites, Plants, Labour Camps	MN	MN	MN	MN	LN	MN	LN	N	MN	LN	LN
Operational Phase											
Operational Traffic Flow	LN	LN	LN	LN	LN	MP	MP	LN	LN	MP	MP
Transportation of Hazardous Materials	MN	LN	LN	LN	MN	HN	HN	MN	HN	MN	HN

Compensatory Plantation	HP	N	MP	MP	HP	MP	MP	LP	N	MP	HP
Monitoring & Community Engagement	-	—	—	—	—	MP	MP	N	N	N	LP

Below is an explanation of the rating undertaken for the Leopold compliance matrix.

Short Form	Full Form
HN	High Negative Impact
MN	Moderate Negative Impact
LN	Low Negative Impact
N	Neutral Impact
LP	Low Positive Impact
MP	Moderate Positive Impact
HP	High Positive Impact

6.4 ENVIRONMENTAL IMPACTS

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 following sections provide a detailed analysis of the project's environmental and social impacts across its various phases in detail. Corresponding mitigation measures have been incorporated into the sub-project ESMP and sub-project RAP, IPDP, including project- level plans (LMP, Work Site safety Plan (OHS plan), SEP, and SEA/SH Prevention and Response Plan). Based on this indicative ESMP, contractor will prepare contractor's environment and social management plan (C-ESMP) and get it approved by MPWD before starting the pre-construction work.

6.4.1 IMPACTS DURING PRE-CONSTRUCTION PHASE

The project envisages upgrading the existing single-lane carriageway to an intermediate lane configuration to enhance the capacity and extend the service life of the WMP Road. While all the construction activities are proposed within the existing Right of Way (RoW).

Pre-construction activities will primarily include:

- Site clearance and reconstruction/improvement of approach roads for movement of plant and machinery,
- Establishment of contractor's camp, material storage, and construction yard, and
- Planning for material sourcing and finalization of work methodology. The contractor shall as part of the material procurement identify the quarry from which the sourcing would take place. Along with the process of approval of the material, they would submit the copy of the EC, CTO to the CSC/PMU. If these documents are identified to be correct then the CSC/PMU would provide an approval of the quarry as part of the material approval. During construction, material can only be procured from these quarries. The royalty payment challans for the material procured would be submitted to the PMU along with the bills by the contractors.

The impact on the different environmental components is discussed in detail in the following sections:

Ecological and Environmental Impacts

During the pre-construction phase, potential impacts are anticipated from site clearance, vegetation removal, tree felling, material sourcing, labour camp establishment, and utility relocation. The WMP corridor passes mostly through agricultural areas and community land, streams. Some of the associated activities e.g establishment of the construction camp, storage of material, staging of equipment which will require land outside the RoW These activities outside the RoW have potential to disturb the sensitive ecology. During field visit, no bird nest has been observed on road side trees. A total of 30 trees will be felled along the corridor, leading to localized loss of vegetation and minor habitat disturbance

Mitigation Measures:

- Avoid locating construction camps, material storage areas, machinery staging areas, and disposal sites near streams, productive community land, floodplains, or within/adjacent to natural habitats. The siting of all such facilities shall be subject to prior review and approval by the Construction Supervision Consultant (CSC). In addition, prior informed consent of the concerned community members and village heads shall be obtained before finalizing these locations. A total of nine (3) disposal site locations have been jointly identified in consultation with the community members, the Public Works Department (PWD), and the Independent Consultants, ensuring that site selection is socially acceptable and environmentally appropriate. The Environmental specialist of CSC shall undertake the visit of the probable sites (at the prospecting stage of the site) and shall provide his opinion on the suitability and also protection measures (within 7 days of such request being made by Contractor) which need to be taken to ensure suitability.
- Restrict vegetation clearing to the minimum area required for works.

- The trees can only be felled with the permission of the Forest Department, Government of Meghalaya. Compensatory plantation at a ratio of 1:10,(or as mandated by the Forest Department shall be carried out. Native species tolerant to local climatic and pollution conditions shall be planted.
- The scheduling of the plantation should be carried out so that plantation activities are undertaken before the monsoon season. The location of the plants shall be georeferenced and reported to a PIU on georeferenced platform provided by the PMU,
- Greenbelt shall be developed at the camp as directed by the MSPCB..
- Maintain a buffer of at least 100 m from natural drainage channels or water bodies.
- Implement soil erosion control measures (silt fencing, sediment traps, and slope turfing).
- Prohibit hunting, fishing, or collection of forest produce by workers.
- Awareness and sensitization of laborers on local wildlife and biodiversity conservation.
- Schedule noisy operations (rock breaking, heavy equipment use) away from bird nesting seasons (March–July).
- Site-specific Environmental Management Plans (EMP) may be developed by the contractor in consultation with the Environment Officer of PMU if any of the location of the construction activities have sensitive ecology to minimize biodiversity loss.

Occupational Health and Safety (OHS)

The road construction activity involves operation of equipment, vehicle and machinery which poses OHS challenges. The construction activities also involve the use of hot bitumen, and working with hazardous material i.e. molten bitumen spray. In addition, the construction activity would take place when the traffic is operational on the road. This poses an additional challenge for the workers. To ensure safe working conditions, a the Contractor needs to carry out a detailed Hazard Identification and Risk Assessment (HIRA) will be conducted for each task A preliminary Hazard Identification and Risk Assessment have been carried out (Annexure 6.3) and some mitigation measures suggested and included in the Labour Management Plan for the project. The work methodology will define activity sequencing and associated occupational and community health and safety (OHS/CHS) risks. It will be reviewed by the PIU- PWD under the oversight of ESMU prior to approval of Work Methodology.

Mitigation Measures:

- Develop and implement a site-specific OHS Plan conforming to World Bank Environmental, Health and Safety (EHS) Guidelines.
- The OHS Plan shall be submitted along with the Method statement. The PMU& CSC shall review the OHS Plan and provide there comments within 15 working days. Once these comments have been addressed and the OHS Plan approved the Method Statement shall be approved. The Method statement shall not be approved by CSC unless the OHS Plan has been approved.
- Arrange for PPE (helmets, safety shoes, high-visibility vests, gloves) to all workers.
- Develop tie-up with hospitals for the regular health check-up and Health Emergency and Accidents.
- Ensure proper sanitation, adequate potable water (minimum 5 liters per person per day), and waste disposal facilities in camps.
- All lifting equipment should have the appropriate certification and construction equipment should meet the emission requirement specified in MoRTH emission standards specified in GSR 144.
- Engage trained personnel for operating machinery and working at height or confined spaces.

Community Health and Safety

The project is not expected to result in significant adverse impacts on ecosystem services.

Construction works along existing habitations and roadside markets can pose safety risks to pedestrians and road users. The improvement works will largely be confined within the existing Right of Way (ROW). No diversion of forest land or large-scale removal of vegetation is involved. However, minor and temporary impacts may occur during construction, such as localized disturbance to roadside vegetation, increased sediment runoff affecting nearby surface water, and temporary obstruction of natural drainage during earthworks.

Mitigation Measures:

- Prepare and implement a **Traffic Management Plan** to regulate vehicle movement, material haulage, and diversions. The Traffic Management Plan shall indicate the locations for diversions, work zones, transition zones. It shall define the safety precautions and the signages etc, in conformance to IRC SP 55: 2014. The Traffic Management Plan shall also be submitted along with the Method Statement and shall state the process for implementation and notification for inspection of the traffic safety measures.
- Make arrangement for New Jersey barriers/ Water filled barrier, MS steel barricades (2 m high) , signage, and warning lamps at work sites.
- Prepare a **Community Health and Safety Plan** (CHS Plan) ensuring public segregation from work zones. The Generic CHS Plan will be submitted along with the Work Statement and should be considered an integral part of the Work Methodology and Work Plan. The Work Plan should not be approved without an approved CHS Plan. The site-specific management plan should present the additional measures which have to be to be implemented. Every RFI should be accompanied with a site specific OHS, CHS and Traffic Safety Plan, which should define the site-specific measures which were implemented. Without these plans being implemented the works should not be approved.
- The material transport route through existing network of roads should be planned and approved by the local transport authorities. Possible risk areas need to be identified along with sensitive receptors and their time of sensitivity. The Traffic Management Plan shall be developed accordingly
- Schedule high-risk activities during off-peak hours to minimize traffic congestion.
- Develop posters for Community Awareness. Conduct community awareness campaigns before any temporary road closure or service disruption.

The OHS Plan, CHS Plan, and Traffic Safety Plan must be reviewed and approved by CSC/MPWD before initiation of construction. To mitigate these ecosystem service risks, appropriate measures have been incorporated in the design and Environmental and Social Management Plan (ESMP). These include provision of adequate cross-drainage structures and roadside drains to maintain natural water flow, slope stabilization and protection works (gabion walls, retaining walls) in vulnerable stretches, controlled construction practices to prevent sediment runoff, and restoration of disturbed areas through turfing and plantation. These measures will ensure that the quality of freshwater, soil stability etc. roadside vegetation, There will be some impact due to tree felling which is anticipated to be long term but would not irreversible because the plantation will be undertaken by the project.

Construction Camp and Site Selection

The location of the construction camp can have adverse impacts while its design and layout would influence the impacts during the operations stage. The establishment of labour camps and construction support facilities may exert localized pressure on water availability, sanitation systems, and waste management infrastructure. Appropriate provisions for safe drinking water, adequate sanitation, drainage arrangements, and solid waste disposal must be made to prevent health and hygiene issues. To avoid these unwanted impacts the following mitigations are proposed.

Mitigation Measures

- Contractor's camps, stockpile, and equipment yards will be located at least 500 m from settlements and 100 m from water bodies or forest areas.
- Camps should follow **IFC/World Bank Labour Accommodation Guidelines** and local environmental norms.
- The measures suggested in the BCOW rules shall also be included in theplan and implemented.
- The layout of camps will be reviewed and cleared by the Environment Officer, PMC prior to establishment.
- No construction camp, material storage area, will be setup 100 m on both sides from the Monolith (At Ch 23+100 and Ch 41+500).

Disposal of Construction Debris and Waste

Limited C&D waste (excavated material, asphalt fragments, scrap metal) will be generated. However, haphazard disposal of such debris can lead to both environmental and social issues.

Mitigation Measures:

- Segregate reusable and non-reusable debris.
- Reuse topsoil for slope stabilization and landscaping.
- Dispose of debris only at approved low-lying barren areas located at least 1 km downwind of settlements and away from drainage channels.
- The waste shall be disposed in predesigned location Jointly identified by the PWD/Community. Details of Spoil disposal site is given in Table 3.15.
- Avoid dumping in water bodies, wetlands, or near agricultural fields.
- Regularly monitor disposal sites to prevent contamination and visual pollution.

Shifting of Utilities

Significant utility shifting is required prior to the commencement of construction works. A total of 720 nos. of electric poles are identified along the WMP road corridor for shifting. Of these, 512 poles are on the LHS and 208 on the RHS. Utility relocation activities may temporarily disrupt local services and traffic movement, and therefore must be planned and executed in coordination with respective line departments, ensuring safety and minimal community inconvenience (ESS4).

Mitigation Measures:

- Coordinate with line departments (MePDCL, PHE, Telecom) for planned relocation prior to construction.
- Provide prior notice to local communities about any temporary service disruption.
- Restrict utility shifting to daytime hours to avoid safety risks at night.
- The scheduling of the construction works will be shared with the line department (MePDCL, PHE and Telecom Departments) for ensuring uninterrupted services during construction.

Plant, Machinery, and Vehicle Selection

To prevent pollution from the different activities during the construction phase preparation of a Contractor's Environmental and Social Management Plan (C-ESMP) will be essential. The following are envisaged:

- The C-ESMP shall apply the mitigation hierarchy—prioritizing avoidance, then minimization, and finally offsetting and restoration through design improvements, slope stabilization, compensatory plantation, and safety training. Implementation of these measures during the pre-construction stage will ensure environmentally responsible preparation and minimize potential social disruptions before commencement of construction works. The CESMP will be submitted along with the Method Statement. The PMU and CSC will review it as stated above for he other plans and shall provide its observations. Once these observations are addressed the CESMP will approve. The Method Statement will not be approved without the approval of the CESMP. Hence the Contractor cannot undertake any works on site till the time the C-ESMP, OHS Plan, Traffic Management Plan, CHS Plans are approved.

- All construction equipment and vehicles shall comply with **MoRTH emission standards** (GSR 144[8]) and have valid **Pollution Under Control (PUC)** certificates. The contractor shall maintain equipment in good working condition to minimize noise and air pollution.
- Conduct air quality monitoring according to the EMP. This will be carried out before the works and will be considered as a reference baseline

Sourcing of Construction Materials

The sourcing of materials such as aggregates, sand, and stone may cause adverse impacts on land, air, and water quality if not properly managed. Sourcing material form unauthorised querries and not operating them as per the specification can lead to unwanted impacts on the environment.

Mitigation Measures:

- The contractor shall as part of the material procurement identify the quarry from which the sourcing would take place. Along with the process of approval of the material they would submit the copy of the EC, CTO to the PMU. If these documents are identified to be correct then the PMU would provide an approval of the quarry as part of the material approval.
- In the case of any change / alteration of the borrow or quarry area the same process shall be applied..
- During construction, material can only be procured from these quarries. The royalty payment challans for the material procured would be submitted to the PMU along with the bills by the contractors.
- No borrowing shall be allowed within forest areas or near habitations.
- Borrow area restoration to be certified by the Environmental Officer, PMU before final payment.
- Borrow areas, if required, shall comply with **MoEF&CC Standard Operating Procedures (SOP 2022)** for rehabilitation and closure.
- If contractor procures any material (such as ready-mix concrete, asphalt/macadam, aggregates etc.), from third party agencies, contractor shall ensure that such agencies have all necessary clearances/permissions as required under the law; these include CTE/CTO from MSPCB, environmental clearance, etc.; contractor shall collect the copy of these certificates and submit to PMU; PIU will approve the source only after all the certificates are submitted; and`

Water Requirement

Construction water will be required for concrete mixing, dust suppression, and domestic use. Overextraction of natural resources can lead ot unwarranted impacts. To prevent this the following mitigations are proposed.

Mitigation Measures:

- Obtain permission for groundwater abstraction from the State Water Resources Department or Surface water from Irrigation Department. appropriate Agency.
- Prefer use of surface water from local streams or treated water from nearby sources.
- Extraction from community wells or structures used by community is prohibited unless it is allowed on cases by case basis.
- Maintain drainage around storage and batching areas to prevent stagnation.
- In the case that water is sourced by tankers the Contractor shall submit the permission of the borewell to the PMU before the sourcing of water.
- Maintain record of the water extracted or sources by tankers

[8] https://morth.nic.in/sites/default/files/notifications_document/GSR%20598%20%28E%29%20dated%2030%20September%202020%20Seperate%20emission%20norms%20for%20agriculture%20tractors%20and%20CEV.pdf

6.4.2 IMPACTS DURING CONSTRUCTION PHASE

Major Activities during the construction phase involves earthworks, grading, drainage works, cutting of slopes, slope protection, disposal of cut material, and culvert construction, laying of bitumen, transportation of material. , These activities are expected to cause significant short-term adverse impacts on air quality, noise, water resources, and soil stability (ESS2, ESS3, ESS4). Occupational health and safety (OHS) risks including accidents, exposure to dust and noise, handling of heavy machinery, and potential landslides require robust safety protocols.

Most of the adverse environmental impacts are related to construction works which are inevitable but are manageable through good engineering and construction practices which have mostly been well defined and standardized. The negative environmental effects can be taken care of at an early stage through proper construction planning, sensitization of workforce and supervision and oversight by the works supervisor.

The associated activities of road construction works would involve operation of plant, movement of machinery laying of bituminous mixtures, handling of hazardous materials like bitumen, diesel, etc., dumping of unusable debris materials, transportation of materials from production site to construction site, and other constructional activities and associated works like mobilization of construction equipment, setting up of construction plants, setting up of workforce camps, quarrying, material storage etc. These activities have certain impacts of various magnitudes on different components of the environment.

The anticipated impacts due to all these activities have been described below:

6.4.2.1 IMPACTS ON PHYSIOGRAPHY

The sub-project area comprises an existing road traversing hilly terrain. Land use along the road stretches includes agricultural areas, unclassed forest, dense vegetation, and shifting cultivation. The same alignment will generally be followed for upgrading the road from existing single/intermediate lanes to an intermediate configuration with paved shoulders and geometric corrections at selected locations. The existing ground profile will be maintained, with minor profile adjustments at certain locations. Rehabilitation and upgradation will generally be restricted to the existing right-of-way (ROW) in settlement areas.

The Weiloi–Mawsynram Road up to Phlangwanbroi traverses terrain ranging from 932 m to 1,963 m above mean sea level. To maintain gradient of the road and obtain adequate RoW for construction hill cutting is required. The total quantity of material to be excavated (cut) along the project corridor is 202270 m^3, while the total fill requirement is 147965 m^3. After balancing the cut and fill volumes, there remains a surplus of approximately 54305 m^3 of excavated material of excavated material that will need to be safely disposed of at designated muck disposal sites. This approach ensures effective earthwork management while minimizing environmental impacts and maintaining slope stability and disposal of excavated material along the project corridor.

Cutting of hill, can lead to slope instabilities and environmental impacts such as soil erosion due to toe failure. The following chainages were identified during the technical designs and areas prone to land instabilities : Ch 34.271, Ch 35.150, Ch 35+400, Ch 39.250, Ch 39.300, Ch 44.220, Ch 44.320, Ch 44.410, Ch 48.600. To address these issues mitigation measures e.g. toe wall protection works and breast walls has already been embedded in the design . The summary of breast walls is presented in Table 6.2 and summary of toe walls is presented in Table 6.3.

Table 6.2: Summary of Breast walls

Sr. No.	Start Chainage (km)	End Chainage (km)	Length (km)	Side	Structure Height (m)	Cutting Height (m)
1	25.910	25.970	0.060	RHS	2.50	2.5 to 4.0
2	26.050	26.150	0.100	RHS	2.00	2.2 to 4.0
3	26.270	26.450	0.180	RHS	2.00	2.0 to 5.5
4	34.270	34.695	0.425	RHS	2.50	3.0 to 5.8
5	35.400	35.500	0.100	LHS	3.00	3.5 to 6.0

6	44.220	44.270	0.050	RHS	1.80	2.0 to 3.5
7	44.320	44.370	0.050	RHS	1.80	2.0 to 2.5
8	44.420	44.450	0.030	RHS	2.00	4.0 to 6.0
9	1.150	1.547	0.397	LHS (Bypass)	2.50	3.0 to 4.0

Table 6.3: Summary of Toe Walls

Sr. No.	Start Chainage (km)	End Chainage (km)	Length (km)	Side	Height
1	33.200	33.230	0.030	RHS	1.5 m
2	35.150	35.320	0.170	RHS	1.2 m
3	35.400	35.650	0.250	RHS	1.5 m
4	39.500	39.590	0.090	RHS	1.2 m
5	48.600	48.690	0.090	LHS	1.5 m

Mitigation Measures

The project has identified the disposal sites (Refer Table 6.5). To prevent environmental impacts form the disposal sites The following needs to be kept in mind during disposal:

- Clear the debris from construction sites. Unusable Debris are to be carried by trucks/dumpers to the identified dumping yards. Covers should be placed on the trucks during the transportation of material. Usable construction and demolition waste/ debris should be stored separately outside the RoW at a designated place for usage.
- The locations of dumping sites should be selected with following considerations.
    - Unproductive/wastelands shall be selected for dumping sites.
    - These should be away from residential areas and located at least 1km downwind side of these locations,
    - These sites shall be finalized such that they do not lie within any designed forest or other eco-sensitive areas, do not affect natural drainage courses and no endangered/rare flora is impacted by such disposal.
    - The lowlands, natural depressions which are natural sinks will not be used for dumping as these are natural sinks.
    - Drainage channels should not be used for dumping
    - Local Authorities should be consulted about the location of debris disposal sites before finalizing the locations.
- Dumping sites should not contaminate water sources.
- Dumping sites should have adequate capacity for the amount of debris generated.

6.4.2.2 IMPACTS ON GEOLOGY

The construction of WMP Roads will require different materials such as earth, aggregate, boulders, and sand that occur naturally and whose formation process is slow and takes years. Minimizing the construction footprint on natural resources is a fundamental design principle for pavement and structures. The sourcing of material from unlicensed quarries can also have unwarranted impacts.

As per the engineering design, the estimated quantities of other construction materials that are required for construction of the sub-project area are attached as **Annexure 3.3.**

To prevent unwarranted impacts the following measures are proposed:

Mitigation Measures

- The aggregate, sand and other construction material shall be supplied from quarries approved by the PMU (indicated in the pre-construction stage)
- The challans for the royalty paid against the material used shall be included in the IUFR / Bills submitted for payments.

6.4.2.3 IMPACT ON SOIL

Contamination of soil during the 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.

Topsoil loss may occur in land parcels used for short-term purposes (e.g., borrow areas, construction camps) as well as in areas permanently impacted due to road rehabilitation, unless measures for preservation are adopted. Project activity involves tree cutting and vegetation removal from the PRoW followed by construction and strengthening of the present carriageway.

Since the project involves upgrading an existing road alignment rather than developing a Greenfield corridor, substantial removal of topsoil is not anticipated. However, localized topsoil disturbance may occur during shoulder widening, drainage improvement, and embankment raising activities. To mitigate this, the ESIA prescribes specific topsoil management measures to be implemented during construction. The alignment passes through areas which have sandy loam with varying amounts of clay, typically exhibiting low to medium plasticity. These soils are light textured and are thus prone to erosion by winds and during rain and consequent slides can occur due to hilly slopes of the area. Additionally, the movement and operation of vehicles, construction equipment, and material transport during project execution may cause soil compaction, particularly in borrow areas, temporary storage sites, and parking zones if not properly managed. Soil compaction reduces permeability and soil fertility, affecting natural drainage and vegetation growth.

Improper operation of borrow areas can also impact the soil environment. Adjacent properties may also be impacted, or it can also lead to erosion. Additionally, the associated activities e.g. haul roads may deteriorate due to movement of overloaded trucks, facilities e.g. culverts or embankment may also get damaged.

6.4.2.3.1 BORROW AREAS AND QUARRIES

Construction materials required for the project road will be transported from Borrow area and Quarries. Details of Quarries site is given in Table 3.13 of Chapter 3.

Opening of a new borrow pit creates the following impact:

- The borrowing of earth in an unregulated manner may lead to unstable slopes, erosion, loss of fertility, inundation of water, breeding areas for mosquitos and an unhygienic environment. Fertile topsoil may be wasted if not preserved for backfilling.
- The transportation of earth from borrows and quarry areas in open/uncovered trucks can increase the dust levels and overloaded borrow transportation material may cause spillage of material on road causing dust, high emission, vehicle wear and tear, road surface damage due to overloading.
- Haul roads may develop surface damage due to plying of trucks and if left unattended may cause problems to other pedestrians and commuters on the road.
- Open borrow pits abandoned without proper restoration may lead to accidents and risks of social nuisance.

The earthwork details in the project area are listed in Table 6.4 below.

Table 6.4: Earthwork details in the project area

Sub Project Road	Fill (m^3)	Cut (m^3)
WMP	147965.00	202270.00

From the above table it is calculated that after balancing cut and fill, the remaining quantity of 54305 cum earthwork will be dumped/disposed by the contractor. The details for the spoil disposal site are presented in **Table 3.12**. Average height should be 1.2 m to 1.5 m.

In addition, 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 would also be generated.

The labour camps would be setup for construction which 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, handles and disposed.

If these excess excavated material, construction and demolition wastes are disposed on agricultural land or adjoining properties it may result in loss of productivity of land and can also impact the ecology.

Mitigation Measures

PREVENTING COMPACTION OF SOIL

- To minimize this impact, all construction activities and machinery movement will be strictly confined within the designated Right of Way (RoW) and approved working areas.
- Parking and servicing of vehicles and equipment will be allowed only in designated hard-surfaced zones,
- Contractor has to obtain the permission of the PMU after submitting the EC, CTE, CTO any quarry area

Borrow Area Management

- Contractor has to obtain and submit EC, CTE and CTO. The Contractor should submit a copy of the EC, CTE, CTO, a copy of agreement with the landowner, borrow area management and closure plan before initiating any kind of borrowing activities.
- No material shall be procured from the PWD before extraction of material from any borrow area
- Borrow area should be located at a minimum distance of 300m from the residential/ settlement area, public road. Proper barricading should be provided and access to the borrow areas should be restricted to the unauthorized persons.
- The Borrow are should comply with the conditions set in the EC/ SoP from MoEF&CC.
- Topsoil up to a depth of 150 mm from all areas of cutting, filling, and temporary construction zones, shall be stripped and preserved as indicated in the MoEF&CC SoP / MoRTH Orange Book: Specification for Road and Bridge Works;
- Topsoil will be stored separately in designated stockpiles with proper slope protection and sediment barriers to prevent erosion;
- Reuse stored topsoil for median greening, roadside plantation, and slope turfing after construction; and
- Prohibit disposal of topsoil at dumping sites.
- These measures shall be monitored through the supervision consultant to ensure effective implementation during the construction phase.

Spoil Disposal

- The muck disposal should be carried out at the site identified and included in Table 6.5 and the following precautions taken
    - Muck disposal sites shall be located on stable, non-erodible terrain away from water bodies and agricultural land. The edges of the muck disposal area should be contained with gabion/ masonary wall at the pheriphery.
    - Dumping will be done in compacted layers (≤1 m thick) with retaining walls, drainage channels, and slopes maintained within the natural angle of repose (30°–35°).
    - Each site will be protected with toe walls, sediment traps, and vegetative cover for stabilization.
    - The contractor shall operate only at approved locations under supervision and maintain the site until full rehabilitation is achieved.
    - The site should incorporate proper retaining structures, such as toe walls and catch drains, to prevent sliding and erosion.
    - Adequate drainage must be provided through surface and subsurface channels to control runoff.
    - Muck should be deposited in layers, compacted, and stabilized using vegetation or geo-textiles to minimize dust and erosion.
    - Access roads should be provided to ensure safe transport of muck, and the site should be fenced and clearly demarcated.
    - Environmental safeguards, including periodic monitoring and rehabilitation plans, must be integrated into the design to ensure long-term stability and ecological compliance.

The typical design of the muck disposal site will be incorporated into the DPR. Dumpsite Stabilization Plan/Spoil management plan is attached as **Annexure 6.1.**

Waste Disposal

- The storage, handling and disposal of Municipal Solid Waste, Hazardous Waste and construction demolition waste the Contractor should follow all the provision of the respective rules. The guidance for storage of these waste are presented in Annexure 6.4. The same guidance (storage of Hazardous Waste) may be used for storage of hazardous materials (oil, lubricants)

6.4.2.4 AMBIENT AIR QUALITY

Construction-stage activities are likely to have adverse impacts on both workers and settlements adjacent to the road, particularly those located downwind. The main types of pollution anticipated are dust pollution and emissions from harmful gases from the construction plant and equipment.

Impacts from 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
- Site levelling, clearing of trees
- Construction of structures and allied activities

Impacts from Generation of polluting gases including SO_2, NO_x and CO

- Hot mix plants

- Large construction equipment, trucks and asphalt producing and paving equipment
- The movement of heavy machinery, oil tankers etc.
- 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 for Ambient Air Quality is presented in Table 6.5.

Table 6.5: Mitigation Measures for Ambient Air Quality (ESS3)

Impact Source	Mitigation Measures
Transportation and tipping of cut material; site levelling and excavation	Regular water sprinkling (at least 3 times in a dry season) on haul roads, excavation areas, and disposal sites to suppress dust. Limit vehicle speeds to 25 km/h on unpaved roads. A log book of the sprinkling has to be maintained. The Contractor should take into consideration the requirement of water for sprinkling which undertaking the planning of works. A grievance system should be communicated to the population along the road so that they can also intimate any dust pollution related issues.
Transportation of raw materials from quarries and borrow sites	Cover all vehicles carrying loose materials with tarpaulin; avoid overloading and ensure proper loading/unloading to prevent spillage.
Stone crushing, batching, and asphalt plants	Locate plants at least 500 m from settlements and sensitive receptors; install dust extraction, bag filters, and stack emission controls. Regularly maintain equipment to minimize emissions. The emission have to be monitored asper the monitoring plan specified in the ESIA Report. A log of the maintenance should also be maintained by the Contractor. The measures suggested in the CTE and CTO shall be maintained
Site clearing, vegetation removal, and handling of topsoil	Restrict vegetation clearance to the required RoW; immediately stabilize exposed soil using mulching, water spraying, or temporary turfing.
Concrete and asphalt mixing operations	Use pre-mixed bitumen and maintain mixing temperature within permissible limits to reduce hydrocarbon release. Avoid fuel adulteration.
Operation of heavy machinery and transport vehicles	Maintain all equipment and vehicles regularly; prohibit use of old or poorly maintained machinery; use low-sulphur fuel.
Generation of gaseous pollutants (SO_2, NOx, CO)	Ensure all machinery meets CPCB emission norms/ MoRTH emission standards (GSR 144); Prohibit idling of vehicles; Schedule material transport to avoid congestion.
Worker and community exposure to dust and fumes	Provide PPE (dust masks, goggles) to workers; display warning and awareness signs; avoid high-emission activities near schools or dense settlements.
Monitoring and compliance	Conduct periodic ambient air quality monitoring (PM_{10}, $PM_{2.5}$, SO_2, NOx, CO) at identified locations and ensure compliance with CPCB National Ambient Air Quality Standards. The Monitoring plan presented in the ESIA Report shall be adhered to.

6.4.2.5 NOISE

During construction, particularly in residential and commercial areas, ambient noise levels may temporarily exceed statutory limits within about 50 m of active work zones due to operation of heavy machinery, material transport, and equipment use. The main noise sources will include excavators, graders, vibratory rollers, and transport vehicles, which typically generate levels above 70 dB(A). Vibration from rollers may also affect nearby structures depending on soil type, structural age, and construction quality.

These impacts will be intermittent, short-term, and localized, as all construction activities will not occur simultaneously along the corridor. Sensitive receptors such as schools, hospitals, and religious places located near the project road may experience temporary disturbance during high-noise activities. However, impacts will attenuate with distance and can be effectively mitigated through equipment maintenance, use of temporary noise barriers, scheduling of high-noise works during daytime, and strict adherence to CPCB noise standards.

The scale of construction required for upgrading the WMP Road is moderate and within the existing Right of Way (RoW). The primary sources of noise emissions include construction equipment, material transport vehicles, stone crushers, and asphalt plants. These activities are temporary, localized, and limited to the construction period. Noise levels are expected to rise intermittently during operations such as excavation, compaction, and pavement laying, especially near settlements and sensitive receptors like schools and health centers. However, with proper scheduling of high-noise activities during daytime, maintenance of equipment, and adherence to CPCB noise standards, the impacts will remain within acceptable limits. Consequently, the overall scale of works and the expected marginal increase in post-construction traffic are not anticipated to result in any significant or lasting adverse impacts on ambient air quality or noise levels.

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 about 1m from the source.

MITIGATION MEASURES

- Staging of construction equipment and unnecessary idling of machinery within noise-sensitive areas shall be avoided wherever possible.
- All plants and equipment used in construction (including third-party units) must conform to MoEF&CC/CPCB noise standards.
- All vehicles and equipment used in construction shall be fitted with effective exhaust silencers.
- Servicing of all construction vehicles and machinery shall be done regularly; during routine servicing, the effectiveness of exhaust silencers shall be checked and replaced if defective.
- Construction activities shall be restricted to daytime hours (6 AM–10 PM). Night-time work may be carried out only in emergencies, following all prescribed mitigation measures for night operations.
- Unnecessary honking at construction sites shall be strictly prohibited.
- Temporary barricading shall be installed around active construction zones, especially near settlements, schools, or hospitals, to minimize noise propagation.
- Noise monitoring shall be carried out at construction sites as per the approved monitoring schedule, and results shall be submitted to the Project Management Consultant (PMC) and Project Management Unit (PMU) for review and compliance verification.

DG SET NOISE CONTROL STANDARDS

To minimize noise from generator operations during construction, the following measures shall be implemented:

- The contractor must use silent DG sets as prescribed by the Central Pollution Control Board (CPCB).
- Each DG set shall be provided with a proper exhaust muffler to further reduce noise emissions.
- The DG set shall be properly sited to minimize its noise impact beyond the premises, ensuring compliance with ambient noise standards at the nearest receptor.

- A routine and preventive maintenance schedule shall be prepared and followed in consultation with the DG set manufacturer to ensure that noise levels do not deteriorate with use.

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;

6.4.2.6 SURFACE WATER QUALITY AND SILTATION

For the Upgradation of sub project Road, the potential impacts on surface water due to the construction of bridges and cross-drainage structures have been assessed and addressed in the design stage. Construction activities such as earthworks, material storage, and operation of construction camps may temporarily affect surface water quality along the WMP Road corridor. Proposed sub project road cross Wah Umkynrem River at Chainage 22+800. Earth Runoff from exposed soil surfaces, stockpiles, and construction zones can carry suspended solids, oils, and debris into nearby streams or drainage channels, leading to increased turbidity and siltation. Additionally, improper disposal of construction wastewater or accidental spills of fuels and lubricants may also contribute to localized water pollution. Construction activities such as bridge works, river training, and slope protection may temporarily increase turbidity and sediment load in the river, potentially affecting local fish habitats and water quality. These effects are expected to be localized and short-term, primarily during active construction near the river crossing. Also, construction would also generate some effluents e.g. dewatering of excavation on the bed, washing of machinery etc, which also can pollute the waterbody unless managed.

Labour camps and site facilities will generate domestic wastewater and sewage, which, if discharged untreated, may degrade nearby water bodies.

Mitigation measures

Labour Camp and Construction Yard

- Temporary construction/fabrication yard / labour camp (with no more than 10 labour) can be proposed at the cross-drainage construction site (will all facilities mentioned above) with the permission of the CSC/PMU.
- To prevent this, sewage treatment through septic tanks and soak pits or mobile bio-toilets shall be provided at all camps.
- Construction runoff shall be managed through temporary drainage channels, sediment traps, and silt fencing, ensuring that no untreated discharge enters natural watercourses.
- . Runoff from the camp shall be passed through an oil-water separator. All peripheral drains shall be linked to the oil water separator
- The Contractor will take all precautionary measures to prevent the wastewater generated during construction from entering into river or any other nearby water bodies by passing wastewater to sedimentation tank to be considered as part of the EM plan and Contractor's responsibility.
- Stagnation of water should not be allowed at any place near the campsite as a precaution against vector-borne disease.
- The wash water from the concrete mixer/ batching plant/ miller should only be disposed at a pit developed in construction camp

Water Pollution from Fuel and Lubricants

- Spill Prevention and Control: Store fuel and lubricants in bunded areas (110% capacity of the largest container) with proper spill kits (sand, absorbents). Immediately clean up any spills or leaks.

- Impervious Flooring: Provide impermeable flooring (e.g., compacted clay or concrete base with HDPE lining) in storage areas for materials such as bitumen, fuel, cement, and chemicals to prevent seepage into soil and groundwater.
- Transfer of fuel by decantation is prohibited, Fuel Pump (manual or electric) should be used
- Storm water Management: Construct peripheral drains around storage yards to collect and divert runoff to sedimentation pits before discharge. Prevent mixing of clean storm water with contaminated runoff.
- Regular Inspection: Conduct routine checks for leakages, cracks, or improper containment in fuel and chemical storage zones. construction sites. Oil-water separator with adequate residence time to be provided before the outfall of these.
- Contractor will ensure that all vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a way that spillage of fuels and lubricants does not contaminate the ground. Only fuel pumps will be used for the transfer of fuel during refueling.

Pollution from construction activities

- The runoff from the construction material storage yard must be channelized through peripheral drains connected to sedimentation tanks (holding tanks excavated in the ground) of adequate capacity.

6.4.2.7 IMPACTS ON NATURAL DRAINAGE AND WATERSHED MANAGEMENT (FLOODING)

Along the rivers and streams crossed by the road, bank protection measures are required to prevent accelerated sedimentation that could alter drainage patterns and affect riverine habitats. The road alignment generally follows the existing topography, except at locations of cross-drainage structures. The project highway stretch includes a total of 11 minor bridges and 210 culverts. Many of the existing culverts, if not adequately strengthened during the proposed road widening, rehabilitation, and upgradation, could fail structurally, leading to disruptions in water flow, increased flood risk, and potential damage to the road. Such failures may also pose safety hazards to road users and nearby communities

Mitigation Measures:

- The contractor will ensure that no construction materials/debris shall disposed off or block the flow of water of any water course and cross drainage channels.
- The stockpiled material must be prevented from erosion and deposition in the drainage channel from sites where these are stocked for construction.
- The runoff from the construction material storage yard must be channelized through peripheral drains connected to sedimentation tanks (holding tanks excavated in the ground) of adequate capacity
- All sedimentation tanks and peripheral drains must be cleaned before the monsoon.

6.4.2.8 GROUND WATER QUALITY

The road construction projects are water intensive and demand a large volume of water during the entire project's construction period. Project road stretch will require approx. 72.1 KLD. The demand for construction is proposed to be met from surface water sources. However, in extreme cases, where surface water is not available, it is proposed to use groundwater resources. The project area is not classified as critical, semi-critical or overexploited by CGWB. It is "safe" area for ground water abstraction.

Untreated discharge from the labour camp may lead to contamination of ground water sources in the vicinity of the camp.

Mitigation Measure

- Construction water will not be procured from any unauthorized wells or existing wells. The permission of CGWB would be obtained in case new wells are sunk;
- The Contractor shall install a meter at the point of extractor and keep a log of the water extracted
- All the measures suggested in the permission for Borewell shall be adhered to
- In case the water is sourced from third parties the Contractor shall only source it from sources cleared by PMU. In such cases also eh shall maintain a log of the water procured.
- Construction materials such as cement, chemicals, fuels, and lubricants should be stored in designated covered areas with impervious flooring to prevent seepage into the soil and groundwater.
- Refueling and maintenance of construction machinery should be carried out in designated areas with spill containment arrangements to avoid accidental leakage into the ground.
- Wastewater generated from equipment washing, construction activities, or camps should be collected in sedimentation tanks or soak pits after treatment, ensuring that untreated wastewater does not percolate into the ground.
- In case the water is sourced from third parties the Contractor shall only source it form sources cleared by PMU. In such cases a log of the water procured has to be maintained.
- Water usage for construction work would be reduced by adopting following best practices:
    - Use buckets etc. to wash tools instead of using running water;
    - Use of auto shut off taps (without sensors) in labour accommodation;
    - Install water metres with main supply pipes/water tanks/bore well to assess quantity of consumed water

6.4.2.8 CONSTRUCTION AND DEMOLITION WASTE

Construction and demolition (C&D) waste from major demolitions is not expected along the proposed WMP alignment because no pucca structures will be removed. Only kutcha structures with masonry or light walls (e.g., kutcha kiosks, sheds, compound walls) will be dismantled where absolutely necessary to establish the right-of-way. Even these limited removals, if not handled correctly, can obstruct natural drainage, cause siltation of nearby water bodies, generate dust, and create temporary traffic inconveniences or health nuisances. To avoid such impacts, all temporary-structure debris will be managed through a contractor-led waste handling plan that emphasizes source segregation, timely removal, reuse/recycling where feasible, controlled transport, and disposal at authorized sites.

Key mitigation measures

- **Avoidance & minimization:** limit removals to only those kuchha walls/structures that are unavoidable for construction; explore minor realignments or temporary protection works to retain structures where possible.
- **Segregation on site:** separate inert masonry/brick, concrete, metal, wood and mixed waste at designated temporary collection points to maximize reuse/recycling.
- **Reuse & recycling:** priorities reuse of intact masonry/brick and concrete as backfill or for temporary access tracks; recover metal and timber for reuse.
- **Designated storage & timely removal:** store debris in covered areas away from drains and surface water; remove to authorized disposal/recycling facilities within agreed short timeframes to prevent runoff and scavenging.

- **Dust control:** dampen stockpiles and vehicle loads, cover trucks during transport, and restrict demolition/dismantling operations during high-wind conditions.
- **Drainage protection:** install silt traps/sediment control (e.g., sandbags, temporary settling pits) at nearby drains and around stockpiles to prevent siltation of water bodies.
- **Traffic & public safety:** schedule dismantling works off-peak where possible, use flaggers and signage, and maintain clear pedestrian/vehicular passage around work areas.
- **Permits & authorized disposal:** ensure waste is transported only to licensed C&D disposal or recycling facilities and that manifests/receipts are retained.
- **Contractor responsibilities & training:** the contractor shall prepare the C&D waste handling plan, train workers on segregation and pollution prevention, and maintain daily records of waste quantities and destinations.
- **Monitoring & reporting:** include C&D waste management in construction supervision checklists; undertake fortnightly inspections and submit waste disposal receipts as part of monthly compliance reports.

6.4.2.9 MUNICIPAL SOLID WASTE

The project corridor is expected to generate approximately 20 to 25 kg of municipal solid waste per day during the construction stage, based on an estimated 50 workers at the project site, assuming an average waste generation of 0.4 to 0.5 kg per person per day. This waste if not disposed of properly, may lead to littering in the immediate vicinity of the camp sites and contamination of ground water as well as air pollution due to unauthorized burning.

Mitigation measures

- Disposal of sanitary wastes and excreta shall be into septic tanks. If bio-toilets will be used the excreta could be converted to manure.
- The camp shall implement a two bin system and the workers mde aware about the segregation of wate
- Poster and leaflets will be done to make the camp residents aware of the segregation and process of segregation
- Kitchen wastewater shall be disposed into soak pits/kitchen sump located preferably at least 15 m from any water body. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged per day. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit. New soak pits shall be made ready as soon as the earlier one is filled.
- Solid wastes generated in the kitchen shall be reused if recyclable or disposed of in landfill sites.
- Provide segregated garbage bins in the camps and ensure that these are regularly emptied and disposed of hygienically as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of Project Authority.

The camping area should be periodically sprayed with Bleaching powder and other disinfectants.

6.4.2.10 HAZARDOUS WASTE

Approximately 180 cu.m. of scarified bituminous material will be generated from the project road during pavement rehabilitation. Improper disposal may cause localized soil and water contamination due to leaching of hydrocarbons; therefore, its reuse and handling shall follow MoRTH (5th Revision) guidelines.

As per MoRTH Clause 517 and Clause 305.2.2.2, the scarified bituminous material shall be recycled and reused in Granular Sub-Base (GSB), Wet Mix Macadam (WMM) layers, or for pavement shoulders, after appropriate screening

and blending to achieve the required gradation. The reclaimed mix can also be incorporated in hot or cold recycling processes depending on site conditions and equipment availability.

Any quantity of scarified bitumen found unsuitable for reuse shall be disposed of at designated locations approved by the Engineer-in-Charge, with proper base lining and containment to prevent leachate migration and protect soil and water quality. This approach promotes resource recovery, cost efficiency, and environmental compliance in line with MoRTH and CPCB sustainability principles.

The corridor-wise details of existing bituminous surface to be scarified in the project area are presented in **Table 6.6**.

Table 6.6: Amount of expected Scarified Bituminous Material

Sl. No.	Description	Unit	Quantity
1.	Scarifying existing bituminous waste	cum	180

A small quantity of hazardous substances, such as used oil, diesel, petroleum products, and other chemicals, will be used or stored during construction. If these substances are not stored properly, leakage or spillage may occur, potentially causing contamination of soil and water.

During the construction phase, used batteries are expected to be discarded and must be disposed of in accordance with the Battery Waste Management Rules, 2022. Lead-based batteries, if not properly managed, may contaminate soil and water through the leakage of lead.

Mitigation Measures:

- The Contract shall obtain Authorization for Generation, Storage and Handling of Hazardous Waste from MPSCB.
- The Hazardous Waste shall be stored as per the provisions specified in the rules (Segregated and access Controlled space, Covered, Impervious floor, bounded for 110% capacity)
- The Contractor shall maintain records of the generation, storage and disposal as per the provisions using the forms specified in the Hazardous Waste rules.
- The Waste shall be disposed of to Authorized recyclers or Aggregators and the records maintained in Form V of the Hazardous Waste Rules.

DISRUPTION OF COMMUNITY SERVICES

Local services, including water supply lines, irrigation channels, drainage systems, ditches, and streets, are often disrupted during road earthworks. These services are essential for crop production, drinking water supply, and local access, and their damage can also affect road construction activities. Details of utilities, such as electric poles, are provided in **Annexure 6.2**.

6.4.2.11 IMPACTS ON OCCUPATIONAL HEALTH & SAFETY

During the construction phase of the road project, workers are continuously exposed to various occupational and environmental hazards. These include prolonged exposure to dust and gaseous emissions from equipment, vehicles, and material handling. In addition, there are significant safety risks associated with activities such as hill-side cutting, benching, excavation, embankment formation, operation of heavy machinery, and protection works along

eroded riverbanks. Specific risks also arise from working near waterlogged or submerged sections, culvert and bridge construction, and sharp curves or junction improvements, where vehicular movement poses added danger. Electrocution, work at heights, slips, trips, and falls, as well as tree cutting and vegetation clearance, further contribute to potential safety concerns. Proper use of personal protective equipment (PPE), adherence to standard operating procedures (SOPs), traffic and work-zone safety management, and regular safety training will be critical to prevent accidents and ensure worker well-being throughout the construction period.

Mitigation Measure

- A Hazard Risk Identification and Assessment (HIRA) carried out by the Contractor during the Pre-construction for the activities which will be included in the road component of the Meghalaya Logistics and Connectivity Improvement Project. The Occupational Health And Safety Plan attached as Annexure 6.3 shall be implemented by the Contractor.
- The Contractor will provide adequate resources for its implementation.

6.4.2.12 DIVERSION OF TRAFFIC

Since the road upgradation works will be carried out on the existing alignment, there will be a direct interface with road traffic. Short-term impacts during construction will include traffic diversions wherever feasible and management challenges, potentially causing hindrance to the existing traffic flow. There is also a risk of accident hazards during this phase. Although such diversions do not directly impact the natural environment, poorly planned diversions can lead to adverse effects. Rapid restoration of diverted services can help minimize the severity of impacts resulting from the disruption of existing services.

6.4.2.13 Sensitive Receptors

Environment Screening of the proposed road corridor identified the presence of sensitive receptors and community assets along the alignment. These include monoliths at chainages 23+100 and 41+500, religious and cultural sites such as a church (43+000) and caves (Mawjyngbuin at 33+740 and Krem Puri at 39+160), as well as educational institutions including Jawahar Navodaya Vidyalaya (32+100) and SSA Schools (43+520 and 46+600). A pipeline at 26+650 and a hairpin bend at 29+650 were also noted.

Mitigation measures for Monolith:

- Maintain a buffer zones around monoliths as described earlier. (100 m on either sides will not have any material storage, construction camp, vehicle parking or repairs, temporary structures
- These areas should not be used by the construction crew for any purpose. The workers should be sensitized about these elements on the project road
- Clear Do's and Do nots would be provided to them about these locations
- Beautification works has been recommended around monoliths. The layout for the same is presented in figure 4.1 of Chapter 4.

- **Mitigation measures for Community Properties/**
  - Ensure uninterrupted access to caves, educational institutions, schools, religions institutions such as churches. The access in front of these institutions shall be kept in motorable condition at all times.
  - Excavation / works in front of these institutions would be scheduled in consultation with the authorities
  - Pipeline protection through ducts and crossovers, safety and pollution control measures near schools, regulated access near the church, and speed management at hairpin bends. Overall, the screening highlights the need for careful planning to protect cultural, educational, and community resources during road construction.

6.4.2.14 WORK ZONE SAFETY

During the construction activities the exiting road would be used by traffic. The risk of accident and collisions are very high because of the constricted width of the road, use of road by both construction vehicle and equipment and the local people for commuting. Thus, pedestrian, vehicles are susceptible to danger.

Labour camps and site operations pose community health and safety risks (ESS2, ESS4), including sanitation, water access, and increased traffic hazards. Labour influx may exacerbate these risks if not well managed.

The following mitigation measures are thus proposed:

Mitigation Measures

Safety in Construction

- RFI will be raised for all excavation or cutting. The CSC will not approve any RFI for more than 500 m at one go or contiguous stretched. The RFI for excavation on both sides of the carriageway shall not be issued at any time. The subsequent RFI for the adjoining chainages should be issued only when the levelling and back filling is done
- Barricade the construction area using hard barricades (of 2 m height MS Steel Barricades/ New Jersey Barrier/ Water filled barriers) where the drop in level is more than 0.3 m.
- Initiate site clearance and excavation work only after barricading of the site is done.
- Confine all the material, excavated soil, debris, equipment, machinery (excavators, cranes, etc.,), to the barricaded area
- Limit the stocking of excavated material at the site; remove the excess soil from the site immediately to the designated disposal area
- Undertake the work section wise, a 500m section should be demarcated and barricaded; open up several such sections at a time, but care shall be taken to locate such sections in different zones
- In case of settlement areas Steel / wooden Planks of sufficient capacity should be provided to cross over the trench.
- The Work zone safety signages shall be placed as per IRC: SP 55. All the safety measures stated in MoRTH Circular RW/NH-36098/25/2022-S&R (P&B)/pt. dated 16.03.2023 shall be applied.
- Construction material must be stored in the barricaded area. If temporary storage is required (for 1-2 days) outside the demarcated construction area, the same must be discussed with the community.
- Retro reflective tapes shall be fitted on all sides of equipment
- Reverse horns must be placed on all vehicles and equipment. In case of rotating equipment rotation alarm must also be fixed on the equipment.
- Preferably machinery should not be parked beside the carriageway. If machinery are parked on the roadside the area should be barricaded by water filled New Jersey barrier . Retro reflective tape must be fixed on the barrier for easy visibility. Solar LED blinkers shall be placed on the machinery for easy visibility.

Labour Influx related

- The project will prioritize the engagement of local workforce to the extent possible during the construction phase. Contractors will be encouraged to hire unskilled and semi-skilled labour from nearby villages along the project corridor. This approach will not only support local livelihood opportunities but also promote community participation in project activities. Skilled labour may be externally if not available locally. However, preference will be given to local workers wherever feasible.
- Labour camp will be set up as per WB guidance (Annexure 6.4).
- The Project Board shall be installed at the beginning /start of the package. The Project Board should provide the critical information about the project including the grievance mechanism.
- The construction zone must be access controlled, and the workers must be provided valid identification cards to allow entry.
- The Contractor shall provide, explain, and obtain signed acknowledgement of the Worker Code of Conduct from all workers as part of the employment agreement. Time to time orientation programme on Code of conduct to be organized with the workers by the contractor.

6.4.2.15 ROAD SAFETY MEASURES

Road construction activities may affect road safety for commuters, pedestrians, students, women, and elderly persons using the corridor. Since sections of the sub-project alignment pass through landslide-prone areas, there is a risk of periodic landslides and rockfall affecting traffic movement and public safety during construction.

Although animal crossings have not been reported along the current project stretch, the possibility of wildlife or livestock movement during the construction phase cannot be ruled out; therefore, appropriate mitigation measures shall be incorporated into the Contractor's C-ESMP.

In addition, sensitive receptors such as schools are located close to the project corridor, specifically at: Ch. 32+100 (LHS), Ch. 43+520 (LHS), Ch. 46+600 (RHS).

These locations will require enhanced traffic safety management measures during construction, including speed control, signage, safe pedestrian access, and coordination with school authorities.

Mitigation Measures

The road Safety measures suggested in IRC SP 55 need to be implemented. The following additional road safety measures have to be implemented include:

- Suitable safety measures in the form of safety barriers along valley side has been proposed throughout the mountainous terrain of the project stretch.
- For lane decision making, thermoplastic reflective road markings, traffic signage, has been proposed to ensure night visibility.
- Crash barriers have also been proposed along critical stretches of the project corridor to enhance road safety by preventing vehicles from leaving the carriageway and minimizing the severity of run-off road accidents.

Traffic Management

- Speed reduction measures to be taken near Ch 29+650(Hairpin band)
- Safety measures shall be implemented to avoid any damage to the school infrastructure and to ensure the safety of students, staff, and the surrounding community during all phases of construction at Ch 32+100, Ch 43+520 and Ch 46+600
- At Ch 33+740 (Mawjyngbuin cave) and Ch 39+160 (Krem Puri cave): Access roads should not be damaged or obstructed during construction activities; necessary precautions must be taken to maintain uninterrupted access for local residents and emergency services

6.4.2.16 ANTICIPATED IMPACTS ON BIOLOGICAL ENVIRONMENT

Since the proposed Weiloi–Mawsynram–Phlangwanbroi Road involves no widening beyond the existing Right of Way (RoW), and no diversion of forest land or habitat alteration. A species wise screening was carried out and it was assessed that none of the identified species meet the threshold for Critical Habitat criteria under IFC PS6 or World Bank ESS6. Hence, all species have been screened out from further critical habitat assessment was not carried out.

A total of 6 species are listed under Schedule I of the Wildlife Protection Act, 2022. Although none of these species were recorded during the field surveys conducted in the study area, their presence has been indicated through secondary information sourced from the IBAT Tool. Details are provided in Table 5.15.

As per the design, the construction activities would also involve felling of 30 nos. of trees. In addition there would be clearing of the undergrowth and, bushes and shrubs. The unplanned removal would impact the impact on

habitats of birds and animals unless the removal of vegetation in planned and limited. The following mitigation measures are required:

Mitigation Measures:

- No tree felling should be carried out without permission of the Forest Department, GoM.
- Clearing and uprooting should be avoided beyond that which is directly required for construction activities.
- If any termite mound is found adjacent to the highway, precaution will be taken, the mound would not be disturbed, and the Bio-diversity specialist of the PMU would be intimated to ascertain the presence of Chinese pangolin and Indian Pangoloin. Pipe culvert will be constructed at a location identified by the Bio-diversity specialist. Additionally, the mitigation measures suggested by the specialist will be adopted.
- Kerosene / LPG should be preferably used to avoid felling of the trees or provide community kitchen for the labour camps for cooking.
- Camps and storage yards shall be located in the areas already devoid of vegetation or having little vegetation
- Compensatory Afforestation 1: 10 would be carried out by the Contractor. As indicated in the ESMF an app based monitoring of the plantation would be carried out.
- All the workers will need to be oriented and monitored by the contractor so as not to cause any harm to the flora and fauna.
- Hunting and fuel wood collection will be strictly prohibited

6.4.2.17 IMPACTS ON AQUATIC ECOLOGY

Impacts on aquatic ecology during construction include increased silt inflow into surface water bodies and the potential discharge of liquid wastes and untreated sewage from construction and labour camps, spillage of fuel and other constriction material or waste into drainage channels or waterbodies.

Mitigation Measures:

- Disposal of construction material or debris into rivers or streams will be strictly prohibited.
- Regular monitoring of water quality will be conducted to ensure compliance with environmental standards
- The dewatering carried out from the excavated pits will not be discharged directly into the river. It will be transferred into a sedimentation tank of adequate size and residence time before discharge.
- A silt curtain will be provided across the river to prevent sediments from flowing downstream.
- Any works affecting aquatic habitat will be done during low flow (when water depth is less than 5 m) and when banks would be dry
- No Solid waste should be discharged into any waterbody
- Where any GI wire mesh gabions are used; all GI wire ends need to be folded inside.
- Ensure that no construction activities will be carried out during monsoon and the fish breeding season

6.4.2.18 IMPACTS ON ARCHAEOLOGICAL, HISTORICAL AND CULTURAL SITES

No ASI-protected monuments are located within 0.5 km of the project site. However, Monoliths (at Ch 23+200 and Ch 41+500) and caves (at Ch 34+000 and Ch 41+000) are situated within 500 m of the project road. No construction camps will be established within 100 m on either side of the Monoliths during the construction period.

During the construction works, as part of the Contractor's project CESMP, a "chance-find" procedure will be developed and implemented. A guidance note for the protocol on the "chance find procedure" is to be incorporated in the indicative ESMP as part of this ESIA. Workers need to be trained in the use of this procedure. Cultural Heritage Monument Conservation Plan is attached as **Annexure 6.7.**

Mitigation Measures

- If any cultural remains of geologic or archaeological interest are found, Stop work immediately.
- CSC and MPWD shall be immediately informed of such discovery and carry out the instructions for dealing with the same

- No construction related activity not limited to the following storage of material or debris, establishment of labour camp, staging of plant equipment or vehicle, parking of vehicle etc shall be carried out in the vicinity of the Monoliths

6.4.3 IMPACTS DURING OPERATIONAL PHASE

During the operation stage, the main sources of environmental impacts are the increased traffic volume and speed. The increase in traffic volume and speed may enhance the safety risk especially in the rural area. No sudden change in the volume of traffic is expected due to this road as the road is already existing and opened for public traffic. The project also provides opportunities for 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 the operation phase, moderate increases in air and noise pollution may occur due to higher vehicular movement (ESS4). Nevertheless, the overall impacts are largely positive, with enhanced road safety, reduced travel time, and improved connectivity supporting local economic development. Landscaping, replantation, and slope bioengineering measures (ESS6) will improve local biodiversity, stabilize embankments, and enhance the corridor's visual aesthetics.

Various impacts during operation phase are discussed below:

6.4.3.1 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 is minimal since enhancement of road safety measures such as improvement of curves and widening of the roads and other pedestrian facilities are taken care of in the design stage.

6.4.3.2 Impact on Air Quality

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

6.4.3.3 Impact on Noise Quality

Impact due to increased noise level and vibration is anticipated due to increased vehicular movement upon improvement of existing road condition. Road side plantation will act as a noise barrier and is likely to reduce the noise quality during the operational phase and any further mitigation is beyond the control of the project authority.

6.4.3.4 Accidents Involving Hazardous Materials

Accidents involving hazardous chemicals may 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 minimizing 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 expected to have printed warning signs on the vehicles and measures to contain any hazardous spillage on the road.

In case of spillage, the report to relevant departments will be made and instructions will be followed in taking up the contingency measures immediately as per the Emergency Management Plan of the contractor's OHS plan.

6.4.3.5 Impact on Ecology

During the operational phase, significant impacts on aquatic ecology are not anticipated; although the alignment crosses a river, appropriate mitigation measures such as sediment control, construction of temporary diversion structures, and proper wastewater management will minimize potential adverse effects.

To address the potential impacts on biodiversity, a comprehensive set of mitigation measures have been developed and incorporated into the ESMP.

6.5 SOCIAL RISKS & IMPACTS

The construction of the road is expected to intersect various areas of significant social and economic value, which necessitates careful consideration and management. Key areas of concern include impacts on agricultural lands, residential communities, and culturally significant sites. The route traverses along agricultural land that are important for local food production, livelihoods and eco system services in general. Disruption to these areas could result in economic losses for farmers and reduced agricultural output. Mitigation measures, including re-alignment and access to community benefit programs have been considered to minimize adverse effects and ensure that the project contributes positively to the socio-economic landscape. This has been outlined in the Resettlement Action Plan.

The construction of the WMP road is not expected to have significant social impacts on roadside communities, as no additional land is required for the project. The project aims to minimize social impacts by ensuring that all construction activities are confined within the existing Right of Way (RoW).

The assessment of impacts on structures along the project corridor indicates that the effects are largely minor and localized in nature, primarily involving partial damage to existing assets. A total of 10 Project Affected Households (PAHs) comprising 66 Project Affected Persons (PAPs) are expected to experience impacts.

The majority of the impacts are associated with encroachers, with no major permanent displacement involved. Commercial structures, mainly consisting of bamboo and GI sheet fencing of shops, account for impacts on 4 PAHs (27 PAPs). Similarly, 6 PAHs (39 PAPs) associated with residential structures will face partial loss of gates, boundary walls, or GI sheds.

Importantly, all identified impacts are less than 10% of the affected structures, indicating that the severity of impact is minimal and does not involve complete loss of assets or large-scale displacement. Overall, the findings suggest that the project will have limited and manageable socio-economic impacts, which can be effectively mitigated through appropriate compensation and livelihood restoration measures. There are 6 nos. of Residential Structures (Such as concrete staircase and concrete compound walls) and 7 nos. of Commercial Structures (Such as G I Sheet, Shed, Shades and Gate). (Refer to Table 5.30. A 30-day notice period will be provided to all Project Affected Persons (PAPs) whose structures fall within the project ROW, allowing them sufficient time to salvage materials and relocate. FPIC was carried out as the project will result in loss of assets and cause relocation of IP's.

No additional land requirement is anticipated for the proposed road project, as all construction activities are planned to be carried out entirely within the existing 12-metre Right of Way (RoW). However, for spoil disposal, 4.466 ha of land is required. This required land for spoil disposal sites will be used temporarily and will be returned to the land owner after project completion and after having redeveloped in accordance to the community requirements. The Consultants along with the officials of the PWD and members of the Village Community including the Rangbah Shnong jointly identified 3 locations for dumping of spoils. The Details for the same is presented in Table 3.13 of Chapter 3.

To mitigate these social impacts, household surveys and extensive meaningful stakeholder consultations and FPIC consultations were carried out to understand the concerns and needs of affected communities. The FPIC process was followed in a culturally appropriate manner to ensure meaningful engagement with indigenous peoples, securing their consent through transparent and participatory consultations. Additionally, community engagement programs have been conducted to provide clear information about the project, address misconceptions, and

explore opportunities for local benefit, such as job creation and infrastructure improvements. Contractors will be required to ensure that access to residences, shops, agricultural land and public amenities is maintained throughout the construction period.

The Project recognizes the critical importance of addressing Sexual Exploitation, Abuse, and Harassment (SEA/SH) both within the workplace and in interactions between workers and the local community. To address these concerns, SEA/SH Prevention and Response Action Plan has been prepared for the project. Considering the potential risk of Gender-Based Violence associated with labour influx and construction activities, a site specific GBV Action Plan has been prepared and is provided as Annexure 6.3.

Social impacts associated with the project have been assessed across the pre-construction, construction, and operation phases of the project lifecycle

6.5.1 PRE-CONSTRUCTION PHASE

Nature of Impacts

During the pre-construction phase, social impacts are primarily associated with impacts on structures, and livelihood disturbance arising from project preparation activities. For this sub project road about 13 structures are expected to be impacted, which are located within the existing Right of Way (RoW). These impacts are largely partial in nature and include compound walls, shade, shed and gates. Such impacts may result in loss of assets and temporary livelihood disruption.
The project affects Indigenous Peoples (IPs) residing along the corridor, requiring culturally appropriate consultation and consent processes prior to implementation.

Mitigation Measures

Mitigation during the pre-construction phase focuses on planning and compensation measures. Household surveys, stakeholder consultations, and the Free, Prior, and Informed Consent (FPIC) process have been conducted to ensure meaningful participation of affected communities. Compensation for affected assets and livelihood assistance through the Resettlement Action Plan (RAP). Community amenities identified through consultations with Indigenous Peoples have been incorporated into the Indigenous Peoples Development Plan (IPDP). Continued disclosure and consultation will be undertaken through the Stakeholder Engagement Plan (SEP).

6.5.2 CONSTRUCTION PHASE

Nature of Impacts

The construction phase is expected to generate mostly temporary social impacts. Construction activities may restrict access to residences, agricultural land, shops, and public facilities along the project corridor. These disruptions may affect daily mobility and reduce customer access to roadside businesses for short periods.
Construction activities may also increase pressure on local ecosystem resources due to the presence of workers in the project area. Vulnerable groups including elderly persons, women-headed households, and economically weaker households may face additional mobility and safety challenges during construction.
The project may require a limited number of workers from outside the project area, creating potential risks related to labour influx, worker–community interaction, communicable diseases, and SEA/SH risks. Occupational health and safety risks for workers are also anticipated during this phase. The project level Labour Management Plan (LMP) and Work site safety plan (OHS Plan) outlines strategies for managing these risks. Labour Management Plan is attached as attached as Annexure 6.4. Occupational Health and Safety plan is attached as Annexure 6.5.

Mitigation Measures

Construction-phase impacts will be managed through measures included in the Environmental and Social Management Plan (ESMP). Contractors will maintain alternative access routes, schedule works in phases, provide

advance notice of construction activities, and install safety signage and temporary crossings to ensure continued access to residences, shops, and public facilities. Contractors will be required to source materials responsibly and avoid dependence on local forest resources. Special attention will be given to vulnerable groups by maintaining access to healthcare facilities, schools, and markets through temporary walkways and crossings where necessary.

Labour-related risks will be managed through implementation of the Labour Management Procedure (LMP), worker codes of conduct, labour camp management provisions, occupational health and safety measures, and worker grievance mechanisms. The SEA/SH Prevention and Response Action Plan will be implemented during construction to address risks related to worker–community interaction. Monitoring of these measures will be carried out as part of ESMP implementation.

6.5.3 OPERATION AND POST-CONSTRUCTION PHASE

Nature of Impacts

No significant adverse social impacts are anticipated during the operation phase. Instead, the improved road infrastructure is expected to generate positive social and economic outcomes for communities along the corridor. Improved connectivity will enhance access to markets, healthcare facilities, schools, and administrative services. Road safety improvements and better drainage infrastructure will improve mobility and travel reliability, particularly during the monsoon season.

Enhancement and Monitoring Measures

During the operation phase, the focus will be on sustaining project benefits and ensuring road safety. Community awareness programs on road safety and maintenance of road infrastructure will support long-term project sustainability. Improved connectivity is expected to contribute to local economic development, improved service access, and poverty reduction in the project area. Efforts should also be made to ensure non-discriminatory employment practices, particularly in the inclusion of women. Over the long term, the project is expected to contribute positively to poverty reduction and overall community development.

6.6 CLIMATE-RELATED IMPACT

Climate change poses a significant challenge to the State of Meghalaya, with its diverse ecosystems, high biodiversity, and socio-economic dependence on agriculture, forestry, and natural resources. The state is highly vulnerable to the impacts of climate change due to its unique geographic and climatic conditions.

Rising temperatures have further contributed to ecological imbalances, affecting agricultural productivity, forest health, and water resources. Additionally, the district lies in Seismic Zone V, and the interplay of climate-induced hazards and geophysical risks adds further complexity to its vulnerability.

Due to the uneven climatic behavior, it is essential that climate mitigation and adaptation plans to combat the impacts of climate change are factored in the development process to avoid economic burden of adaptation in the long run, and gain from new opportunities that will be thrown up along the way. The Potential impacts of Climate Change trend on road transport infrastructure are provided in **Table 6.7**. A detailed preliminary assessment has been undertaken to assess climate disaster risks, details of which are available in **Annexure 6.6.**

Table 6.7: Potential impacts of Climate Change trend on road transport infrastructure

Climate Trend / Parameter	Observed Pattern	Impact on Road Infrastructure
High Rainfall	10,000–11,800 mm (Mawsynram)	- Erosion of road embankments and landslides in hilly terrains. - Structural damage to culverts and bridges.

Low Rainfall	- Significant drop in annual rainfall -Reduced annual rainfall correlates with reduced soil moisture and vegetation	- Dry soil conditions may cause cracks in asphalt roads. - Lower soil stability, leading to uneven settling of road foundations. - Loss of vegetation can weaken slopes and lead to landslides in hilly areas like East Khasi Hills. - Roads may face increased dust and reduced traction due to dry conditions.
Rising Temperatures	- Maximum temperature rising from 20.4°C to 23.5°C	- Higher temperatures cause thermal expansion of road materials, leading to surface cracks. - Softening of asphalt during hot days can cause deformation and rutting.
Landslide Risk	- Frequent rainfall and runoff events increase landslide susceptibility in the district's terrain	- Roads in hilly areas may face closures due to landslides. - Increased repair costs for damaged road sections and disrupted connectivity to remote areas.

7. STAKEHOLDER CONSULTATION AND INFORMATION DISCLOSURE

This chapter presents an overview of the stakeholder consultations conducted as part of the Environmental and Social Impact Assessment (ESIA) for the proposed MLCIP. These consultations were intended to ensure a participatory approach in identifying and addressing potential environmental and social impacts of the project.

Relevant stakeholders were mapped and can be categorized under three broad categories as shown in below **Table 7.1**.

Table 7.1: List of relevant stakeholders

Category of stakeholder	Project Stakeholder
Project-Affected Parties	▪ Village community ▪ Street side Shop Owners ▪ Shop owners (NTH) ▪ Residential structure owners ▪ Dorbar Shnong
Interested Parties	**Government agencies** • Public Works Department Meghalaya • Khasi Hills Autonomous District Council (KHADC) • Meghalaya Forests & Environment Department • Meghalaya State Pollution Control Board (MSPCB) • Meghalaya State Biodiversity Board (MSBB) • Jawahar Navodaya Vidyalaya School **Civil society organizations** • Church-based Organizations (Presbyterian / Catholic Missions) – significant role in education, health, and social services across villages • Women's groups
Vulnerable groups	▪ Women Headed Household (WHH) ▪ PAPs falling under Below Poverty Line (BPL), ▪ Scheduled Tribe (ST) categories, ▪ Persons with disabilities

During the ESIA, consultations were carried out with representatives from all three stakeholder categories, including government agencies, communities, and other organizations, with particular attention to vulnerable groups. Special focus was given to communities located in sub-project areas likely to experience significant impacts, such as effects on residential and commercial structures or on common property resources. Key common property resources identified include religious structures, public utilities, and other community assets critical to local livelihoods and cultural heritage.

Representatives from relevant stakeholders were consulted to incorporate their concerns and expertise, ensuring that the project aligns with broader developmental, economic, and environmental objectives. Key discussions focused on potential displacement, loss of livelihoods, environmental degradation, law and order issues, irrigation impacts, structural matters such as cross-drainage structures, and corresponding mitigation measures. These consultations helped document and integrate the priorities and concerns of affected communities, providing valuable input to shape strategies for minimizing adverse impacts.

Through public consultations, stakeholders' viewpoints and suggestions were captured and considered as inputs to the technical design. All suggestions were incorporated into the project design to the extent feasible and warranted.

Additionally, **Annexure 7.1** provides a summary of consultations with project-affected parties from local communities and institutional stakeholders from government agencies.

The project has prepared a project-level Stakeholder Engagement Plan (SEP), which outlines the procedures for stakeholder engagement throughout the project cycle. The SEP details the process, methods, and frequency of engagement with various stakeholders and will be implemented accordingly during the project period.

Discloded Stakeholder Engagement Plan link on MPWD website is **https://www.megpwd.gov.in/pdf/2025/MLCIP/DRAFT%20STAKEHOLDER%20ENGAGEMENT%20PLAN%20(SEP)%20MLCIP.pdf.**

7.1 PUBLIC CONSULTATION

Public consultations were a key component of the Environmental and Social Impact Assessment (ESIA) process. These consultations were conducted to ensure that the views, concerns, and suggestions of local communities and other stakeholders were effectively considered in project planning and decision-making. The process was guided by the principles of transparency, inclusiveness, and participation, in line with the requirements of the World Bank's Environmental and Social Standard 10 (ESS10) on Stakeholder Engagement and Information Disclosure. Consultations were organized at different stages of the project to inform stakeholders about the project objectives, potential environmental and social impacts, and proposed mitigation measures, while also providing an opportunity for them to share feedback and local insights. The outcomes of these consultations were incorporated into the project design and environmental and social management plans to enhance the project's sustainability and community acceptance.

7.2 STAKEHOLDER CONSULTATIONS

Stakeholder consultations were carried out to ensure that the perspectives, concerns, and expectations of all relevant stakeholders particularly the project-affected persons, IPs, and vulnerable groups were effectively captured and integrated into project planning and decision-making. A total of six consultations were conducted as part of the Environmental and Social Impact Assessment (ESIA) process for the proposed road project. These included two preliminary public consultations, two Focus Group Discussions (FGDs) with youth, one Focus Group Discussions (FGDs) with women and one with DPR consultant.

The details of consultations along the project road are presented in **Table 7.2**.

Table 7.2: Summary of consultations

Sl. No.	Stakeholders	Dates of consultantion	No of Participants	Summary of Feedback
1.	Local residents at Weiloi	20-08-2025	4 Men 1 Woman	• The community expressed strong support for the project and expects improved road quality to enhance accessibility and transportation efficiency.
2.	Local residents at Mawsynram	20-08-2025	6 Men 2 Woman	• The community expressed strong support for the project and expects improved road quality to enhance accessibility and transportation efficiency.
3.	Local residents at Laitsohum	20-08-2025	4 Men 2 Woman	• There is a strong need to incorporate skill development and capacity-building initiatives to enhance local employment opportunities and reduce dependency on external livelihoods.
4.	Local residents at Phlangwanbroi	20-08-2025	5 Men 2 Woman	• Stakeholders highlighted safety concerns, particularly inadequate street lighting and the need for pedestrian safety measures such as speed breakers and zebra crossings near sensitive locations like L.P.S. School.
5.	Shopkeepers	20.09.2025	PAH	• Reaffirmation of community support with emphasis on improved road conditions as a key expectation from the project.
6.	Local residents at Mawkasain	20.09.2025	5 Men 2 Woman	• There is a strong need to incorporate skill development and capacity-building initiatives to enhance local employment opportunities and reduce dependency on external livelihoods.
7.	Local residents at Mawsawa	20.09.2025	4 Men 3 Woman	• Improved road connectivity is expected to boost local economic activities.
8.	Youth Groups	16.09.2025	Youth (8 nos.)	• The community highlighted migration due to lack of opportunities, emphasizing the need for local livelihood generation through skill development and promotion of microenterprises.
9.	Youth Groups	16.09.2025	Youth	• Improved road connectivity is expected to boost local economic activities. Continuous stakeholder engagement and monitoring mechanisms are required

Sl. No.	Stakeholders	Dates of consultantion	No of Participants	Summary of Feedback
			(7 nos.)	to ensure project responsiveness to community needs.
10.	Women	16.09.2025	Women (6 nos.)	• There is a strong demand for women-centric interventions, including skill development and enhanced participation of SHGs, to promote inclusive growth and empower women economically.
11.	DPR Consultant	25-08-2025	DPR Consultants	▪ Technical inputs indicate the need for adopting standard design parameters (12 m PRoW), utilizing survey data, and incorporating safety, environmental considerations, and future expansion provisions to ensure a sustainable and compliant road design.
Consultations held during FPIC for Priority Projects				
12.	Community Members & Project Affected Households & Families	04.09.205 & 09.09.2025, 16.09.2025, 08.10.2025 and 10.12.2025	No of consultation: 5, Total no. of participants: 138 (Male; 124 and Female: 14)	**Major key Agreements:** ▪ Improvement of the existing road to Intermediate Lane with provision of safety measures, drainage, and protection works in habitation and market areas, subject to technical feasibility. ▪ Construction of passenger waiting sheds at specific village locations ▪ Construction of drains cum footpath near settlement areas etc. ▪ Construction of toilets

7.2.1 FPIC PROCESS

As per the requirements of the World Bank's Environmental and Social Standard 7 (ESS7), Free, Prior, and Informed Consent (FPIC) is required where project activities affect lands and natural resources traditionally owned or used by Indigenous Peoples, result in their relocation, or have significant impacts on their cultural heritage. For the proposed Weiloi - Mawsynram Road upto Phlangwanbroi (WMP) road sub-project, FPIC was triggered under the first condition, as the intervention involves the use of natural resources traditionally used by Indigenous communities. Accordingly, a structured FPIC process was undertaken to ensure culturally appropriate engagement with Indigenous communities and their traditional institutions, including Rangbah Shnong, village councils, and community representatives. Consultations were conducted in the local Khasi language using accessible formats and covered key aspects of the project such as alignment, design, anticipated environmental and social impacts, and proposed mitigation measures, with particular attention to land use, vegetated community land, water sources, livelihoods, and community assets.

The FPIC process was carried out in a phased and participatory manner through multiple rounds of consultations, allowing adequate time for internal deliberations in accordance with customary decision-making systems. The process ensured inclusive participation of women, youth, and vulnerable groups, and was undertaken in good faith, free of coercion or external influence. The outcomes reflect broad community support for the WMP sub-project, subject to agreed mitigation measures and design considerations, which have been incorporated into the project design. These measures, along with the detailed record of the FPIC process and continued engagement framework, are presented in the Indigenous Peoples Development Plan (IPDP) prepared specifically for the WMP sub-project.

Documentation of the FPIC process, including signed minutes of meetings and attendance records endorsed by Community Leaders, is provided in the Indigenous Peoples Development Plan (IPDP) prepared for the WMP sub-project.

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT, MONITORING & REPORTING PROGRAMME

8.1 GENERAL

Monitoring and reporting are critical components in the implementation of the project. Monitoring involves periodic checks to determine whether activities are being carried out in accordance with the proposed mitigation plans. It provides essential feedback to project management, helping ensure that project objectives are achieved on schedule. The reporting system ensures that environmental and social mitigation measures are implemented as planned. Together, monitoring and reporting support the proper implementation of the Environmental and Social Management Plan (ESMP).

The broad objectives of monitoring and reporting on E&S management are:

- To evaluate the performance of mitigation measures proposed in the ESMP and in other mitigation plans.
- To evaluate the adequacy of environmental and social assessment.
- To suggest improvements in ESMP and other mitigation plans based on the monitoring and to devise fresh monitoring based on the improved ESMP.
- To enhance environmental quality and social development through proper implementation of suggested mitigation measures.
- To meet the requirements of the existing environmental and social regulatory framework and community obligations.

8.2 ENVIRONMENT AND SOCIAL MANAGEMENT PLAN

The Environmental and Social Management Plan (ESMP) has been prepared in accordance with the World Bank's Environmental and Social Framework (ESF) to ensure that the potential environmental and social impacts identified during the assessment are effectively managed during the design, construction, and operation phases of the project. The ESMP outlines specific mitigation, enhancement, and monitoring measures; defines institutional responsibilities; and provides a framework for capacity building and reporting. It serves as a practical tool to guide the implementation of mitigation measures, ensuring compliance with applicable national regulations and the World Bank's Environmental and Social Standards (ESSs), while promoting sustainable and inclusive project outcomes. Environment and Social Management Plan is presented in Table 8.1.

Table 8.1: Environmental and Social Management Plan

Sl. No.	Activity	Environment and Social Aspects	Impacts	Mitigation/ Management Measures	Implementation	Indicator	Supervision/ Monitoring
PRE-CONSTRUCTION							
1	Consents/ Permits/ Approvals/ Compliances	Regulatory Compliance	Non-compliance to various Environmental/ social/ regulatory requirements pertaining to the proposed project could lead to legal Implications	• Obtain all necessary statutory clearances (CTE, CTO, Labour License, Fire NOC, Tree Cutting Permission, Hazardous Waste Authorization etc.) • Obtain necessary insurance and indemnities as specified in the Contract Agreement or a necessitated by law. • The CSC will not allow any construction activity without these being completed • Renew permits before expiry. • The conditions mentioned in the permit need to be maintained. • Reports and Returns need to provided.	Contractor/ MPWD	CTE, CTO, Labour License, Fire NOC, Tree Cutting Permission Insurance and indemnities to be submitted and tracked	MPWD/PMC/CSC
2	Land Procurement	Asset and Livelihood	Loss of Land/ Livelihoods	• RPF and RAP shall be followed MPWD division, Village Council and concerned authorities shall coordinate implementation. Compensation records shall be maintained; grievances resolved. Civil works shall commence only after written confirmation from PMU/MPWD that RAP compensation, assistance, and site handover have	MPWD division, Village Council and concerned authorities	Compensation records maintained; Grievances resolved	MPWD/CSC/NGO

				been completed for the relevant stretch.			
3	Preparation of Works Methodology Contractor's ESMP (CESMP)		Inadequate preparation and implementation of CESMP by Contractor can leave environmental and social issues unattended	• The contractor needs to follow the project ESMP to formulate the CESMP aligned with its work methodology. • The CESMP shall be submitted with the Work Plan and Method Statement. • The CSC shall review it and provide one set of consolidate comments within 15 days and the plan shall be approved once these are compiled to by the Contractor. The Work Plan and Method Statement will be approved by MPWD only when the CESMP, Traffic Management Plan, OHS Plan is prepared and approved by the CSC.	Contractor	Approved CESMP including TMP, LMP and other relevant plans, and implemented;	MPWD/PMC/CSC
4	Identification of land for material storage yard/ construction camp/ labour camp	Land use and ecology	Discharges from Yards/ Camps to pollute the surroundings and lead to social tension.	• Contractor needs to identify suitable land for storage yard/ construction camp/ labour camp • The land shall not be closer to the water bodies, waterlogged areas or wetlands. • The land will be handed back to the owner in the same condition as it was prior to the commencement of project activities, once the project is completed. • Contractor to produce the lease agreements, NOC etc. for these lands. • Avoid construction camps and material storage near streams or unclassed forest on community land, flood plain, encroachment into natural habitats.	Contractor	Approved site location; Lease/NOC copies;	MPWD/PMC/CSC

				• Restrict vegetation clearing to the minimum area required for works. • Maintain a buffer of at least 100 m from natural drainage channels or water bodies. • Implement soil erosion control measures (silt fencing, sediment traps, and slope turfing). • Prohibit hunting, fishing, or collection of forest produce by workers. • Awareness and sensitization of labourers on local wildlife and birds. • The guidance for the preparation, construction and operation of the labour camp shall comply with the World Bank Group9 Guidance on Labour Accommodation • No construction camp, material storage area, will be setup 100 m on both sides from the Monolith (At Ch 23+100 and Ch 41+500).			
5	Supply of Construction Material	Physiography	Sourcing materials from unauthorized sources.	• The Contractor will submit the EC, CTE, CTO of the aggregate and sand quarry to the PMU for the approval at the beginning of the project. • Procurement of construction material only from approved quarries and sites and licensed/ authorized vendors/ manufacturers. • Contractor to produce approvals and receipts of the payment of royalty for	Contractor	EC, Permits, challans, Material source approval copies;	MPWD/CSC

[9] Workers' accommodation: processes and standards

				all the material procured along with the bill / IUFR.			
6	Water	Groundwater and Surface Water	Abstraction and Pollution of surface and groundwater sources.	• The Contractor will be responsible for arranging adequate supply of water for the entire construction period. • In case of own borewell the Contractor shall obtain a permission of abstraction form CGWB/ SWID. • He shall arrange for a meter to be fixed at the borewell and the log of the water extracted will be maintained. • Measures suggested in the permission will also me maintained • The contractor will minimize the pollution and wastage of water during construction. The labour camp shall be provided with adequate number of toilets as specified in BCOW Act/ WBG Guidance on Labour accommodations. The toilets have to be provide with soal pits, septic tank or be linked to a mobile treatment unit. Bio-toilets can also be considered as an option • The Construction Camp, Construction material storage yard will be providing with peripheral drain which shall be linked to a sedimentation tank. • The vehicle repair area , oil storage area shall be impervious , the runoff form these areas shall be sent to a drain and the same is connected to an oil water separator of adequate	Contractor	Permission for Water source; Usage records; Wastewater management measures	MPWD/PMC/CSC

				capacity			
7	Appointment of Environment, Social and Safety Officers		Inefficient and incompetent supervision by contractors may lead to negative impacts on environment, Social, health and safety.	• The contractor will appoint qualified and experienced Environment. Social and Safety personnel to ensure implementation of CESMP and occupational health and safety issues at the camps and construction work sites. • The Environmental Officer along with the other key members of the team shall be responsible for the preparation of the Plans and also obtaining the statutory permits.	Contractor	To be mobilized before construction; approved OHS plan	MPWD/PMC/CSC
8	Identification of OHS Hazard and Risk Categorization	Occupational Health & Safety	May cause physical harm, injury, illness, or death to workers.	• Develop a site-specific Hazard Identification and Risk Assessment (HIRA) and develop mitigation measures. The Contractor shall prepare an OHS Plan containing the HIRA and submit it as part of the Work Plan and Methodology. The Work Plan shall be approved only when the OHS Plan is satisfactory. • Arrange for PPE (helmets, safety shoes, high-visibility vests, gloves) to all workers. • Develop tie up with local Hospital/ PHCs/ CHCs for Health Checkups of labours and also to handle to any accident cases. • Ensure proper sanitation, adequate potable water (minimum 5 litres per person per day), and waste disposal facilities in camps. • Consulting with workers to identify	Contractor	OHS hazard register; Inspection reports;	MPWD/PMC/CSC

				hazards that may not be obvious to employers or safety professionals. • Reviewing safety data sheets (SDSs) to collect information about the hazards of chemicals and other substances used in the workplace.			
9	Other Construction Vehicles, Equipment and Machinery	Pollution Management	Vehicles and equipment not complying with regulations may lead to pollution of environment.	• The contractor will maintain records of fitness and Pollution Under Control (PUC) certificates for all vehicles and generators used during the contract period.. This certification shall be renewed and always maintained. The certificate shall be submitted with the IUFR's (if necessary) • All lifting should have the appropriate certification and construction equipment should meet the emission requirement specified in MoRTH emission standards specified in GSR 144. • Engage trained personnel for operating machinery and working at height or confined spaces. • Crushers, hot-mix and batching plants shall be located at least 1000m (1km) away from residential/ settlements, forests, wildlife movement areas, and commercial establishments, preferably in the downwind direction. • The crushers, batching plant and all other equipment shall meet the specification which are likely to be mentioned by MSPCB in the consent. .	Contractor	Records of valid PUC / fitness; Inspection log	MPWD/PMC/CSC

10	Tree Cutting	Ecology	Loss of green cover and biodiversity	• Maximum efforts shall be made to minimize the number of trees to be felled. • The requirement or specifics to fell trees shall be notified to the Forest Department in advance. • Tree felling shall only be carried out when permission has been obtained from the Forest Department. • Tree cutting and disposal shall be done as per the Forest Dept.	Contractor	Records of trees cut and saved.	MPWD/CSC
11	Joint field verification		The impacts may not have been identified in time.	• The MPWD and the Contractor shall carry out joint field verification to ascertain the local complaints/suggestions and to confirm the need for additional protection measures or changes in design/scale/nature of protection measures including the efficacy of enhancement measures suggested in the ESMP. • Contractor shall provide advance notice to communities and village councils prior to road closures, diversions, or major construction activities. • The MPWD shall maintain proper documentation and justifications/reasons in all such cases.	Contractor	Verification reports;	MPWD
12	Identification	Damage to existing eco-	Indiscriminate borrowing activities	• Borrow area should be located at a minimum distance of 300m from the	Contractor	Borrow area EC copy; Approved	MPWD /CSC

	of Borrow Area	system due to borrowing activities	may damage the eco-system and lead to unproductive environment	residential/ settlement area. Preferably, non-agricultural land and barren lands shall be used. Proper barricading should be provided and access to the borrow areas should be restricted to the unauthorized persons. • The Contractor will have to obtain the Environmental Clearance for borrow areas. • The borrow area will be operated as per the MoEFCC guidelines10 issued by the concerned SEAC and SEIAA.		management and closure plan	
13	Identification of construction material transportation route	Community Health and Safety	The safety aspects like (i) safety of road users including pedestrians and cyclists (ii) safety of cattle; (iii) safety of local community (iv) unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during the construction stage. Children are most	• Plants and equipment will be installed sufficiently away from the settlements. • Proper caution signage, barricading, delineators, lightings etc. will be installed at construction zone and temporary diversions. • Hard barricading will be provided at construction zone near habitation area and public roads, and the same will be maintained throughout the construction period. • Proper traffic management will be ensured near roads of the Construction zone. • Road safety education will be imparted to drivers running construction vehicles. In case of negligent driving, suitable action will	Contractor	Approved route plan; Community consultation record	MPWD/CSC

[10] https://parivesh.nic.in/publicdocument/UPLOAD_OM_NOTIFICATION/IA_DOCS/1001_19032025024958.pdf

			vulnerable to injury due to vehicular accidents.	be taken. • Speed restrictions shall be imposed on project vehicles to control speeding. • Installation of temporary speed bumps to control speed near designated pedestrian crossing areas/school areas/ market places/ religious places/ human habitations. • The general public/ residents shall not be allowed to any of the risk areas of the project, e.g., excavation sites, construction sites and areas where heavy equipment is in operation. • In the consideration of risk at civil works, each labour should be covered under ECA 1923 insurance until completion of work. • Contractor shall maintain continuous access to residences, shops, agricultural land, and community facilities during construction. • Temporary walkways or alternate access routes shall be provided where needed. • Special attention shall be given to safety of children, elderly persons, and persons with disabilities near work zones.			
14	Identification of sites for debris disposal or wastes generated from construction	Land and Water environment	Pollution due to indiscriminate dumping of wastes. Wastes entering water bodies and groundwater causing	• MPWD Division and the Contractor are responsible for identifying a suitable area in consultation with local administration to dispose of the wastes from labour camps, construction sites and site offices. • The locations of dumping sites should	Contractor	Approved disposal site and its management plan; NOC, Agreement with landowner; Waste	MPWD/CSC

	camps and site offices		pollution	be selected with following considerations i) Unproductive/wastelands preferred , ii) away from residential areas (at least 1km downwind side), iii) are not designed forest or other eco-sensitive areas, Iv) do not affect natural drainage courses , v) no endangered/rare flora is impacted vi) are not lowlands, natural depressions which are natural sinks • Drainage channels should not be used for dumping • Local Authorities should be consulted about the location of debris disposal sites before finalizing the locations. • The topsoil of 15cm shall be removed before any works are carried out Reuse topsoil for slope stabilization and landscaping. • Dispose of debris only at approved low-lying barren areas located at least 1 km downwind of settlements and away from drainage channels. • Avoid dumping in water bodies, wetlands, or near agricultural fields. • Regularly monitor disposal sites to prevent contamination and visual pollution.		disposal records;	
15	Relocation of Utility and Common Property Resources	Utility Service	Loss of services from utilities and common property resources for the public	• When the utilities/ Common Property Resources need to be shifted, they will be shifted in consultation with the communities and with least inconvenience to the public. • If any displacement of Utility/CPRs is	Contractor/ Divisional offices of MPWD	Records of Relocation completion.	MPWD/ PMC/CSC

	(CPR)			required, they will be relocated with prior approval of the concerned agencies. The relocation site identification will be in accordance with the choice of the community. • Restrict utility shifting to daytime hours to avoid safety risks at night. • The scheduling of the construction works will be shared with the line department (MePDCL, PHE and Telecom Departments) for ensuring uninterrupted services during construction. • Provision of utility ducts for underground pipelines shall be incorporated into the design to ensure safe and organized routing of essential services, minimize future excavation, and facilitate maintenance without disrupting road infrastructure			
16	Planning for Worksite and Work Zone Safety	Community Health and Safety	Accidents and inconvenience to communities	• Make arrangement for New Jersey barriers/ Water filled barrier, MS steel barricades (2 m high), signage, and warning lamps at work sites. • Prepare a Generic Community Health and Safety Plan (CHS Plan) along with the Work Methodology and Work Plan. The Work Plan should not be approved without an approved CHS Plan. • Schedule high-risk activities during off-peak hours to minimize traffic congestion. • Develop posters for Community	Contractor	Community Health Safety Plan	MPWD/PMU

				Awareness. Conduct community awareness campaigns before any temporary road closure or service disruption. • Every RFI should be accompanied with a site specific OHS, CHS and Traffic Safety Plan, which should define the site-specific measures which were implemented. Without these plans being implemented the works should not be approved.			
		CONSTRUCTION					
1	Crushers, Hot mix Plants & Batching Plants	Air Pollution	Impacts due to establishment and operation of plants and equipment	• The Contractor shall submit a detailed layout plan for all such sites and seek prior approval before entering into a formal agreement with a landowner for setting-up such sites. • Specifications of crushers, hot mix plants, and batching plants shall comply with the technical requirements of the contract and prior Consent / NOC for all such plants shall be obtained. • No such installation by the Contractor shall be allowed till all the required legal clearances are obtained from the competent authority • The emission has to be monitored asper the monitoring plan specified in the ESIA Report. • The plant has to be maintained as per the specification of the manufacturer. A log of the maintenance should also be maintained by the Contractor..	Contractor	Approved layout plan; Valid NOCs/Consents; Dust suppression records; Air quality monitoring reports	MPWD/PMC/CSC

2	Operation of Borrow Areas	Topsoil and land	Impacts due to improper operation and closing of borrow areas	• Borrow areas shall be selected as specified in the guidance in The Contractor should submit the EC, a copy of agreement with the landowner, borrow area management and closure plan before initiating any kind of borrowing activities. • The Borrow are should comply with the conditions set in the EC/ SoP from MoEF&CC. • Topsoil up to a depth of 150 mm from all areas of cutting, filling, and temporary construction zones, shall be stripped and preserved as indicated in the MoEF&CC SoP / MoRTH Orange Book: Specification for Road and Bridge Works; • Topsoil will be stored separately in designated stockpiles with proper slope protection and sediment barriers to prevent erosion; • Reuse stored topsoil for median greening, roadside plantation, and slope turfing after construction; and • Prohibit disposal of topsoil at dumping sites.	Contractor	EC and lease copies; Approved Borrow area restoration and Closure plan	MPWD/PMC/CSC
3	Operation of Quarries	Physiography and Geology	Impacts due to improper management, operation and closing of quarries	• The Contractor shall only source material from quarries approved by PMU(indicated in the Pre-Construction stage) • The challans for the royalty paid against the material used shall be included in the IUFR / Bills submitted	Contractor	Quarry permit, EC; Safety inspection report; Haul Road maintenance record, dust suppression	MPWD/PMC/CSC

				for payments. • In case of new quarry fo the project the Contractor has to obtain EC and other relevant permits and licenses. • Inca se of Blasting , A Blasting Management Plan shall be prepared in addition to the Blasting Permit, • No quarry or associated plants can be set-up within 1000m from the residential/ settlement locations • Contractor shall prepare a haul road network for quarry transport and ensure the suitability of such haul roads from the safety of residents, biodiversity and other environment points of views.		measure, geotagged photos	
4	Dismantling of Bridges/ Culverts/ Structures, Hill Cutting	Land use and Land quality	Impacts due to improper dismantling and disposal	• All necessary precautions shall be taken while working near cross-drainage channels, to prevent earthwork, stonework, construction materials from obstructing cross-drainage at rivers, streams, and drainage systems, or from causing flooding. • Any material which has spilled into the river/ drainage channel or road shall be removed by end of day . • In case of hill cutting if any debris cannot be removed by end of day the and shall be demarcated with, crash barrier and traffic safety beacons. However, such sites cannot be left for more than 2 days. • Reusable materials (e.g., steel, stones, and bricks) shall be	Contractor	Debris disposal/reuse records; Approved Site restoration plan; Photographic documentation.	MPWD/PMC/CSC

				segregated and stored properly for reuse or recycling. • Non-recyclable debris and waste materials shall be transported to approved disposal sites identified and approved by the concerned authority. • dampen stockpiles and vehicle loads, cover trucks during transport, and restrict demolition/dismantling operations during high-wind conditions. • Only sites which have been approved by the PMU/PMC/CSC shall be used for dumping. • Temporary barriers or silt fences shall be provided to prevent debris from entering watercourses. • Dumping will be done in compacted layers (≤1 m thick) with retaining walls, catch and chute drains, and slopes maintained within the natural angle of repose (30°–35°). • Each site will be protected with toe walls of adequate height, sediment traps, and vegetative cover for stabilization. • The contractor shall operate only at approved locations under supervision and maintain the site until full rehabilitation is achieved. • The site should incorporate proper retaining structures, such as toe walls and catch drains, to prevent sliding and erosion. • Adequate drainage must be provided			

				through surface and subsurface channels to control runoff. Temporary barriers or silt fences shall be provided to prevent debris from entering watercourses. • Muck should be deposited in layers, compacted, and stabilized using vegetation or geo-textiles to minimize dust and erosion. • Access roads should be provided to ensure safe transport of muck, and the site should be fenced and clearly demarcated. • Upon completion, the associated disposal sites shall be restored to their original condition or as directed by the Engineer			
5	Road scraping and dismantling	Bituminous waste disposal	Impacts due to hazardous wastes	• The contractor shall maintain records of quantities generated, transported, and disposed of, along with details of the disposal site and approvals obtained. • Bituminous waste shall be collected and stored temporarily in impermeable, lined containers or areas to prevent leaching or contamination of soil and groundwater. • Scrapped Bituminous Material shall be reused in asphalt mix design/ sub base, strengthening of shoulders as directed by CSC. other lower order roads • The disposal of bituminous wastes shall be carried out by the Contractor	Contractor	Records of Waste reused/disposed; Details of approved disposal site; Photographic documentation.	MPWD/PMC/CSC

				at secure landfill sites approved by the concerned government authorities. • No bituminous waste shall be disposed of in water bodies, open lands, agricultural fields, or along the roadside • Periodic inspections shall be carried out to ensure compliance with waste management guidelines.			
6	Storage of Fuel and Repair of vehicles	Soil pollution due to Oil and fuel spills from construction equipment and plants or storage of Hazardous waste.	. Contamination of Soil	• Construction plants, workshops, and fuel storage areas shall be located at least 500 m away from any surface water body and environmentally sensitive locations. • Oil interceptors shall be installed at construction camps, vehicle parking, and washing areas to trap oil and grease before wastewater is discharged. • All fuel and lubricant storage tanks shall be placed on impermeable platforms or within bunded (contained) areas. • The Storage area should be covered and have restricted access • The area should be bunded to contain 110% of the capacity of storage. • The area should be provided with ABC type fire extinguishers as per the IS codes (IS 1641, IS 1642 and IS 1643, etc) • Transfer of fuel by decantation is prohibited, Fuel Pump (manual or	Contractor	Spill log; Waste oil disposal records; Fuel storage inspection record. Photographic documentation.	MPWD/PMC/CSC

				electric)should be used • Regular maintenance and inspection of construction equipment and vehicles shall be carried out to prevent leakage of oil, fuel, or hydraulic fluids. • Spill control kits (absorbent pads, sand, and containment booms) shall be available at all fuel storage and handling locations. • Records of fuel usage, storage, and waste oil disposal shall be maintained and made available for inspection. • Storm water runoff from fuel and equipment storage areas shall be directed through oil-water separators before discharge.			
7	Operation of Plant, Machinery and equipment	Generation of Hazardous Waste	Contamination of land and soil	• Used oil and lubricants shall be collected, stored in labeled, leak-proof containers, and handed over only to authorized aggregators/recyclers for disposal in compliance with applicable hazardous waste regulations. • Records of waste oil generation and disposal shall be maintained and made available for inspection. • Returns shall be submitted to comply with the Hazardous Waste Permit.	Contractor	Hazardous waste permits, records and returns	PMC/CSC
8	Operation of Vehicles and earthwork during	Air Pollution - Dust Generation	Dust generation will cause air pollution and will have impacts on health and safety.	• Vehicles delivering materials should be covered to reduce spills and dust blowing off the load. • Water should be sprinkled regularly (3 time a day) on the work sites. • Plying of vehicle on unpaved surface	Contractor	Air quality monitoring reports; Dust suppression log; PPE compliance	MPWD/PMC/CSC

	construction			should be prohibited.. • Speed limits shall be enforced for construction vehicles within and near project sites to reduce dust generation. • Personal protective equipment (PPE) such as masks shall be provided to all workers exposed to dusty environments. • Air quality monitoring shall be conducted periodically to ensure compliance with prescribed air quality standards. • Community complaints related to dust shall be recorded, and addressed promptly. • The Contractor should keep a records of community grievances due to dust , runoff separately and mitigations adopted.		records	
9	Operation of Vehicles, plant, and machinery	Emissions	The emissions from vehicles and construction equipment will pollute the air causing health and safety issues as well.	• Fitness and PUC of the vehicles and equipment's need to be ensured. • Maintain all equipment and vehicles regularly; prohibit use of old or poorly maintained machinery; use low-sulphur fuel • Dust extraction, collection and control systems shall be installed at batching plants, crushers, and material handling areas to minimize particulate emissions • Ensure all machinery meets CPCB emission norms/ MoRTH emission standards (GSR 144); prohibit idling of vehicles; schedule material transport	Contractor	Valid PUC certificates; Equipment maintenance log; Emission test results	MPWD/PMC/CSC

				to avoid congestion.			
10	Operation of construction Camp and construction activities	Contamination of Surface / Ground Water	Discharges from construction activities and construction camps/ labour will lead to surface/groundwater pollution.	• All the debris resulting from construction activities and labour camp shall be removed from the site and disposed at approved sites (by CSC/ PMC/ PMU) away from water bodies, on a regular basis to prevent them from getting into surface runoff. • The Contractor shall maintain the sanitation facility in good conditions. Covered and enclosed facility shall be provided for washing and bathing. • The sanitation facility and waste management facility to be shall be maintained in construction camp. • Construction labours should be restricted from polluting the water sources or misusing the sources. • Bentontie slurry is prohibited during piling work. • Any slurry used in piling works should be in a closed systems. It should not be allowed, to enter waterways. The residual slurry shall only be disposed of in lined pits , It should not be dumped near agriculture lands. •	Contractor	Water quality monitoring report; Waste disposal records; Camp inspection records. Photographic documentation.	MPWD/PMC/CSC
		Deteriaoration of Air Quality	Emission	• LPG shall be used as fuel for cooking of food at construction labour camp instead of fuel wood. • DG sets should meet the specification mentioned by CPCB from time to time			
11	Sourcing Water	Surface Water	Over extraction or	• Contractor to ensure optimum and judicious use of water;	Contractor	Water	MPWD/PMC/CSC

	for project	resources	exploitation of ground/surface water will lead to water scarcity.	• The Contractor shall install and keep the water meter running at the point of extraction, main consumption areas. A log of water abstraction and • Discourage labour from wastage of water and applicable prior approvals shall be obtained from concerned authorities. • Rainwater harvesting structures shall be installed at construction camps and plant sites to promote sustainable use of water. • Awareness programs shall be conducted for laborers and staff on responsible water use and conservation practices. • Records of daily water consumption shall be maintained as part of regular reporting.		consumption log; Permission for water source; Installation of Rainwater harvesting structure	
12		Coffer dam to make dry working space for bridge work	Change in the flow pattern and quality of water, effect on local habitat	• Selecting the right location for the cofferdam to minimize its impact on the environment. • Using environmentally friendly materials to construct the cofferdam eg. Biodegradable/ reusable materials can be used instead of concrete. • Restoring the environment after construction. This may involve replanting vegetation and removing any debris.	Contractor	Worksite inspection record; Restoration completion record	MPWD/PMC/CSC
13	Operation of Vehicle , Plant and Machinery	Noise	Noise from construction vehicles, plant and equipment will lead to noise	• Staging of construction equipment and unnecessary idling of machinery within noise-sensitive areas shall be avoided wherever possible. • All plants and equipment used in	Contractor	Noise level test report; PPE usage record; Complaint	MPWD/PMC/CSC

			pollution and cause health and safety issues	construction (including third-party units) must conform to MoEF&CC/CPCB noise standards. • All vehicles and equipment used in construction shall be fitted with effective exhaust silencers. • Servicing of all construction vehicles and machinery shall be done regularly; during routine servicing, the effectiveness of exhaust silencers shall be checked and replaced if defective. • Construction activities shall be restricted to daytime hours (6 AM–10 PM). Night-time work may be carried out only in emergencies, following all prescribed mitigation measures for night operations. • Unnecessary honking at construction sites shall be strictly prohibited. • Temporary barricading shall be installed around active construction zones, especially near settlements, schools, or hospitals, to minimize noise propagation. • Noise monitoring shall be carried out at construction sites as per the approved monitoring schedule, and results shall be submitted to the Project Management Consultant (PMC) and Project Management Unit (PMU) for review and compliance verification.		register; vehicles, plants and equipment maintenance records.	
14	Operation of	Noise and Air	Noise	• The contractor must use silent DG sets as prescribed by the Central			

	DG Sets			Pollution Control Board (CPCB). • If a silent DG set is not available, noise shall be controlled by providing an acoustic enclosure or acoustically treated housing. • The acoustic enclosure shall be constructed with suitable materials of adequate thickness, supported by a structural or sheet-metal base, and insulated with fire-retardant acoustic foam. • The acoustic enclosure/acoustic treatment shall be designed to provide a minimum 25 dB(A) insertion loss or to meet ambient noise standards, whichever is higher. • Each DG set shall be provided with a proper exhaust muffler to further reduce noise emissions. • The DG set shall be properly sited to minimize its noise impact beyond the premises, ensuring compliance with ambient noise standards at the nearest receptor. • A routine and preventive maintenance schedule shall be prepared and followed in consultation with the DG set manufacturer to ensure that noise levels do not deteriorate with use.			
15	Blasting of rocks (if required)	Blasting	Unmanaged blasting result in health and safety issues and accidents.	• The Contractor will inform well in advance the PMU of the requirement for blasting. • He will have to obtain all required Statutory permission as is required	Contractor	Approved Blasting management Plan; Blasting permission;	MPWD/PMC/CSC

				from all Government Authorities, public bodies and private parties; • The Blasting Management Plan shall be prepared by the Contractor and reviewed by the CSC and approved by PMC/PMU. • The Blasting permits shall be reviewed by the PMU. Blasting will be carried out only with permission of Engineer-in-charge. • All the statutory laws and regulations, rules etc., pertaining to acquisition, transport, storage, handling, and use of explosives will be strictly followed. • The CSC shall maintain oversight of the implementation of the Blasting Management Plan.		Incident log. Geotagged photos.	
16	Tree Felling	Loss of trees and Plantation works	Cutting of trees can lead to loss of biodiversity.	• No tree felling should be carried out without permission of the Forest Department, GoMM. • Clearing and uprooting should be avoided beyond that which is directly required for construction activities. • Kerosene / LPG should be preferably used to avoid felling of the trees or provide community kitchen for the labour camps for cooking. • Camps and storage yards shall be located in the areas already devoid of vegetation or having little vegetation • Compensatory Afforestation 1: 10 would be carried out by the Contractor. As indicated in the ESMF an app based monitoring of the	Contractor	Tree felling register; Plantation record;	MPWD/PMC/CSC

				plantation would be carried out.			
17	Removal of Vegetation	Terrestrial Flora and Fauna	Construction activities and workers may cause harm to flora and fauna.	• All the workers will need to be oriented and monitored by the contractor so as not to cause any harm to the flora and fauna. • Hunting and fuel wood collection will be strictly prohibited	Contractor	Worker awareness attendance; Wildlife sighting log	MPWD/PMC/CSC
18	Discharges from Construction	Aquatic Fauna	Construction activities and workers may cause harm to fauna.	• Disposal of construction material or debris into rivers or streams will be strictly prohibited. • Regular monitoring of water quality will be conducted to ensure compliance with environmental standards • Any works affecting aquatic habitat will be done during low flow (when water depth is less than 5 m) and when banks would be dry. • Where any GI wire mesh gabions are used; all GI wire ends need to be folded inside. • Ensure that no construction activities will be carried out during monsoon and the fish breeding season.	Contractor	Work timing records; Site inspection checklist	MPWD/PMC/CSC
19	Construction Activities	Occupational Health and Safety	When Occupational Health and Safety are compromised the associated risks from accidents and incidents could affect health and safety of	• The Contractor would prepare OHS plan and other required plans as per the WBs guidelines. • All the laborers to be engaged for construction works shall be screened for health and adequately treated before issue of work permits. • Periodic health check-up of construction workers.	Contractor	Approved OHS plan; OHS training log; PPE checklist; Awareness programme and Health inspection reports	MPWD/PMC/CSC

			the workers and others on constriction/ project sites. Improper first aid facilities on the sites could affect health and safety of workers and others.	• Prevention of mosquito breeding need to be ensured at the project site and other ancillary areas • The contractor's Environment and Safety personnels, shall ensure implementation of CESMP including Occupational health and safety issues at the camp, construction work sites • All workers and staff should be provided with Personal Protective Equipment (PPE) appropriate to their job on-site and their use shall be ensured. • All construction sites should be barricaded properly. • Smoking should be prohibited near areas of fire or explosion risk. • Sufficient supply of potable water should be ensured for all workers and employees on-site. • Ensure a First Aid room at the camp and first aid kits are available in all work areas. • Safe working techniques will be followed up and all the workers will be trained. • An Emergency Response system in case of any incidence will be developed and implemented. • The Contractor will conduct awareness programmes on EHS, HIV/AIDS and other sexually transmitted diseases for workers at least once in a quarter and the record of such training programme must be			

				recorded. • Conduct regular safety audits on safety measures adopted during construction.			
20		Community Health and Safety	The safety aspects like (i) safety of road users including pedestrians and cyclists (ii) safety of cattle; (iii) safety of local community (iv) unsafe/ hazardous traffic conditions due to construction vehicle movement need to be considered during the construction stage. Children are most vulnerable to injury due to vehicular accidents.	• Plants and equipment will be installed sufficiently away from the settlements. • Proper caution signage, barricading, delineators, lightings etc. will be installed at construction zone and temporary diversions. • Hard barricading will be provided at construction zone near habitation area and public roads, and the same will be maintained throughout the construction period. • Proper traffic management will be ensured near roads of the Construction zone. • Road safety education will be imparted to drivers running construction vehicles. In case of negligent driving, suitable action will be taken. • Speed restrictions shall be imposed on project vehicles to control speeding. • Installation of temporary speed bumps to control speed near designated pedestrian crossing areas/school areas/ market places/ religious places/ human habitations. • The general public/ residents shall not be allowed to any of the risk areas of the project, e.g., excavation	Contractor	Safety signage installed; Community complaint register; Traffic control records	MPWD/PMC/CSC

				sites, construction sites and areas where heavy equipment is in operation. • In the consideration of risk at civil works, each labour should be covered under ECA 1923 insurance until completion of work.			
21		Emergency Response system	Absence may result to increased incidents, injury, economic loss etc.	• Develop and implement ERS • Train personnel and Establish communication channels • Systematic planning and training for emergencies.	Contractor	Approved ERP; Emergency drill and training report; Incident response record	MPWD/PMC/CSC
22		Health Management – Communicable Diseases	The water fringe areas provide suitable habitats for the growth of vectors of various diseases, which is likely to increase the incidence of water-borne diseases.	• There would be possibility of the transmission of communicable diseases due to migration of labour population from other areas at the construction site. • Agreement shall be made with nearby health center or hospital for emergency treatment. • Special Measures for COVID 19 should be strictly followed at the camp and construction site.	Contractor	Health screening record; Awareness session log; Medical report; Agreement with nearby hospital	MPWD/PMC/CSC
23		Risk of Natural Hazards	The project area is at risk from floods and Earthquakes.	• Protection of Agriculture Land near roads/ bridges. • The mitigation measures should be adopted as per norms of State Disaster Management Authority, Government of Meghalaya.	Contractor	Site assessment report; Record of Compliance with SDMA norms	MPWD/PMC/CSC
24		Risk of Force Majeure	These unforeseen risks can have both	• All reasonable precaution will be taken to prevent danger of the workers and the public from fire,	Contractor	Force majeure preparedness	MPWD/PMC/CSC

		Combine with previous	adverse environmental and social impacts	flood, drowning, etc. • All necessary steps will be taken for prompt first aid treatment of all injuries likely to be sustained during the course of work. • Contractor has to prepare a response plan before start of construction works		plan; Emergency contact list	
25		Hygiene	Impacts related to unhygienic surroundings	• At every workplace, good and sufficient water supply shall be maintained to avoid waterborne diseases to ensure the health and hygiene of workers. • Adequate drainage, mobile toilets shall be provided at workplace. • Preventive Medical care shall be provided to workers. • Proper Hygiene shall be maintained	Contractor	Sanitation inspection record; Hygiene logbook	MPWD/PMC/CSC
26		Traffic Management	Unplanned and unmanaged traffic diversion and detours can result in public nuisance.	• Before start of the construction, proper traffic management plan will be prepared and submitted to MPWD for approval. Secure assistance from local police for traffic control during the construction. • Necessary signage and barricading will be provided for safety of road users. • Contractor will ensure that no construction materials and debris are lying on the road. It will be collected and disposed of properly. • Unnecessary parking and sound pollution to be strictly avoided near settlements and sensitive receptor such as schools, hospital and cultural	Contractor	Approved TMP; Signage/ barricade checklist; Traffic incident register; geotagged photos	MPWD/PMC/CSC

				centers. • The contractor will ensure that the diversion/ detour is always maintained in running conditions, particularly during the monsoon to avoid disruption to traffic flow.			
27		GBV-SEAH Risks	GBV-SEAH risks may arise due to labor influx	• Ensure labor camps are away from settlement areas • Ensure that every worker working in the project has been given an orientation on the Worker's Code of Conduct, especially on GBV and SEA/SH, and has signed the Code of Conduct. • Conduct periodic awareness programs targeted at women laborers and women and children of communities residing close to the work sites for reporting incidents of GBV- SEAH • Ensure complaints of GBV- SEAH are recorded and addressed with urgency. Ensure that name(s) of complainant(s) are kept in confidence and enable anonymous reporting of complaints. • Activate GBV Grievance Redressal Committee immediately on receipt of any GBV- SEAH complaint. Take action on recommendation of the GBV Grievance Redressal Committee within 24 hours of submission of the report.	Contractor	Signed CoC register; GBV training log; GBV complaint record	MPWD/PMC/CSC
28	Works carried	Chance Finds	There is a possibility	• If any cultural remains of geologic or archaeological interest are found,	Contractor	Chance find	MPWD/PMC/CSC

	out near the Archeological Properties or Monoliths, chance finds		of Cultural relics, Chance finds at the construction sites. Without proper plan these artefacts may be misused by contractor/ workers.	Stop work immediately. • CSC and MPWD shall be immediately informed of such discovery and carry out the instructions for dealing with the same • No construction related activity not limited to the following storage of material or debris, establishment of labour camp, staging of plant equipment or vehicle, parking of vehicle etc shall be carried out in the vicinity of the Monoliths		report; Notification records	
29	Engagement of labour	Compliance to Labour Welfare Laws and reporting	Workplace accidents and injuries, unsafe working condition, loss of productivity etc.	• Establish a policy and ensure the compliance within the organization, from the top to the lowest-level employee, understands the importance of complying with labour laws and reporting. • Employees should be trained on their rights and responsibilities under labour laws. • Employees should have a way to report violations of labour laws without fear of retaliation. This could be a hotline, an email address, or a suggestion box. • Investigating and taking action on violations. This could include disciplinary action against the violator, or even legal action. • Employees should be kept updated on the organization's compliance with labour laws. This could be done through regular training sessions,	Contractor	Labour law compliance record; Training attendance record	MPWD/PMC/CSC/ Labour Inspectors, Govt of Meghalaya

				newsletters, or other communication channels. • Contractor shall establish and maintain a Worker GRM consistent with the LMP. Worker grievances shall be recorded and resolved within defined timelines. • Anonymous reporting shall be permitted and retaliation prohibited. Employment of child labour and forced labour is prohibited. Age-verification records shall be maintained.			
30	Engagement of Labour	Labour Influx	Strain on infrastructure, such as housing, healthcare, and education; social tension, as new arrivals compete with locals for jobs and resources.	• Proper plan for labour influx by investing in infrastructure and social services. • Governments can regulate the flow of labour to ensure that it is orderly and sustainable. • Local communities can engage with new arrivals to help them understand the local culture and customs. • Maximum use of local labours • Workers shall receive orientation on local customs and behavioural expectations. Workers shall not enter nearby settlements unnecessarily. Contractor shall coordinate with village authorities regarding labour camp establishment.	Contractor	Labour License and registration records; Local labour hiring records; Orientation logs;	MPWD/PMC/CSC Labour Inspectors, Govt of Meghalaya
31	Site-specific stakeholder	Community participation,	Lack of information sharing, unresolved	Establish and implement a structured system of regular consultation meetings at the site	Contractor/ CSC/	Meetings conducted per	MPWD/ PMC

	engagement and consultation	transparency, and inclusion of affected persons, including Indigenous communities (FPIC compliance)	grievances, and reduced community participation in project activities	level in line with ESS10 and FPIC requirements under ESS7. Conduct meetings at least twice a month with PAPs, Rangbah Shnong /traditional leaders, women and youth groups, and local institutions. • Share project information, discuss construction-related impacts, review implementation of mitigation measures, and address concerns through the GRM. The process will also be used to track adherence to agreed FPIC commitments and ensure culturally appropriate engagement throughout project implementation.	PWD	month Attendance records with representation of Indigenous communities, women, and vulnerable groups Number of issues raised and resolved Availability of documented meeting records (MoMs)	
32	Grievance Redressal	GRM	Increased impunity, conflict and violence; Loss of trust and confidence	• Establish a grievance redressal mechanism • Ensure that the mechanism is impartial and independent • Provide adequate support to people who use the mechanism • Communicate effectively with people about the mechanism	Contractor	GRM register; Grievance resolution records	MPWD/PMC/CSC
33	Monitoring and Reporting Mechanism	Monitoring and Reporting (Monthly/ Quarterly)	Monitoring environmental attributes like (Air, Water, Noise & soil microbiology) and proper reporting are important for the	• The parameters to be monitored, frequency and duration of monitoring as well as the locations to be monitored will be as per Monitoring Plan prepared. • Regular submission of CESMP implementation monitoring report	Contractor	Monthly/quarterly ESMP compliance report; Monitoring data records	MPWD/PMC/CSC

			successful ESMP implementation				
	Operation Phase						
1		Debris and Waste from Clearing/ Closure of Construction Site, Labor Camps, Disposal Sites, and Borrow Areas	Land and soil contamination due to improper waste disposal; Aesthetic degradation; Health risks to nearby communities	• Contractor shall prepare and implement a Site Restoration Plan approved by the Engineer. • On completion of works, all kuchha structures, debris, and wastes shall be cleared. • Disposal pits and sanitation trenches shall be filled, compacted, and sealed. • Topsoil removed during construction shall be re-spread to aid vegetation regrowth. • Native grass or trees shall be planted to stabilize restored areas and improve aesthetics.	Contractor	Site clearance restoration records and closure NOC; Geotagged photos	MPWD
2		Soil Erosion due to Runoff over Steep Slopes and Embankments	Loss of fertile topsoil; Siltation of nearby water bodies; Slope instability or road damage	• Regularly inspect slopes and embankments for erosion signs. • Implement bioengineering measures like turfing, hydroseeding, and vegetation planting. • Provide stone pitching, retaining walls, or gabions where needed. • Maintain effective drainage systems to reduce concentrated runoff.	Contractor	Reports on Erosion inspection; implementation of mitigation measures; Drain maintenance log	MPWD
3		Water Pollution from Road Runoff and Drainage into Water Bodies	Deterioration of surface and groundwater quality; Sediment and oil contamination in	• Conduct regular water quality monitoring during operation phase. • If pollutants exceed prescribed limits, install silt traps, or sedimentation chambers. • Ensure roadside drains are cleaned and desilted regularly.	Contractor	Water quality monitoring results; Drain cleaning records	MPWD

			nearby streams or waterbodies	• Conduct public awareness to discourage waste disposal into water bodies.			
4		Dust Generation from Vehicular Movement	Deterioration of ambient air quality; Nuisance to roadside residents and vegetation; Reduced visibility	• Establish and maintain roadside plantation to serve as dust barriers. • Maintain smooth road surfaces to minimize dust generation. • Install signage discouraging over-speeding, which increases dust levels.	Contractor	Air quality results; Plantation survival record	MPWD
5		Air Pollution from Vehicular Emissions	Increased levels of NOx, SO_2, CO, and PM; Health impacts on local population; Deterioration of roadside vegetation	• Conduct ambient air quality monitoring at sensitive locations. • Maintain green buffers along the corridor. • Organize awareness campaigns for drivers on emission reduction and vehicle maintenance.	Contractor	Air quality results; Plantation survival record ; Awareness records	MPWD
6		Noise Pollution from Increased Traffic Movement	Noise nuisance to residents; Disturbance to schools, hospitals, and wildlife	• Conduct periodic noise level monitoring. • Provide noise barriers, dense plantation near sensitive receptors. • Enforce “No Horn” zones near schools and hospitals. • Maintain road surface to minimize noise due to uneven pavement.	Contractor	Noise monitoring results; Maintenance records	MPWD
7		Road Safety and Accident Risks	Traffic congestion; Increased likelihood of road accidents; Risk to pedestrians and local communities	• Install and maintain proper signage, reflectors, and road markings. • Ensure adequate lighting at intersections and pedestrian zones. • Provide speed control measures and pedestrian crossings in settlement areas.	Contractor	Accident record; Safety audit report; Awareness records	MPWD

				• Conduct community road safety awareness programs.			
8		Maintenance Waste from Roadside Maintenance, Drain Cleaning, or Repairs	Soil and water contamination from indiscriminate disposal; Visual pollution and clogging of drains	• Collect and dispose of maintenance waste at designated locations. • Prohibit dumping into drainage channels or low-lying areas. • Reuse or recycle suitable materials (e.g., asphalt, concrete, metal).	Contractor	Waste logbook; Disposal reccords	MPWD
Site Specific mitigation							
1	Identification of land for material storage yard/ construction camp/ labour camp	Land use and ecology	Discharges from Yards/ Camps to pollute the surroundings and lead to social tension.	• Contractor needs to identify suitable land for storage yard/ construction camp/ labour camp • The land shall not be closer to the water bodies, waterlogged areas or wetlands. • The land will be handed back to the owner in the same condition as it was prior to the commencement of project activities, once the project is completed. • Contractor to produce the lease agreements, NOC etc. for these lands. • Avoid construction camps and material storage near streams or unclassed forest on community land, flood plain, encroachment into natural habitats. • Restrict vegetation clearing to the minimum area required for works. • Maintain a buffer of at least 100 m from natural drainage channels or	Contractor	Approved site location; Lease/NOC copies;	MPWD/PMC/CSC

				water bodies. • Implement soil erosion control measures (silt fencing, sediment traps, and slope turfing). • Prohibit hunting, fishing, or collection of forest produce by workers. • Awareness and sensitization of labourers on local wildlife and birds. • The guidance for the preparation, construction and operation of the labour camp shall comply with the World Bank Group11 Guidance on Labour Accommodation • No construction camp, material storage area, will be setup 100 m on both sides from the Monolith (At Ch 23+100 and Ch 41+500).			

[11] Workers' accommodation: processes and standards

8.2.1 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN BUDGET

An amount of Rs. 99,45,600 have been marked for ESMP budget. The detailed budget for the same have been presented in Table 8.2.

Table 8.2: Environmental and Social Management Plan Budget

Sl.No	Particulars	Stages	Unit	Total Number	Rate (INR)	Cost (INR)	Costs Covered By
A.	**Monitoring Measures**						
1	Air quality monitoring	Construction	No.	27	9,000	243000	Civil works contract
		Operation	No.	9	9,000	81000	Civil works contract
2	Noise levels monitoring	Construction	No.	27	3,000	81000	Civil works contract
		Operation	No.	9	3,000	27000	Civil works contract
3	Soil quality monitoring	Construction	No.	18	6,000	108000	Civil works contract
		Operation	No.	6	6,000	36000	Civil works contract
4	Ground and Surface Water	Construction	No.	36	7,000	252000	Civil works contract
		Operation	No.	12	7,000	84000	Civil works contract
	Subtotal (A)					**9,12,000**	
B.	**Capacity Building**						
1	EMSP implementation (1 days)	On Award of Contract	ump sum			Included in project safeguards	PIU Cost

						capacity building	
2	Plans and Protocols Orientation (1 day)	At Beginning of Construction	ump sum			Included	PIU Cost
3	Experiences and best practices sharing	Once every Year for 2nd yr, 3rd yr , 4th yr , 5th yr	ump sum			Included	PIU Cost
4	Contractors Orientation to Workers on ESMP implementation and refresher program	Once every year or as directed by the PIU	ump sum			Included	Civil works contract
5	Water Sprinkling Measures for Dust Suppression	Construction	Trips	No of trips to be decided by the Contractor (work areas and haul roads to be sprinkled as two times every day or as directed by the Engineer)	-	0	Civil works contract
6	Silt Fence along Water Bodies	Construction	Rm	1000	331		Civil works contract
	Subtotal (B)					----------	**Civil works contract**

C.	**Construction Contractor ESMP Implementation**						
1	Providing, fixing, maintaining, shifting & refixing, barricading of minimum 2.0 mtr height at stipulated active site of the same project site, made with angle iron frame of 50x50x5mm and GI sheet of 0.63mm thick including primer painted initially, painting, lettering & border with reflective paint at the time of every shifting, traffic diversion arrangement, safety guard, suitable lightning arrangement during night, complete in all respect till completion of the project as per technical specification and direction of Engineer-In-charge and same shall be possessed by the contractor after completion of the Project	Construction	to be provided at each of the active sites by the Contractor (i.e. till the completion for the works)	To be decided by the contractor as per his schedule of works	-	0	Civil works contract
2	Supplying and fixing of cautionary and or information signs boards including the cost of posts, fixtures, fixing, foundation, fitting and fixing. Sheeting will be made of encapsulated lens type of retro-reflective type and message / borders will be screen printed complete as per screen specification in IRC SP 55:	Construction	Numbers	To be decided by the contractor as per his schedule of works (every worksite to have	-	0	Civil works contract

	2001. To be made available at all time at the work sites as required and directed by the engineer			cautionary boards as described by the Engineer)			
3	Supplying and fixing of flashing beacon warning lights including the cost of posts, fixtures, fixing, foundation, fitting and fixing, cost of material, labour, loading, unloading, lead, lift, shifting, transportation etc. and as per specification in IRC SP 55: 2001	Construction	Numbers	To be decided by the contractor as per his schedule of works (every worksite to have flashing beacons to warn the approaching train as directed by the Engineer)	-	0	Civil works contract
4	Provision and maintenance of Bio toilets with 1 male and 1 female units including cost of material, labour, loading, unloading, lead, lift, transportation, shifting etc. And shall be made available at worksite at the direction of the PIU. The facility shall complete with water arrangement, privacy, lighting arrangement. The WC and /urinals should be made of	Construction	Numbers			------	Civil works contract

	stainless Steel and the partitions should be made of aluminums framework with FRP panels. The bio-digester tank should be approved by Defence Research & Development Organization (DRDO) or any other competent agency. The whole toilet shall be mounted on MS framework with skids; Overhead water tank shall be made of HDPE with proper arrangement of ball cock and mosquito proof cover. These should also be provided with two dustbins for wet and dry waste. The bio-digester toilets shall be mounted on skids and shall not require any creation of permanent structure so that they can be shifted from one worksite to another						
5	Provision of Helmets (IS CODE 2925 : 1984) , Safety Shoes (IS CODE 5852 : 1996), Googles (•IS CODE 5983 : 1980), Reflective Jackets, mitten/ gloves (IS 2573) , safety nose masks to all personnel (including temporary labour) involved in the worksites	Construction	Lumpsum			-------	Civil works contract

6	Provision of First Aid Kits for worksites	Construction	Nos	20	3000	----------	Civil works contract
7	Provision and maintenance of waste collection bins in sets of 2 (blue and green) for collection of municipal solid waste generated at the worksite including cost of material , labour, loading, unloading, lead, lift, shifting, transportation etc.	Construction	Nos	100	300	----------	Civil works contract
8	Environment, Health & Safety Engineer/Supervisor having Bachelors in Env Science / Management/ B.Tech (Env Engg.) Diploma in Central Labour Institute / Regional Labour Institute (Mandatory)	Construction	Nos	12	40000	----------	Civil works contract
9	Tree Plantation (Afforestation) (1:10 ratio)	Construction	Nr.	230	--	--	Civil works contract
10	Worker Code of Conduct orientation, labour awareness sessions, and OHS refresher training	Construction	Lumpsum	-		Included in the Contract	Civil works contract

	Sub Total (C)					---------	**Civil works contract**
D	**Social Safeguards Implementation (Framework Instruments)**						
1	Stakeholder engagement, consultations, disclosure, and GRM implementation (SEP)	Construction & Operation	-	-		5,00,000	As per SEP
2	Indigenous people development plan (IPDP)	Construction & Operation	-	-		80,00,000	As per IPDP of the Sub Project
3	Resettlement action Plan (RAP)	Construction	-	-		5,33,600	As per RAP of the Sub project
4	Safeguards capacity building and training (ESMF)	Construction	-	-	-	As per ESMF	Project
5	Labour Management Plan Budget	Construction				As Per LMP	Project
	Sub Total (D)					**9033600**	
E	**PIU ESMP Implementation cost**						
	Environmental Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost
	Social cum Tribal Development Expert	Construction and	Salary	0	-	0	PIU Cost

	at PIU	Operation					
	Labour / OHS Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost
	Gender Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost
	Biodivesity Expert at PIU	Construction and Operation	Salary	0	-	0	PIU Cost
	ESMP Supervision Cost	Construction and Operation	per month	0	30000	0	PIU Cost
	Equipment	Construction and Operation	(Noise Meter 1 nos, Cameras 1 nos)	lumpsum		0	PIU Cost
	Sub Total (E)					**0**	
	Total (A+B+C+D+E+F)				**INR**	**99,45,600**	

8.3 PERFORMANCE INDICATORS

Environmental and social components identified in affecting the environment and social conditions at critical locations have been suggested as performance indicators (PIs). For example, near the construction site, a thick layer of dust over the nearby vegetation/leaf is an indication that the dust control measures are not effective. The performance indicators shall be evaluated under three heads as;

- Environmental condition indicators to determine efficacy of environmental management measures in control of air, noise, water and soil pollution.
- Environmental and social management indicators to determine compliance with the suggested environmental and social management measures. Social monitoring indicators will be indicated as part of the Resettlement Action plan (RAP)/Indigenous People Development Plan (IPDP).
- Operational performance indicators have also been devised to determine efficacy and utility of the proposed mitigation measures.

The performance indicators and monitoring plans prepared for the road stretch are given in **Annexure 8.1**. Details of the performance indicative parameters for each of the component will have to be identified and reported during all stages of the implementation.

8.4 MONITORING PLAN FOR ENVIRONMENTAL CONDITIONS

Environmental monitoring involves regular checking of the environmental management issues detailed in the ESMP and to ascertain whether the mitigation measures are achieving their objectives, according to the ESMP, with the progress of the works. It provides the necessary feedback for Project management to keep the programme on schedule.

For each environmental condition, the Monitoring Plan specifies the parameters to be monitored, the locations of monitoring sites, and the frequency and duration of monitoring. It also outlines the applicable standards, as well as the responsibilities for implementation and supervision. The Monitoring Plan, along with details of monitoring locations for environmental condition indicators during the construction and operation stages of the project, is presented in **Table 8.3**. Sample environmental site inspection report has been attached as **Annexure 8.2.**

The monitoring will be carried out by Contractor through the NABL accredited agency and will be supervised by the Environment Specialists of the CSC/PMC and E&S Cell, MPWD.

8.5 MONITORING PLAN FOR SOCIAL CONDITIONS

The social monitoring plan is designed to track and evaluate the effectiveness of social safeguard measures implemented under the Environmental and Social Impact Assessment (ESIA). It ensures compliance with national and international social safeguard frameworks, including the Resettlement Action Plan (RAP) and the Indigenous Peoples Development Plan (IPDP). The monitoring plan for social condition indicators of the sub-project during the construction stage is presented in **Table 8.4**.

Table 8.3: Environmental Monitoring Plan for Environmental condition indicators (Air, Water, Noise and Soil)

Environmental Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Total no. of Samples during construction and operation stage.	Implementation
Air	Construction	CO, NOx, PM10, PM2.5 and SO2	CPCB Guidelines (NAAQMS/ Volume-I/2013-14)	3 locations for 3 Seasons* for 3 year	24 hours sampling	3 locations (Construction Plant Sites, settlements and Work Zones)	27	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
	Operation			3 locations for 3 Seasons for 1 year.		At 3 locations during operation stage where monitoring had been done during construction stage	9	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
Water	Construction	As per Drinking Water Standards	Indian standards for inland surface waters (IS:2296,1982) and for drinking water (IS:10500-	Surface water at 2 locations for 3 Seasons for 3 consecutive years. Ground water at 2 locations for 3 seasons for 3	As per Grab Sampling guidelines	Drinking water samples from the labour camps and from hand pumps. Surface water from the water courses near the work site	36	Contractor through NABL accredited Laboratory and supervised by Construction Supervision

Environmental Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Total no. of Samples during construction and operation stage.	Implementation
			2012)	consecutive years		and River.		Consultant
	Operation			Surface water 2 locations for 3 Seasons for 1 years. Ground water at 2 locations for 3 Seasons for 1 years.		At 4 locations during operation stage where monitoring had been done during construction stage	12	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
Noise	Construction	Noise Levels on dB (A) scale	Noise rules 2000 by CPCB	3 locations for 3 Seasons for 3 year.	Leq in dB(A) of daytime and night-time	Near the working zones, sensitive receptors and construction plant sites.	27	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
	Operation			3 locations for 3 Seasons for 1 year		At 03 locations during operation stage where	9	Contractor through NABL accredited Laboratory and

Environmental Attribute	Timing	Parameter	Standards	Frequency	Duration	Location	Total no. of Samples during construction and operation stage.	Implementation
						monitoring had been done during construction stage		supervised by Construction Supervision Consultant
Soil	Construction	Monitoring of Pb, SAR and Oil and Grease	(IS): 2720 for 'Method of Test for Soils'	2 locations for 3 Seasons for 3 consecutive years.	Grab Sampling	Soil at 2 location 3 times a year for 24 Months	18	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant
	Operation			2 locations for 3 Seasons for 1 year		During operation stage where monitoring had been done during construction stage	6	Contractor through NABL accredited Laboratory and supervised by Construction Supervision Consultant

*Except Monsoon

Social Monitoring will be done during Construction stage of the proposed Project as per the details provided in Table 8.4.

Table 8.4: Social Monitoring Plan

Indicator Category	Responsibility	Performance Indicators	Data Collection Method	Frequency
Resettlement & Livelihood Restoration	RAP Implementation consultant/ MPWD	• % of affected households receiving compensation & assistance; livelihood restoration progress • RAP implementation completion certification for civil-works stretches; livelihood restoration status of vulnerable households • Number of PAPs surveyed and compensated (by category). • Compensation disbursed and structures restored. • Households relocated prior to construction. • Livelihood program enrollment. • GRM usage and resolution rate. • Timeliness of compensation relative to displacement.	Household surveys, payment records, RAP monitoring reports	Quarterly
Labour & Working Conditions	Contractor/ CSC/ MPWD	• Compliance with fair and equal wages, working hours, safety, Working conditions & worker rights: • Non-payment, delayed or unequal wages; denial of benefits (overtime, leave, maternity, bonus); • discrimination in hiring/promotion/termination;	Labour camp inspections, interviews	Monthly

		unclear employment terms; restrictions on organizing; absence of grievance mechanism.		
		• % of local workforce employed in project • Worker GRM functioning and resolution status; labour camp inspection compliance; OHS training coverage (%)	Contractor reports	Quarterly
Community Health & Safety	Contractor / CSC / MPWD	• Number of accidents/incidents affecting communities; traffic safety compliance; public safety measures at worksites; access-continuity complaints recorded/resolved; safety compliance near settlements/schools	Beneficiary tracking	Quarterly
Social Inclusion & Gender Stakeholder Engagement & Grievance Redressal	RAP Implementation consultant/ Contractor/ MPWD RAP Implementation consultant/ Contractor/ CSC/MPWD	• Participation of women in consultations and % of women engaged in livelihood activities • SEA/SH awareness training coverage (% workers trained) • Percentage of women among total project workforce, disaggregated by skilled, semi-skilled, and unskilled categories. • Data of average daily wages paid to women and men for comparable work (wage parity index) • Number of days women are engaged compared to men in similar roles.	Beneficiary tracking, Consultation records	Bi-annually

		• Growth in women's income due to project participation. • Reduction in women's migration days (if they previously migrated for work). • Number of women gaining new market-oriented and employable skills. • Number of women accessing government schemes, agricultural interventions, or entitlements. • Improvement in women's asset ownership (productive and household assets). • Percentage of women trained under the project, disaggregated by road safety training, livelihood enhancement training, and project-related technical or non-technical skills. • Percentage of women participants in stakeholder consultations, including consultations with Indigenous Peoples and FPIC processes where applicable under ESS7. • Percentage of women beneficiaries reporting improved mobility, perceived safety, and access to essential services, measured through periodic beneficiary feedback surveys. • Number and percentage of		

		GBV/SEA/SH-related grievances received, resolved, and resolved within the stipulated timeframe, disaggregated by complainant gender and grievance type. • Increase in women's participation and leadership in local institutions and decision-making processes (membership, management roles, committees, etc.). • Improvement in women's representation in consultations and project-related decision forums.		
		• No. of community consultations held	GRM logs	Quarterly
Indigenous Peoples & Cultural Heritage Indigenous Peoples & Cultural Heritage	RP Implementation consultant/ Contractor/ MPWD RP Implementation consultant/ Contractor/ MPWD	• % of grievances resolved within timeline; average grievance resolution time	Meeting records, video/audio evidence	Ongoing
		• Summary of affected IPs by impact type, gender, age, village, income, status, and household vulnerability including female-headed households. • Documentation of consultations with Indigenous communities and traditional institutions, FPIC meetings & community agreements • Number of meaningful consultations with IP, trainings, and IEC materials (e.g., brochures, flyers) disseminated.	Site inspections, community feedback	Annually

		• % of IP women participants; vulnerable IPs attending • Documentation of negotiation process, participants, locations, and correspondence. • Evidence of broad support from community records of process, participants, and agreements. • Whether consultations were inclusive, gender-sensitive, free from coercion, and respectful of IP customs and languages.		
Supply Chain/ Contractor Compliance	Contractor/ PMC/ CSC/ MPWD	• Confirmation of no child labour or forced labour in supply chain; contractor ESMP compliance reporting	Contractor audits, compliance reports	Annually
SEA/SH Risk Management	Contractor / PMC/ CSC / MPWD	• SEA/SH Code of Conduct compliance; SEA/SH complaints recorded and referred through survivor-centred GRM; SEA/SH awareness sessions conducted • Risks of SEA/SH to community members, particularly women and children by contractors' workers during construction period; • Risks of workplace SH at all establishments by co-workers under the project	Training records, GRM records, supervision reports	Quarterly

8.6 REPORTING SYSTEM

Effective monitoring and supervision would require regular reporting of the implementation of the E&S Management measures by the contractor. The E&S Non-conformance / non-performance needs to be flagged and followed up on regularly so that performance improves. Repeated non-conformance / non-performance needs to be brought to the notice of decision makers for contractual action and management decision. These aspects will be monitored and reported through the Concurrent Monitoring and Reporting.

The more strategic aspects of E&S Performance Monitoring, Gap Analysis, and documentation of good and bad practices, which would guide the management to have a review and provide direction, will be done through the Periodic Monitoring. The Mid-Term and End-Term audits will be carried out through specialised Third-Party Agencies to be hired under the project. The findings and recommendations of these studies, along with the analysis of the concurrent monitoring, will be used by the Officers of the E&S Cell to brief the Management during the review. Details are given in section 9.1 of Chapter 9 of ESMF.

8.7 INSTITUTIONAL FRAMEWORK OF THE PROJECT

The Meghalaya Infrastructure Development and Finance Corporation (MIDFC) acts as the nodal agency for planning, financing, and coordinating major infrastructure projects, with the PMU providing overall strategic and policy oversight. The Project Implementation Unit (PIU) under PWD executes road and connectivity works, ensuring technical quality, environmental and social safeguards, and coordination with local institutions. An E&S Cell within PIU manages safeguards, including tribal land rights, biodiversity, and community engagement, supported by specialized experts. Project Management Consultants (PMC) provide technical, managerial, and E&S support, while Construction Supervision Consultants (CSC) ensure on-site compliance with quality, safety, and safeguard standards. Divisions of PWD supervise field-level execution, facilitate grievance redressal, and monitor ESMP implementation. This structure aligns with Meghalaya's institutional framework and Sixth Schedule provisions to integrate sustainability and positive social-environmental outcomes. Details are provided in chapter 7 of ESMF.

9. GRIEVANCE REDRESS MECHANISM

9.1 INTRODUCTION

An effective grievance redressal mechanism fosters good governance, accountability, and transparency in addressing project-related environmental and social concerns. An integrated system, featuring Grievance Redressal Cells (GRCs), will be established at the MIDFC Project Management Unit (PMU), supported by designated officers and dedicated procedures. Grievances may be lodged in person, in writing, via email, or by telephone, with overall coordination managed by the PMU's Social and Environmental Expert. The mechanism will become operational from the commencement of R&RAP and construction activities, adopting a two-tier structure at the site and state (PMU) levels, and incorporating regular platforms and meetings to facilitate timely and amicable resolution.

The project follows a two-tiered Grievance Redress Mechanism (GRM). Tier I operates at the project/site level, chaired by the Village Head with PWD, CSC, and contractor representatives, aiming to resolve grievances within 15 days. Tier II functions at the State/PMU level, chaired by the Secretary of Planning, addressing unresolved or escalated grievances within 15 days. Complaints can be submitted via toll-free helplines, WhatsApp, email, in-person at DPIU/PMU offices, project sites, grievance boxes, or social media. All complaints are logged, categorized, acknowledged within 2 days, investigated, and actions taken by the respective GRCs. Feedback is collected post-resolution, and reparations, if applicable, are documented. Training on grievance handling, stakeholder engagement, and gender sensitivity is conducted every six months. Complainants can escalate to Tier II or pursue legal remedies at any stage. Details are provided in Chapter 7 of ESMF. The grievance mechanism for workers will be setup by the contractors prior to convening of civil works. The grievance mechanism process has been described in detail in the Labor Management Procedures.

10. CONCLUSION AND RECOMMENDATIONS

10.1 CONCLUSION

An Environmental and Social Impact Assessment Study was conducted to assess the potential environmental and social impacts of the project. Primary information about the project influence area was gathered using an Environmental and Social Screening Checklist to evaluate the extent of environmental and social impacts resulting from project interventions. Environmental and social baseline data were collected from secondary sources to depict the existing conditions of the project area accurately. This information serves as a foundation for assessing potential environmental and social impacts, as well as enhancing the accuracy of impact predictions. Additionally, public consultations and FPIC were held with stakeholders to incorporate their inputs and concerns. The key findings of the ESIA are summarized as follows:

- Proposed project will ease the traffic flow and create safe and smooth mobility to motor vehicles as well as pedestrians. The proposed road improvement can reduce travel time from the farthest section of the road to the nearby market from one hour to just 30 minutes. The project is imperative for encouraging more trade and commercial activity (including public transport) in the district of East Khasi Hills.
- The environmental and the social impact assessment have been conducted in accordance with World Bank ESF and National & State regulations. All the potential impacts were identified in relation to pre-construction, construction, and operation phases.
- The existing road is a State Highway situated at an elevation of over 1,000 m above mean sea level (AMSL), with the Bangladesh border located within 20 km of the project road (aerial distance). As per the EIA Notification dated 14th July 2022, all highway projects of defense or strategic importance located within 100 km of the Line of Control or an international border are exempt from prior environmental clearance, provided they comply with the Standard Operating Procedures (SOP) issued from time to time. Accordingly, the proposed project does not require environmental clearance.
- Unclassed forest on community land is located along the project road corridor at chainages 38+300, 40+400, and 46+150. However, as all construction activities will remain confined within the existing Right of Way (RoW), no adverse impact on this Unclassed forest is anticipated.
- The proposed project alignment does not pass through any Wildlife Sanctuary/National Park/Biosphere Reserve/Tiger Reserve.
- No ASI Protected monuments found within 0.5 km from the project site. However, Monolith (Ch 23+200 and Ch41+500) and Cave (Ch 34+000 and 41+000) are present within 500 from the project Road.
- Approximately 30 nos. of trees are located within the existing Right of Way (RoW) along both sides of the road. To mitigate the ecological impact of tree felling, compensatory afforestation should be undertaken in line with applicable environmental regulations and guidelines.
- The project road is expected to have some environmental and social impacts due to construction activities along the corridor, its proximity to culturally important sites such as monoliths and caves, and potential effects on Project-Affected Persons (PAPs) arising from access-related issues.
- Stakeholder Consultations were conducted to assess the perception of the people about the proposed project. The outcome of the consultations suggested that people are in general with the project because it will improve the present road conditions and connectivity. However, they also raised the requirement for the road safety measures; road furniture's (including streetlights, signage's, speed breaker etc.).
- Occupational health and safety measures for both workers and the local community shall be ensured through the preparation and implementation of a comprehensive Labour Management Plan (LMP), in

compliance with the World Bank's Environmental and Social Standard ESS2 on Labor and Working Conditions

- The mitigations will be further assured by a program of environmental and social monitoring conducted during construction and operation to ensure that all measures are implemented, and to determine whether the environmental and social conditions has stipulated or protected. 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 MPWD.
- The ESMP shall be included in the bidding document along with appropriate contractual clauses for safeguarding the environment and social impacts during the project construction and operation (maintenance period).
- An overall project level and also construction stage level Grievance Redress Mechanism (GRM) will be formed to receive, feedback, suggestions and complaints, if any, from affected parties and addressing them during the construction stage and operation stage.
- The prepared ESMP will assist the Contractor and MPWD 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 always kept on-site during the construction period. As per the World Bank policy requirements, the prepared safeguard documents shall be disclosed in the World Bank website.
- During the field survey, as well as consultations with the Detailed Project Report (DPR) team and the Public Works Department (PWD), several key issues were identified. For each observation, appropriate mitigation measures have been proposed to minimize adverse impacts and ensure smooth project implementation.
- The ESIA Consultant's field observations along the WMP road corridor have been effectively integrated into the DPR through chainage-specific design interventions, ensuring a balanced approach towards engineering adequacy, environmental safeguards, and community safety.
- Site-specific protection needs highlighted by the ESIA, particularly in agricultural and vulnerable zones, have been addressed through toe walls and gabion/protection works, ensuring slope stability and protection of adjoining land uses. Recommendations near sensitive receptors such as schools at 32+100, 43+520, 46+600 have been incorporated through zebra crossings and traffic calming measures.
- Overall, the DPR demonstrates strong alignment with ESIA observations, translating field-level concerns into practical, sustainable, and approval-ready design solutions, thereby ensuring environmental compliance, enhanced road safety, and long-term infrastructure resilience.

10.2 RECOMMENDATIONS

The following recommendations are made in accordance with the World Bank's Environmental and Social Standards (ESS) for the proposed Upgradation of Weiloi - Mawsynram Road upto Phlangwanbroi for Meghalaya Logistics and Connectivity Improvement Project (MLCIP), funded by the World Bank, to ensure environmentally sustainable and socially inclusive development outcomes:

- The Contractor should prepare a site-specific contractor Environmental and Social Management Plan called as C-ESMP based on final design and identifications of locations of construction camps, quarries and borrow areas etc. within one month from the date of entering into the contract.
- MPWD shall conduct required consultations regularly or as needed with all stakeholders, including local residents, village councils, and public representatives, and maintain records of each consultation and

meeting. These consultations are to be carried out during the pre-construction and construction phases to ensure stakeholder concerns are addressed and documented.

- MPWD shall organize training for the capacity development of concerned E&S cell MPWD /PMC/CSC staff and district-level MPWD engineers on ESHS policies, regulations, and procedures for implementing, monitoring, and reporting ESMP measures. This training is to be conducted during the pre-construction phase.
- Contractors will engage the experienced ES&HS Staff for ESMP implementation as well as to ensure imparting induction, work-specific and other required trainings to the workers;
- MPWD will support Project Affected Peoples (PAP) as per RAP prepared for the project road stretch.
- Contractor/ MPWD to ensure the compliance of applicable laws at State/National level and relevant policies and best practices.
- The shifting of public utilities will be planned in advance to maintain supply of electricity and telephone services to people without or minimum disruptions, with prior intimation through Media, newspaper and other mode of communication.
- MPWD to monitor the implementation and redress of grievances timely and amicably.
- The contractor to ensure safe access to vulnerable people such as elderly and people with disabilities during the construction stage.