

PUBLIC WORKS DEPARTMENT
EXTERNALLY AIDED PROJECTS
(GOVERNMENT OF MANIPUR)

INITIAL ENVIRONMENTAL EXAMINATION
(Revision-R1)

**Manipur Urban Road and Asset Management Improvement
Project (MURAMP) - Improvement of Roads within Imphal City**

June - 2023

ABBREVIATIONS

AADT	-	ANNUAL AVERAGE DAILY TRAFFIC
AAQM	-	AMBIENT AIR QUALITY MONITORING
AIIB	-	ASIAN INFRASTRUCTURE INVESTMENT BANK
CPCB	-	CENTRAL POLLUTION CONTROL BOARD
CSC	-	CONSTRUCTION SUPERVISION CONSULTANT
DFO	-	DIVISIONAL FOREST OFFICER
DPR	-	DETAILED PROJECT REPORT
EA	-	EXECUTING AGENCY
EAC	-	EXPERT APPRAISAL COMMITTEE
IEE	-	INITIALENVIRONMENTAL EXAMINATION
EIA	-	ENVIRONEMNTAL IMPACT ASSESSMENT
EFP	-	ENVIRONMENT FOCAL PERSON
EHS	-	ENVIRONMENTAL HEALTH AND SAFETY
EMOP	-	ENVIRONMENTAL MONITORING PLAN
ESP	-	ENVIRONMENTAL AND SOCIAL POLICY
ESS	-	ENVIRONMENTAL AND SOCIAL STANDARDS
GHG	-	GREENHOUSE GAS
GIS	-	GEOGRAPHIC INFORMATION SYSTEM
GOI	-	GOVERNMENT OF INDIA
GRC	-	GRIEVANCE REDRESS COMMITTEE
GRM	-	GRIEVANCE REDRESS MECHANISM
IUCN	-	INTERNATIONAL UNION FOR CONSERVATION OF NATURE
MDR	-	MAJOR DISTRICT ROAD
MOEF&CC	-	MINISTRY OF ENVIRONMENT, FORESTS AND CLIMATE CHANGE
MORTH	-	MINISTRY OF ROAD TRANSPORT AND HIGHWAYS
PMC	-	PROJECT MANAGEMENT CONSULTANT
PMU	-	PROJECT MANAGEMENT UNIT
ZSI	-	ZOOLOGICAL SURVEY OF INDIA

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Fulfilment of Requirements of issued TOR.

Description/ ToR Clause No.	Terms of Reference	Compliance
Activity 3.5: Environmental and Climate Change Risk Assessment Environmental Safeguards	(i) Carry out an environmental assessment of the project in accordance with MDB's Safeguard Policy, and the government's environmental regulations and policies.	Chapter No: 2
	(ii) Classify the project in accordance with the environmental impact assessment (EIA) requirements under the Central and State Governments, as applicable, and MDB's Screening Checklist for Environmental categorization.	Chapter No: 2, Serial no 2.6
	(iii) Depending on the classifications, prepare an initial environmental examination (IEE) as per relevant guidelines of the Government and MDB, and if an EIA is required, prepare the associated TOR that are acceptable to the Government. In preparing the IEE and/or EIA, a minimum of the following issues must be covered:	IEE report has been prepared as per National and MDB guidelines and is submitted
	(a) Potential impacts on biodiversity including modified, natural, critical habitat and protected areas, and necessary measures to minimize, mitigate, and offset impacts	Chapter No: 5, Serial no 5.7.15 & 5.7.16
	(b) Potential waste issues including hazardous materials and wastes and appropriate measures for their disposal, treatment, and other forms of management	Chapter No: 5, Serial no 5.7.17
	(c) Potential impacts on ambient air and water quality, noise levels, soil, and recommendations for suitable mitigation measures	Chapter No: 5, Serial no 5.7.11, 5.7.9, 5.7.12, 5.7.8
	(d) Climate change related risks of the project based on consultation with the government, and recommendations for adaptation measures in the engineering design	Chapter No: 5, Serial no 5.7.14
	(e) Quantification of greenhouse gas emissions expected from the construction and operation stages of the project, with recommendations for suitable mitigation and/or offset measures.	Chapter No: 5, Serial no 5.7.17, 5.7.11 and Chapter No 3, Serial no 3.5.2.5
	(f) Occupational health safety issues and measures for the construction workers as well as the local communities in and around the project site	Chapter No: 5, Serial no 5.7.18
	(g) Potential impacts on physical and cultural resources, including sensitive receptors (temples, schools, hospitals, etc.) and measures to avoid, minimize, or mitigate impacts	Chapter No: 5, Serial no 5.7.22
(h) Public consultations with affected people in the project area including men, women, vulnerable or Indigenous groups, with clear documentation on dates of meeting and issues discussed.	Chapter No: 6	

Description/ ToR Clause No.	Terms of Reference	Compliance
	Consultations must also be carried out with relevant government agencies (e.g., Forestry Department to ensure that any impacts on forested areas will be off set through appropriate afforestation programs, Irrigation Department, etc.) and relevant local NGOs, if any	
	(i) Grievance redress mechanism to address concerns and grievances of the affected people during the project cycle	Chapter No: 7
	(j) Cumulative and induced impact assessment (brief assessment for IEE and in-depth assessment for EIA)	Chapter No: 5, Serial no 5.9
	(k) Alternative analysis including the no-project option (if necessary)	Chapter No 3, Serial no 3.5
	(l) Assessment of the institutional setup and capacity of the EA for meeting environment safeguard requirements of the government. Institutional and capacity needs, if any, must be identified and planned for with adequate budget provisions.	Chapter No 3, Serial no 8.4
	(iv) Prepare an environmental management plan (EMP) and environmental monitoring plan (EMOP) to implement and monitor the mitigation measures with clear information on costs, time frame, responsible agencies, monitoring methods, and monitoring indicators.	Chapter No 8
	(v) Incorporate into the EIA/IEE report and EMPs the feedback from all relevant stakeholders, including the Client, affected persons, and others.	Included, Chapter No 8
	(vi) The outputs will be complete IEE or EIA reports fulfilling the requirements of both the Government and the MDB, including as many site-specific details as possible. For sub-projects/ projects with different requirements under Government, one report will at least be prepared to fulfil requirements of both agencies.	One site specific IEE is prepared as per MDB guideline and GoI requirements for the entire project
	(vii) During the detailed design stage, provide clear recommendations in the EIA or IEE report for activities that need to be taken. Recommendations may include but not be limited to (a) updating the EMP to provide more site-specific details or other updates; (b) providing more detailed or updated information and analysis on location, expected impacts, and mitigation measures on sensitive receptors; (c) updating the number of trees required for removal; (d) conducting air and noise impact modelling; and (e) other updates in the reports based on design updates. The output of the detailed design stage will be the final IEE and/or EIA reports fulfilling the	Design stage management measures have been incorporated in IEE, Chapter 5 & 8

Description/ ToR Clause No.	Terms of Reference	Compliance
	<p>requirements of both the Government and the MDB.</p> <p>(viii) Study integration within the environment to ensure that transport choices support a better environment.</p>	<p>Detailed analysis of alternatives have been conducted with environmental perspective, Chapter 3, Serial no 3.5</p>
Climate Change Risk Assessment	<p>(ix) The ensuing project, which will involve development of various infrastructures, needs to be screened for climate (and disaster) risks. For example, if the ensuing project falls under ‘medium’ or ‘high’ climate risk category, a full climate risk and vulnerability assessment (CRVA) must be conducted, and measures have to be included in the design of the ensuing project to make it climate and disaster risk resilient. The costs of these measures will determine the ensuing project’s contribution to climate financing.</p>	<p>Impacts on climate due to the project are assessed and are discussed Chapter No: 5, Serial no 5.7.17, 5.7.11 and Chapter No 3, Serial no 3.5.2.5. Considering that the project is improvement project and involve limited impact on land and the flora associated with it., project is classified as low climate risk category</p>
	<p>(x) Review the state/ national level initiatives in addressing climate change impacts, climate action plans, any related design practices, technological innovations/ best practices that address climate resilience and facilitate in disaster risk reduction; addressing impact of pandemics (such as COVID-19); any environmental conservation requirements, any integrated gender related roles and interventions, etc.</p>	<p>Chapter No: 5, Serial no 5.7.17, 5.7.11 and Chapter No 3, Serial no 3.5.2.5.</p>
	<p>(xi) Undertake integrated risk assessment, and prepare the climate change assessment, CCA/CRVA documents, and a climate resilience framework, guidance on adaptation planning, clearly identifying necessary design inputs to be considered during DPR preparation, e.g. on minimizing/ avoiding risks, adaptation and/or mitigation measures/ options to address climate change impacts and ensure climate resilient designs, including “climate proofing” of existing urban roads and transport infrastructure, etc.</p>	<p>Chapter No: 5, Serial no 5.7.17, 5.7.11 and Chapter No 3, Serial no 3.5.2.5.</p>
	<p>(xii) Deliver CRVA related functions, in coordination with the other technical/ sectoral inputs, e.g. how the adaptation and/or mitigation measures will be implemented (engineering versus non-engineering), who will be responsible, regular monitoring through review reports to confirm adoption of climate resilient design inputs and adaptation and/or mitigation measures have been ensured in DPRs prepared, how the lessons gained over time can be fed back to policy makers and mainstreamed into sector policy and planning, etc.</p>	<p>Chapter No: 8, Serial no 8.5</p>

EXECUTIVE SUMMARY

1. Background:

Imphal city is the capital of the state of Manipur as well as the major business hub of the state. It is pertinent that transportation system is the lifeline of socio-economic development. However, low bearing capacity, low shear strength of subgrade soil combined with intense rainfall from March to October and lack of proper run-off drainage in the area, results in the damage of the existing bituminous road which require routine and periodic maintenance/ rehabilitation/strengthening thereby disturbing the transportation system of the city. Regular maintenance work is not only cost intensive but also time-consuming works. The poor quality of roads within Imphal City also creates an imbalanced distribution of socio-economic benefits and poor access to livelihood opportunities in the state. Improving transport connectivity thereby is an important factor for bringing in overall socio-economic development in the state.

2. The Project

Public Work Department, Government of Manipur aims to upgrade the state road network of Greater Imphal region (includes Districts of Imphal East and Imphal West) comprising of multiple state highway (20.389 km), Major District Road (71.992 km), Other district Road (19.792 km) and Internal Village Road/Local Street (435.108) of approx. 547.281 km in the Greater Imphal region to rigid/ concrete pavement with the design life of 30 years depending upon the road type with line drains. Other than the roads there are 85 bridges in the scope of the project road network, out of which 50 bridges are proposed for repair and rehabilitation and 26 bridges for proposed for reconstruction/new construction at shifted location, 8 bridges and under construction and 01 bridge is newly constructed. Environmental enhancement measures like compensatory plantation and rainwater harvesting are also included. The estimated total project cost is approximately INR 3219.645 crore. Total land 13.28805 Ha to be acquired, out of which 7.88415 (Imphal West) & 5.40390 (Imphal East). Land Acquisition under progress as per RFCTLARR 2013 and Manipur State Act. The requirement of 583,348.42 cum of sand, 1,783,117.12 cum of Aggregates, 47,908.65 Tonnes steel, 31,003.48 cum of Bitumen, 534,068.18 Tonnes of cement, 993,766.39 cum of concrete from batching plant for Sub-Project Work. The project creates temporary employment of 500-1000 workers including skilled, semi-skilled and non-skilled labour. The executing agency for the project will be Project Implementation Unit (PIU), External Aided Project, Public Works Department (PWD), Government of Manipur. A project management unit (PMU) will be established which will be headed by a full-time project Director. PMU will have an environmental and social unit who will be assisted by an AE/non-government organization to implement the resettlement plan & Environmental Management Plan. Safeguard specialists for environment and Social & resettlement will be a part of the PMU & PIU to monitor the EMP implementation and ensure compliance with both AIIB and Government of India requirements.

3. Environmental Sensitivity and Project Categorization

As EIA Notification, 2006 & its amendment Improvement of road projects does not fall under the schedule of the EIA Notification 2006 and thus does not require conducting EIA study. The proposed project is spread over a large spatial extent (150 sq. km) and traverse through the populated areas of the city, traverse close to archaeologically protected monuments, involve cutting of trees (approx. 5345 Nos). Land for temporary facilities like casting yards, labour accommodation, storage yards etc. shall be arranged by the EPC contractor as per Provision of Contract Agreements. None of the Sub-projects are located inside or near any legally protected and/or eco-sensitive areas. None of the project roads involve forest diversion and, hence, no sub-project attracts forest clearance. Most of the potential environmental impacts such as use of construction material, its transportation, storage, and handling, increase in air pollutants, noise and vibration levels, management of construction and demolition waste, traffic obstruction near active construction sites, etc. are reversible, co-terminus and concomitant to construction activities/period, consequently localised and short-term in nature. There will be some residual impacts in terms of emissions, road safety issues from generated traffic, and minimal residual impacts due to ground water extraction. Road safety measures have been incorporated in the design

while groundwater impacts will be minimized by adopting rainwater harvesting measures. Due to additional tree plantation, there will be positive residual impact in the long term. Consent to establish, consent to operate and authorization for generation of hazardous waste, NOC for storage of petroleum etc. under the respective acts/rules and other safety, labour, and social regulations of GoI shall apply on the project. The proposed project is being implemented with the financial assistance of AIIB and AIIB has established Environment Management Framework 2016 (amendment 2022) comprising of three Environment Social Safeguards (ESS 1: Environmental and Social Assessment and Management, ESS 2: Involuntary Resettlement & ESS 3: Indigenous Peoples) and requires all the project to follow the ESF and conduct the Environmental Assessment Study as applicable. As per Environment and Social policy of AIIB, projects are broadly categorized into 4 categories (Category A: Adverse Impact, Category B: Limited number of adverse impacts, Category C: minimal or no adverse impacts and Category F1: For financial intermediaries). Therefore, the project has been categorised as Category 'B' in accordance with as per AIIB ESF. Also, the project attracts applicability of all ESS1, ESS2 and ESS3 of AIIB.

4. Existing Environment:

The proposed project is spread over a large spatial extent, i.e., Greater Imphal region comprising of Imphal East and Imphal West, having area of approx. 150 sq km. Baseline data collection, entire project road network area is considered as study area. The study period considered for primary baseline data collection is winter season i.e., Nov 2022-January 2023. Meteorology data was also collected for one month (January 2023). Stakeholder consultations were undertaken during Jan-March 2023. The topography of most of the project area is plain, whereas some portions are located adjacent to lower mountains. Manipur lies in the NE region of India, which is regarded as one of the most seismically active regions worldwide. All the districts of Manipur state fall in seismic hazard zone V indicating high seismic risk. The valley area of Greater Imphal (East & West) districts are fertile and is mainly made up of alluvial soil of recent origin. However, the soils are acidic with pH ranging between 4.5 to 6.8, rich in organic carbon. Availability of Nitrogen is medium to high, Phosphorus is low to medium, and Potassium is medium to high. Soil quality study was undertaken at 16 locations in the project area. Texturally the soils of study area are observed to be Sandy Clay Loam Soils. As per the chemical analysis, it is found that there are no heavy metal pollutants in the soil of the study area. Project area is majorly flat area sloping from north to south and drained by Imphal, Iril, Kongba, Nambul and Naga Rivers. The aforesaid rivers are the primary drains which carry most of the water of the Greater Imphal area. There are also abandoned river channels locally called Turel Amanbi (Turel Amanbi means old river) of Imphal river. Waishel Maril is the temporary stream draining the southwestern part of the Greater Imphal. Imphal River is the one of the upstream of Irrawady River System and Nambul River empties to the Loktak Lake. Due to the presence of large number of rivers & heavy rainfall, project areas are prone to flooding. To generate baseline data for ground water quality, a study at 16 locations in the project area was conducted during January-Feb 2023. Results are compared with drinking water quality standards IS 10500-2012 and is found that concentration of Iron (Fe) location is higher than defined permissible limit as per IS-10500. Parameters like Mg, TDS, Total alkalinity etc. at many locations are higher than desirable limit but within permissible limits. baseline data for surface water quality, a study at 16 locations in the project area was conducted during January 2023. Results are compared with designated Best Use Criteria for the Inland Surface Water Bodies (IS 2296: 1982) and is found that quality is not good and meets the criteria define for class C (3 water bodies) and D & E for rest of the monitored water bodies. The climate of Greater Imphal proposed project sites is sub-tropical or humid sub-tropical in nature. The winters are very cool and dry while summers are hot and humid. The minimum temperature of the region is 4° C and maximum is 28° C. Greater Imphal faces an average rainfall of 1320 mm. Meteorology data was collected for January 2023 by installation of Automatic Weather Station in the project area to obtain the meteorology of the project area. Most dominant wind direction is N and WNW during January 2023. Data on ambient air quality is collected from the project area at 16 locations during Dec 2022-Jan 2023. As per the result, it is found that the value of PM10 and PM2.5 are much above the prescribed standards (NAAQS 2009) whereas the values are above the prescribed limits of the standards due to Some Other Construction activity undergoes by different stakeholder. Data on noise level quality is collected from the project area at 16 locations during Dec 2022-Jan 2023. As per the

result, it is found that Leq level at all the locations is high at all the location when compared to the Noise standards of Noise Rules 2000 except at location 3 (Kongba Bazar) during daytime and location 2 & 3 (Luwang sangban and Kongba Bazar) during nighttime. Project falls in urban areas hence flora in the project area is restricted in the form of avenue plantation, homestead plantation and plantation along the water bodies. Project development may affect 5435 trees. Important varieties of non-fruit bearing trees, fruit bearing trees, etc. of worth mentioning are Bamboos, Pepals, Kaubila, Eucalyptus, Amla, Parkia roxburghi (Yongchak), Arundo donax (yendhou), Carica papaya (papaya), Citrus grandia (Pamelo), Mangifera indica (Mango), Prunus domestics (plum), Prumus persica (peach), Pyrus selerotina (pear), Psidium guavaya (guava), Famarin dus indica (Tamarind). There are around 500 types of orchids and out of that 472 have been identified. The region is popular for the lily that is known as the "Siroi Lily" that are found in the forest of the hilly region. The varied flora adds to the beauty and charm of the place. Some of the important rare and endangered floral species found in the project districts are Tectona grandis, Dipterocarpus turbinatus, Dipterocarpus tuberculaus, Melonarrhoeausitata, Duabanga Sonnoroes, Dilleniapentagyna, Terminalliatomentosa, Gmelina arborea, Bauhinia spps., orchids, etc. There are no notified/protected area, reserve/protected forest/notified wetland within the project area. Lamphelpat wetland is not a notified wetland but is very important ecosystem of the project area. The wetland stores water drained from the Lamphel Reserve Forest and the Nambul River. There are no wildlife significant areas like wildlife sanctuaries, national parks etc. in the project area. Due to urban settings, presence of fauna is limited to domesticated fauna in project areas like cow (*Bos taurus*), goat (*Capra aegagrus hircus*), pig (*Sus*), dogs (*Canis lupus familiaris*) and buffalos (*Bubalus bubalis*). However, project area is rich in avifauna and include birds like Sparrow, swallow, owl, myna, pigeon, nightingale, king fisher, woodpecker, heron, kite, Black-headed bulbul (*Pycnonotus atriceps*), Black-headed yellow bulbul (*Pycnonotus melanicterus*), Purple wood pigeon (*Columba punicea*) and Batek, Blue-eared kingfisher (*Alcedo meninting*), White-breasted kingfisher (*Halcyon smyrnensis*) etc. Some of the globally threatened species (Great Indian hornbill) and five nationally vulnerable (Mrs. Hume's bar backed pheasant, Burmese ring dove, Indian moorhen, the Bar tailed dove, Pheasant tailed Jacana) birds' species are also found in the forest area of the State. The lakes and the marshy lands of the valley are the favorite habitat of a variety of rare migratory birds such as duck, geese, snipe etc., arriving particularly in winter months from places as far as Siberia. The important fishes commonly found in the region's plain and river basins are Catla, Labeo rohita, Labeo calbase, Cirrihinus mirigale, Clarius, batrachus, Rita, Heteropneustus fonilis, Notopterus notopterus, N. Chitala, Macrobrachum rosenbergii, M. malconsoni, M. Chapral, Channa punetatus C. gaehua, C. striatus. Project area is urban area of Imphal East and Imphal West district having population of 4.56 Lakhs and 5.18 Lakhs respectively. Sex ratio in the project area is 1017 and 1031. The area is well equipped with infrastructural, health and education facilities. Project development will impact approx. 2 Nos. of CPRs in the project area.

5. Since the project area is characterized mainly by urban/rural/open areas and intermittently traversed by urban settlements/ built-up areas, sources of air pollution are mainly vehicular emissions, dust from unpaved shoulders/ deteriorated roads, and domestic fuel burning. Monitored parameters of ambient air quality largely meet the prescribed limits of the World Bank, National Ambient Air Quality Standard (NAAQS), and Central Pollution Control Board (CPCB). Noise levels also meet the CPCB prescribed standards and World Bank Environmental, Health, and Safety Guidelines for noise for all land use categories. Ground water sampling collected and analysed; parameters meet the desirable limit of drinking water standard prescribed in IS: 10500:1991.

Anticipated Environmental Impacts and Mitigation Measures

Main preconstruction impacts are: (i) cutting of a few trees (most of the trees within formation width are likely to be translocated) (ii) waterlogging in built-up areas due to absence/blockage of side drains and (iv) accident risk due to poor horizontal curve along some sub-projects. All cross-drainage (CD) structures have been designed for a 50-year return period, considering climate change impacts. Vent size CD structures have been proposed for widening to avoid overtopping of road. A free board of 0.45 to 0.9m has been considered for all bridges. Lined side drains are proposed throughout the project area to prevent waterlogging.

Significant impacts anticipated during construction phase are: (i) increase of local air pollution and noise level due to construction and site clearance activities, earthworks, borrowing and quarrying, operation of hot mix plants, etc.; (ii) deterioration of surface water quality due to silt run-off, spillage from vehicles and discharge from labour camps; (iii) health impacts from labour camps; (iv) traffic disruption; and (v) occupational health and community safety. Mitigation measures include: (i) utilizing least noisy equipment and regulating time of construction near settlements and sensitive receptors; (ii) sprinkling of water on earthworks, active construction sites, material storage locations, and haulage roads; (iii) installation of silt and oil traps; (iv) slope stabilization to control erosion and protection work for ponds; (v) camp siting and management as per IRC guidelines and best practices; (vi) traffic management to avoid congestion and maintain access of local residents; (vii) implementation of compensatory plantation to offset impacts from tree cutting and additional plantation to curb effects of greenhouse gas emissions and enhancement of micro-climate; (ix) no camp, materials storage, hot mix plant near forest areas/ water bodies/ residential areas; and (x) no construction in the stretches of potential wild animal crossings during night time

Anticipated operation stage impacts are increased road accidents, accidental spillage, sub-mergence/ overtopping of CD structures, waterlogging due to blockage of side drains, increased air pollution and noise levels, poor survival of compensatory and additional plantation. All these are mainly associated with maintenance and monitoring of effectiveness of mitigation measures taken during design and construction stage. Executing agency is mandated to undertake regular maintenance of the road conditions and its appurtenances.

Greenhouse Gas Emissions and Addressing Risk of Climate Change:

For the development of the project various alternate construction methodologies were considered viz. Full depth reclamation (FDR), Short panel concrete pavement, thin white topping, Interconnected concrete block pavement and flexible pavement. Construction methodology will be considered depending on the road and site condition only. Also, analysis is made for “With” and “Without Project” Scenario also taking in consideration various parameters like dust emission, vehicular emissions, noise level, Quality of life, Vehicle Operating Cost, Ecology, Micro-climate, and Water logging & drainage. It is found that the “With Project” Scenario is preferable over “Without Project” Scenario.

The total CO₂ emission as estimated for business-as-usual and with project scenario for all the roads individually is less than AIIB & ADB’s threshold of 100,000 tons per year. Total CO₂ emission at business-as-usual and with project scenarios (over the design life of road) were estimated as 88,350 tons/year, and 22,837 tons/year respectively. It is therefore evident that ‘with project scenario’ will reduce more than 74% of CO₂ emissions in comparison with the business-as-usual scenario. Within the project lifespan, business-as-usual scenario will continue to have more CO₂ emissions due to the restricted width with increasing traffic. With project scenario will bring wider roads, improved road conditions, ease in traffic movement, and better fuel efficiency. Major reduction comes from the improvement of road carrying capacity, as the traffic volume will reach saturation limit with existing road infrastructure, and it would be difficult to sustain design speed with existing 1 or 1.5 lanes during the entire project life. By the same principle, emissions are predicted to go up once the saturation limit is reached beyond the project lifespan.

Public Consultations

Meaningful public consultation was conducted for the project at 60 locations during December 2022 to March 2023 in line with Environment Management Framework 2016 (amendment 2019) were conducted with local communities and government agencies like Forests, Revenue etc. Emphasis was made to include women and vulnerable groups in all interactions organized with local community. Focused Group Discussions were organized at 60 locations. Project received strong acceptability among potential beneficiaries. Main demands include provision of road safety measures, upgradation of CD structures and inclusion of side drains in project, employment in road construction and petty contracts during construction, and avenue plantation. Most of their demands have been integrated in the design.

Environmental Management Plan:

The total budget provided in the civil works contract and PWD budget to implement the environmental management plan (EMP) and (EMoP) is INR 25.52145 Crores

- a) Mitigation cost which includes dust suppression, installation of noise barriers, connection water harvesting, compensatory plantation, additional plantation; and
- b) Monitoring cost which includes pollution monitoring for air, water, noise, and soil. PWD, through its Project Implementation Units (PIUs), will ensure the effective implementation of the environmental management plan. To provide regular monitoring information, training, and technical advice to the PIUs a Construction Supervision Consultant/Authority Engineer/Project Management Consultant will be engaged to examine environmental compliances and suggest corrective actions and guide them to enhance the environmental performance of the project.

Grievance Redressal Mechanism

A Grievance Redressal Committee (GRC) will be established at PIU & PMU level. The GRC will provide an opportunity for affected persons to have their grievances redressed. Depending on the nature and significance of the grievances or complaints, the GRM comprises procedures to address grievances at the project site or PIU level then PMU level. Most serious complaints which cannot be addressed at the PIU level will be forwarded to the PMU.

Conclusion

This initial environmental examination (IEE) ascertains that upgrading is unlikely to cause any significant environmental impacts. Few impacts were identified attributable to the proposed subproject, all of which are localized and temporary in nature and can be easily mitigated with minor to negligible residual impacts. The need to undertake detailed EIA is not envisaged at this stage. The Executing Agency shall ensure that EMP and EMoP are included in Bill of Quantity (BOQ) and forms part of bid document and civil works contract. The same shall be revised if necessary, during project implementation or if there is any change in the design with prior approval of AIIB.

1. INTRODUCTION

1.1 Project Rationale

Manipur has been at the crossroads of Asian economic and cultural exchange for more than 2,500 years. It connects the Indian subcontinent and Central Asia to Southeast Asia, East Asia, Siberia, regions in the Arctic, Micronesia and Polynesia enabling migration of people, cultures, and religions. Manipur is a state in Northeast India, with the city of Imphal as its capital. It is bounded by the Indian states of Nagaland to the north, Mizoram to the south and Assam to the west. It also shares borders with Myanmar. The topography of the state is majorly hilly and being hilly in region, it requires such an infrastructural set up which provides physical accessibility to all parts of the state. Adequate and efficient provision of a well-connected road, rail, and aviation network is an important pre-condition for the social and economic development of the state.

The Government of Manipur intends to objectively develop State's road infrastructure for fueling economic growth, by providing transportation and rural connectivity, and by providing good quality inter-state and international connectivity. Public Works Roads Department in the state is responsible for managing the secondary, urban, and rural road network in Manipur, had initiated several projects in the state to boost its Infrastructure.

Imphal city is the capital of the state of Manipur as well as the major business hub of the state. It is pertinent that transportation system is the lifeline of socio-economic development. However, low bearing capacity, low shear strength of subgrade soil combined with intense rainfall from March to October and lack of proper run-off drainage in the area, results in the damage of the existing bituminous road which require routine and periodic maintenance/ rehabilitation/strengthening thereby disturbing the transportation system of the city. Regular maintenance work is not only cost intensive but also time-consuming works. The poor quality of roads within Imphal City also creates an imbalanced distribution of socio-economic benefits and poor access to livelihood opportunities in the state. Improving transport connectivity thereby is an important factor for bringing in overall socio-economic development in the state. In view of this, PWD, Government of Manipur has proposed to undertake a project "Improvement of Roads Within the Imphal City with Rigid Pavement including concrete drains".

The project involves upgradation of the state road network comprising of State Highways, Major District Road, Other district Road and Internal Village Road/Local Street of total length of approx. 547.281 km in the Greater Imphal region. The project aims to improve connectivity and access to basic services and livelihood opportunities as the rigid/concrete pavements are largely unaffected by rainfall and have better performance in the high rainfall area of Imphal City. The proposed road connectivity will be upgraded to rigid/ concrete pavement with the design life of 30 years. Rigid pavement will provide a suitable and sustainable solution and will require low life cycle maintenance cost in comparison to flexible pavement, also few roads which run along the riverbanks are proposed as flexible pavements. Project involves majorly upgrading recognized roads to rigid pavement with provision of line drain. The executing agency for the project will be Project Implementation Unit (PIU), External Aided Project, Public Works Department (PWD), Government of Manipur.

Government of Manipur has sought the financial assistance of Asian Infrastructure Investment Bank (AIIB) for development of the project. AIIB has established Environment Management Framework 2016 (amendment 2019) comprising of three Environment Social Safeguards (ESS 1: Environmental and Social Assessment and Management, ESS 2: Involuntary Resettlement & ESS 3: Indigenous Peoples) and requires all the project to follow the ESF and conduct the Environmental Assessment Study as applicable. M/s RODIC Consultants Pvt. Ltd has been appointed by PWD, Govt of Manipur for the work of preparation of Detailed Project Report (DPR) including Initial Environmental Examination Report (IEE) and Environment & Social Management Plan (ESMP) as per the requirement of AIIB.

This IEE-ESMP report is prepared for the project "Improvement of Roads Within the Imphal City with Rigid Pavement including concrete drains" as per the requirement of AIIB ESF, legislative requirements of Government of India & State Government of Manipur and the terms of references

issued for the project by PWD.

1.2 Objectives of the Project

Project involves improvement of existing state road network of 547.281 km Greater Imphal Region of Manipur State to improve the socio-economic conditions in the region and reduce the required recurring cost for period maintenance of the roads. Following are the major objectives of this project:

- Provide a sustainable and climate resilient solution to road network in Imphal City by providing better and reliable connectivity.
- Provide relief to state's budget and resources from requirement of substantial high funding of road maintenance.
- To bring about ease of living, road safety, improvement in the general standard of living of the people and economic prosperity.

1.3 Project Region and Existing Scenario of Project Roads

Project is planned to be developed in Greater Imphal region which Covers the Districts of Imphal East and Imphal West. The region is surrounded by Senapati District on the north & west and on the south by Thoubal and Bishnupur Districts. Project road passes through Imphal east and Imphal west districts covering major settlements: Uripok, Uripok Bachaspati Leikai, Uripok Khoisnam Leikai, Nagamapal, Thangmeiband, Thangmeiband Sinam Leikai, Lalambung, Majorkhul, Thangal Bazar, Rims Doctor Colony, Naoremthong, Iroisemba, Langol, Game Village, Takyel, Ghari, Tera, Lamboikhongnangkhang, Sagolband, Heingang, Luwangsangbam, Mantripukhre, Sangakpham, Nagaram Village, Chingmeirong, Dewlaland, Ragailong, Zomi Villa, Kairang, Kontha Ahallup, Khuman Lampak, Khurai Thoudam Leikai, Khurai Laishram Leikai, Khuraisala Thong Leikai, Porompat, Top Khonang Makhong, Kongba, Wangkhei, Naharup, Naharup Pangong, Naharup Thongjao, Thongju, Bashikhong, Akampat, Tellipati, Hatta Minuthong, Checkon, Nongmeibong, Kheikhu, Koirengi, Kyamgei, Langthabal, Kakwa, Monsangei, Heirangoithong, Singjamei, Malom, Chanchipur, Kwakheithel, sangaiprou, Keishamthong, Ningombam, Hawairou (a small portion), Meitram, Changangei, Keishampat & Yaiskul. The topography of most of the project area is plain, whereas some portions are located adjacent to lower mountains. Existing features of the project area are given in Table 1 and Figure 1. Photographs of project area are given in Figure 2

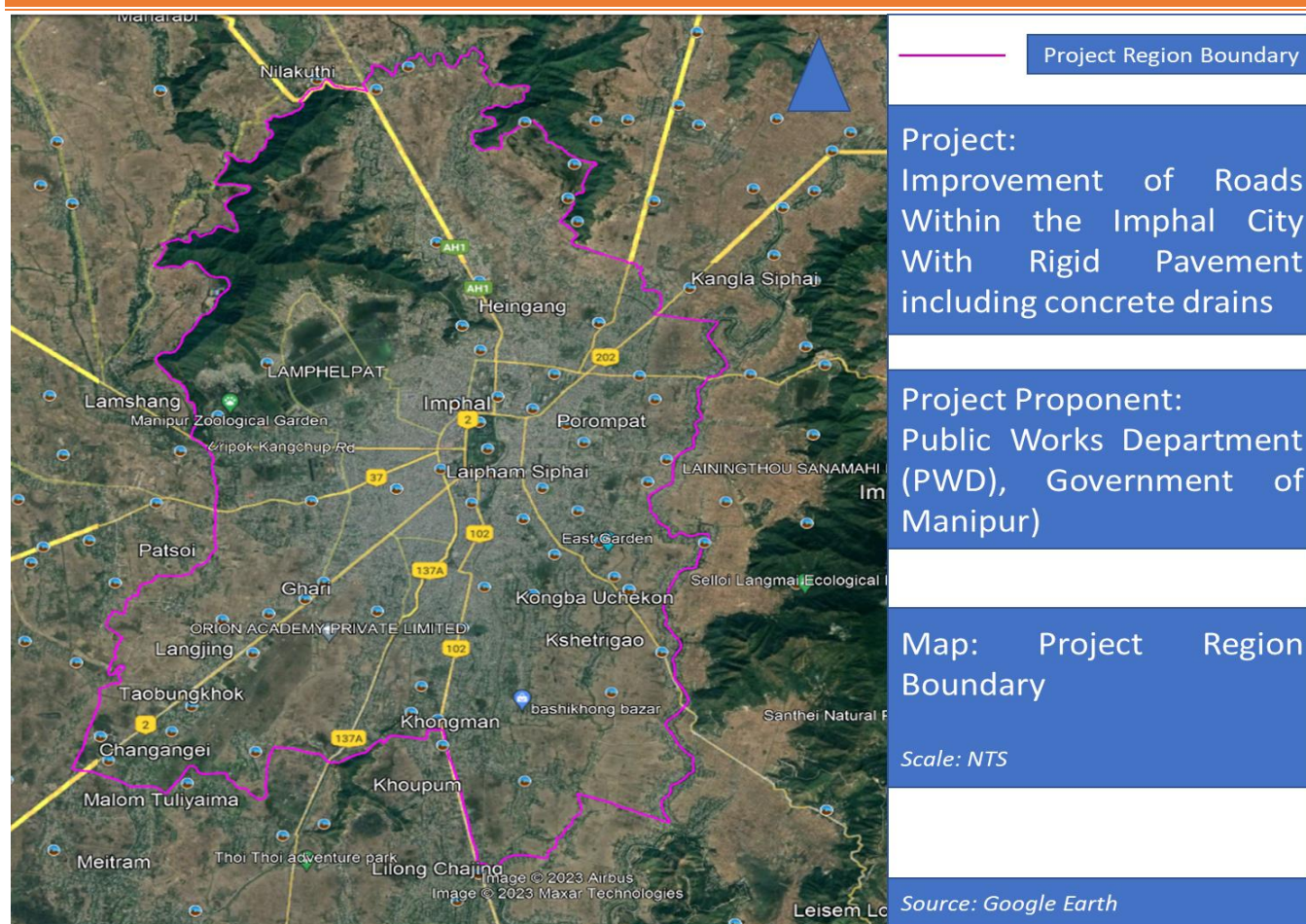


Figure 1: Project Region Map

Table 1: Existing Features of the Project Area

Sr. No.	Existing Features	Description
1	Length	The project has a finalized length of 547.281 Km. <ul style="list-style-type: none"> 172.858 Km in Imphal West, 141.032 Km in Imphal East Package A 122.209 Km in Imphal East Package B 111.182 Km in Highway South Division
2	Terrain	Plain Terrain
3	Land Use	93% of the land is built up and remaining area is open area.
4	Settlements	<p>Notable Settlements in Imphal West Division Uripok, Uripok Bachaspati Leikai, Uripok Khoisnam Leikai, Nagamapal, Thangmeiband, Thangmeiband Sinam Leikai, Lalambung, Majorkhul, Thangal Bazar, Rims Doctor Colony, Naoremthong, Iroisemba, Langol, Game Village, Takyel, Ghari, Tera, Lamboikhongnangkhong, Sagolband.</p> <p>Notable Settlements in Imphal East Division Heingang, Luwangsangbam, Mantripukhre, Sangakpham, Nagaram Village, Chingmeirong, Dewlaland, Ragailong, Zomi Villa, Kairang, Kontha Ahallup, Khuman Lampak, Khurai Thoudam Leikai, Khurai Laishram leikai, Khurai Sala thong leikai, Porompat, Top Khonang Makhong, Kongba, Wangkhei, Naharup, Naharup Pangong, Naharup Thongjao, Thongju, Bashikhong, Akampat, Tellipati, Hatta Minuthong, Checkon, Nongmeibong, Kheikhu, Koirengi.</p> <p>Notable Settlements in Highway South Division Kyangei, Langthabal, Kakwa, Monsangei, Heirangoithong, Singjamei, Malom, Chanchipur, Kwakheithel, sangaiprou,</p>

Sr. No.	Existing Features	Description																																												
		Keishamthong, Ningombam, Hawairou (a small portion), Meitram, Changangei, Keishampat, Yaiskul.																																												
5	Carriageway	The project road has single lane, intermediate lane, two lane and 4 lane configuration roads. Lane wise road details is given below- <ul style="list-style-type: none"> • 350.948 Km of Single Lane, • 104.578 km of Intermediate Lane, • 18.247 Km of two lane, • 9.615 Km of 4 lane and • 63.893 Km of roads along riverbank. 																																												
6	Pavement Type	Flexible																																												
7	Major Junctions	There are total of 13 major junctions in which, <ul style="list-style-type: none"> • 8 in Imphal West, • 2 in Imphal East Package A • 3 in Imphal East Package B • 0 in Highway south division. 																																												
8	Minor Junctions	There are total of 552 minor junctions in which, <ul style="list-style-type: none"> • 266 in Imphal West, • 66 in Imphal East Package A • 74 in Imphal East Package B • 146 in Highway south division. 																																												
9	Bridges	There are 85 number of existing bridges in the project network. <ul style="list-style-type: none"> • 18 in Imphal West, • 24 in Imphal East Package A • 35 in Imphal East Package B and • 08 in Highway south division. 																																												
10	Culverts	There are 58 number of existing culverts of different type (Hume Pipe, Box, Slab culvert) in project network.																																												
11	Forest	Limited forest areas and as the project involves improvement of existing roads, there shall be no direct impact on the forest.																																												
12	Sensitive Location	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">Imphal West</th> <th style="text-align: center;">Imphal East</th> <th style="text-align: center;">Highway South Division</th> </tr> </thead> <tbody> <tr> <td>School</td> <td style="text-align: center;">50</td> <td style="text-align: center;">156</td> <td style="text-align: center;">20</td> </tr> <tr> <td>College</td> <td style="text-align: center;">12</td> <td style="text-align: center;">11</td> <td style="text-align: center;">4</td> </tr> <tr> <td>Library</td> <td style="text-align: center;">4</td> <td style="text-align: center;">2</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Health Centre/Clinic</td> <td style="text-align: center;">10</td> <td style="text-align: center;">7</td> <td style="text-align: center;">3</td> </tr> <tr> <td>Hospital</td> <td style="text-align: center;">18</td> <td style="text-align: center;">7</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Temple</td> <td style="text-align: center;">7</td> <td style="text-align: center;">5</td> <td style="text-align: center;">1</td> </tr> <tr> <td>Mosque</td> <td style="text-align: center;">1</td> <td style="text-align: center;">10</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Church</td> <td style="text-align: center;">5</td> <td style="text-align: center;">12</td> <td style="text-align: center;">2</td> </tr> <tr> <td>Police Station</td> <td style="text-align: center;">5</td> <td style="text-align: center;">3</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Cremation Ground/Burial Ground</td> <td style="text-align: center;">60</td> <td style="text-align: center;">44</td> <td style="text-align: center;">30</td> </tr> </tbody> </table>		Imphal West	Imphal East	Highway South Division	School	50	156	20	College	12	11	4	Library	4	2	2	Health Centre/Clinic	10	7	3	Hospital	18	7	2	Temple	7	5	1	Mosque	1	10	-	Church	5	12	2	Police Station	5	3	-	Cremation Ground/Burial Ground	60	44	30
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KHUMAN LAMPAK ROAD (IMPHAL EAST)



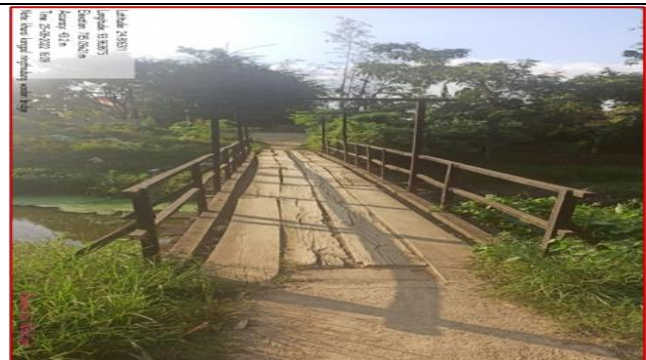
KONGBA LAIISHRAM ROAD (IE)



JNIMS ROAD (IMPHAL EAST)



MAJID ROAD (IMPHAL WEST)



Existing Temporary Bridges in Project Area Proposed to be Re-constructed Under the Project

Figure 2: Photographs of Project Region

1.4 Project Brief

This project involves rehabilitation and upgradation of 547.281 Km of project length comprising of multiple State highways, Major District Road, Other district Road and Internal Village Road/Local Street connectivity in the vicinity of Greater Imphal region. Under the project existing state roads in the project area will be improved and upgraded to rigid/ concrete pavement with a design life of 30 years with line drains. Details of the road network considered under the project are provided in Table 2 and Figure 3 below. Salient features of the project are discussed in Table 1. Other than the roads there are 85 bridges in the scope of the project road network, out of which 50 bridges are proposed for repair and rehabilitation and 26 bridges for proposed for reconstruction/new construction at shifted location, 8 bridges and under construction and 01 bridge is newly constructed.

Table 2: Detail of the State Road Network Considered Under the Project

Road Type	Imphal West	Imphal East Package A	Imphal East Package B	Highway South	Total
Single Lane	130.978	81.212	60.08	78.678	350.948
Intermediate Lane	26.601	39.94	16.251	21.786	104.578
2 Lane	5.967	4.307	7.973	0	18.247
4 Lane	4.242	3.416	1.957	0	9.615
Riverbank Side Roads	5.070	12.157	35.948	10.718	63.893
Sum	172.858	141.032	122.209	111.182	547.281

Road Category	Imphal West	Imphal East Package A	Imphal East Package B	Highway South	Sum
State Highway Roads	10.463	4.578	5.348	0	20.389
Major District Roads	22.834	5.028	4.679	39.451	71.992
Other District Roads	7.768	4.196	6.906	0.922	19.792
Inter Village Roads	131.793	127.23	105.276	70.809	435.108
Sum	172.858	141.032	122.209	111.182	547.281

1.4.1 The project Road is divided in 4 Nos of Project Contacts

- i. Works Contract-1/ Contract No. MUR-CW-01: Improvement of Roads within Imphal City and Greater Imphal with Rigid Pavement including Concrete Lined Drains of selected road under Imphal West Division –Package1: Total Road length – 172.858 Kms.
- ii. Works Contract-2/ Contract No. MUR-CW-02: Improvement of Roads within Imphal City and Greater Imphal with Rigid Pavement including Concrete Lined Drains of selected road under Imphal East Division- Package A (ED-1) – Package 2: Total Road length – 141.032 Kms.
- iii. Works Contract-3/ Contract No. MUR-CW-03: Improvement of Roads within Imphal City and Greater Imphal with Rigid Pavement including Concrete Lined Drains of selected road under Imphal East Division Package B (ED-2) – Package 3: Total Road length – 122.209 Kms.
- iv. Works Contract-4/ Contract No. MUR-CW-04: Improvement of Roads within Imphal City and Greater Imphal with Rigid Pavement including Concrete Lined Drains of selected road under Highway South Division – Package 4: Total Road length – 111.182 Kms.

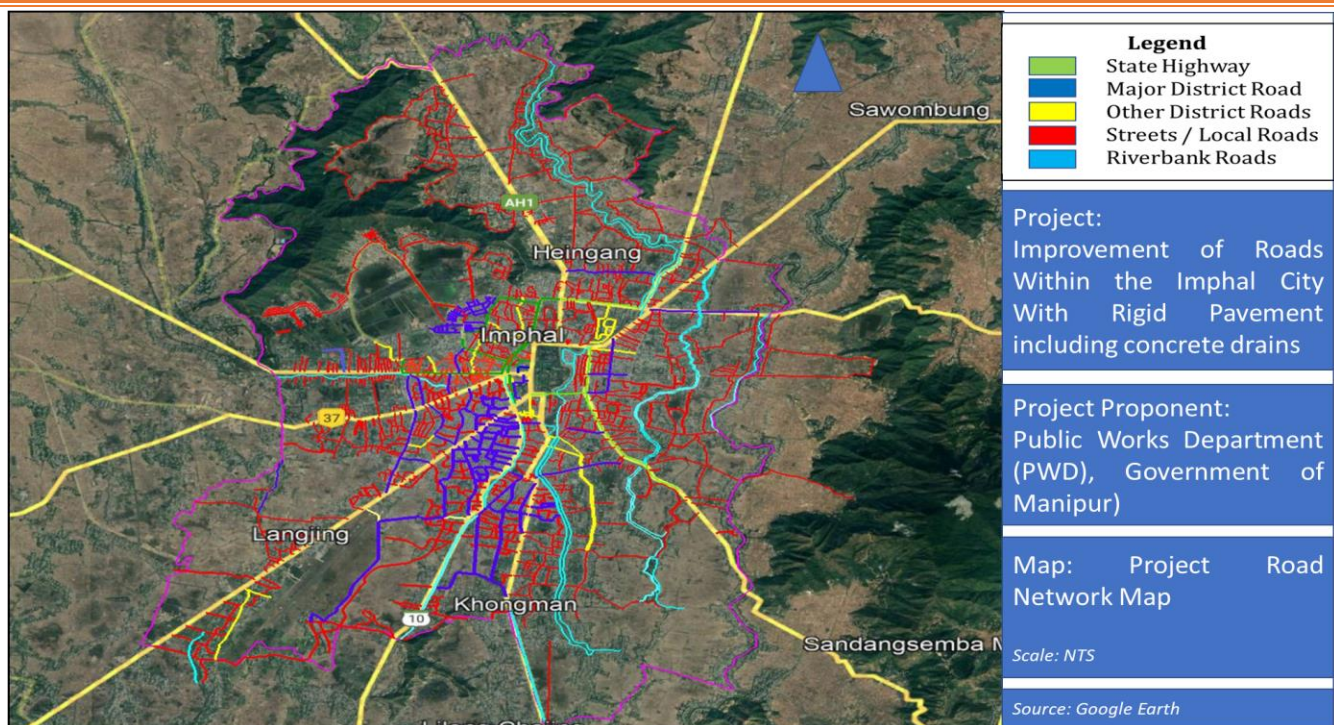


Figure 3: Project Road Network Map

1.4.2 Need of Project

This project is proposed as the area is experiencing various issues due to existing road conditions, design, and the climatic condition of the region. Area receives heavy rainfall which damages the roads and thus road requires period repair and maintenance which is both cost & time intensive work. Other issues with the existing projects are:

- Deficient road surface conditions with poor riding quality & distresses in the pavement.
- Absence or Inadequate and poor condition of cross drainage structures & side drains
- Presence of loose aggregates and road material on road surfaces. Poor regular and interval road/drain maintenance.
- Absence of road marking, road signs and others road safety items especially at sensitive locations
- Shoulder functionally and structurally inadequate. Shoulder drop-off at places.
- Differential settlement due to poor subgrade support

All these issues are critical and significantly impact the day-to-day life of the residents. Improvement of the roads will have several socio-economic benefits, especially to the people of the Greater Imphal region. Benefits of the project are discussed in the section below.

1.4.3 Benefits of the Project

The proposed development of project from flexible to rigid pavement with lined drain will serve the long-term benefit to the road user with improved safety and level of service. The project roads are scattered throughout the Greater Imphal area, and the roads will be used by about 1 million people in the area. This is expected to result in huge economic and overall development of the area. It will also reduce the annual maintenance cost as the road has been designed for 30 years and being a rigid pavement, it will require less maintenance cost in compared to bituminous road with reduction in roughness index. The new improved connectivity to be provided under the project will.

- promote new economic activities,

- improve transport links to get agricultural and farm goods to markets and
- result in better education and health outcomes because of improved connectivity, both inter-habitation and from habitations to the higher order roads.

This is expected to bring benefits to the One million people that are living in the habitations covered under the project, particularly women and children, who will have improved access to healthcare, schools, and public transportation services. Service providers, such as public transport operators, educational institutions, hospitals, and traders, will also benefit from the new improved connectivity. One of the key requirements for small habitations to grow faster is through linkages to economic and market centers. Currently significant travel time is required between habitations and market centers, schools, and hospitals due to absence of better and safer linkages. The project will better integrate the rural population, businesses, and industries with the national and state economy through better transport connectivity. Improved road access will have a transformational impact on rural poverty by contributing to improved agricultural productivity, higher non-farm employment opportunities and increased rural income. It will facilitate inclusion of rural communities in development through better access to markets, growth opportunities and services. The improved connectivity that will be provided by this project will result in the following benefits-

- Increased agricultural productivity and industrial development (agro-industries, in particular) through improved connections to markets with more favorable prices for agricultural inputs and outputs.
- Reduced travel time and hence better access to schools and hospitals for the rural population, resulting in improved healthcare and increase in literacy levels. Better access roads to habitations also will result in setting up of more schools and healthcare centers around the habitations (which are considered unviable by service providers without such roads), resulting in further improvement of healthcare, literacy levels and overall quality of life.
- New employment opportunities during project implementation (construction labor force) and after project completion (increased agricultural and small-scale industrial activities).
- Changes in travel patterns from the existing potted road to usage of motor vehicles, resulting in increased mobility and socioeconomic activities with increased speed of travel, along with improvement in levels of safety and passenger comfort, will result in reduced vehicle operations cost (VOC).
- Significant improvement in access to administrative services, law and order and welfare services (normally located at district headquarters).

1.5 Purpose of Initial Environment Examination (IEE) Study

Environment Impact Assessment Study is the only legal tool in India to ensure environmental management and sustainable development of polluting project under EIA Notification, 2006 as amended. However, improvement of road projects does not fall under the schedule of the EIA Notification 2006 and thus does not require conducting EIA study. However, the proposed project is being implemented with the financial assistance of AIIB. AIIB has established Environment Management Framework which essentially requires all the projects being funded to be sustainable and environmentally sound. As per Environment and Social policy of AIIB, projects are broadly categorized into 4 categories (Category A: Adverse Impact, Category B: Limited number of adverse impacts, Category C: minimal or no adverse impacts and Category F1: For financial intermediaries).

Proposed project is spread over large spatial extent, i.e., over the entire Greater Imphal region of approx. 150 sq km comprising of 547.281 km of road network, traverse through heavily populated areas, traverses close to traverses close to Kangla Fort & other Protected Monument, involves tree cutting and thus may have impact during implementation phase if not managed properly. But as per the nature of the activity involved, i.e., improvement works majorly within the RoW of existing road with only some land acquisition requirements in parcels. Also, entire project region is habituated area

majorly having urban settings and no additional forest or notified environmentally protected areas are being impacted. Also there is no vibration intensive activity planned close to locations of archaeological monuments. However, some roads are falling within the forest area, rehabilitation works will be carried out within the existing RoW of these roads and no additional forest land will be acquired. There is also requirement for the cutting or removal of some trees which will be compensated for as per State Forest Policy. Majorly the anticipated impacts are site specific and will confine within the RoW and will not lead to fragmentation of any critical habitat. Considering these facts, the project has been assigned under category B. As per Environment and Social policy of AIIB, it is required to conduct initial examination for the Category B project so as based on which bank in consultation with PWD can decide on appropriate instrument to assess the Project's environmental and social risks and impacts. Thus, this IEE study is conducted accordingly as per requirement of AIIBs Environment and Social policy. In this IEE report, the environmental impacts due to the project, concerning construction-related environmental impacts, infringements with places of cultural heritage in the context of state protected archaeological monuments identified in project area and 'chance-find', are covered. The findings of IEE will guide the effective development of the specific EMP and appropriately facilitate the implementation of safeguard measures.

1.6 The objective of the IEE Study

Development of any road project requires procurement of large quantity of construction material, land acquisition, change in land use patterns, road diversion/blocking, cutting of trees/vegetation removal, storage & transportation of men & material, establishment of labour camps, demolition, vegetation clearance etc. which may lead to displacement, loss of access to the utilities/properties, occupational health hazards for workers & community, deterioration of quality of soil, water, and other environmental components especially during the construction stage. Thus, it is required to conduct the environmental assessment for the project to identify all possible impacts of project and design mitigation plan. The project is categorized as Category B as per Environment and Social Policy of AIIB and as per the requirement of the AIIB's ESF, the IEE has been prepared for the project with the following objectives:

- To collect the baseline data on the physical, biological, and socio-economic conditions of the project area using primary as well as secondary sources.
- To conduct stakeholder consultation to understand their concern and suggestion for the project to enhance its environmental and social acceptability.
- To prepare detailed legal framework applicable to the proposed project as per National legislation and requirement of AIIBs' ESF.
- To carry out the environmental assessment for the project and design implementable, cost effective and time bound measures elimination or reduction of the identified potential environmental impacts of the project to acceptable levels.
- To prepare the specific ESMP which will include the institutional responsibilities and methods of monitoring the mitigation measures and monitoring procedures.
- To prepare an indicative cost estimate and timeframe for implementation of ESMP.

1.7 Scope of the IEE Study

Initial Environmental Examination (IEE) and Environment Social Management Plan is prepared in accordance with relevant policies and regulation of the Government of India, Government of Manipur, ToR issued by PWD, Government of Manipur and the AIIB's Environmental and Social Framework. IEE consists of the study, describing the status of the environment in the project area (before the commencement of project), identification of potential impacts and its mitigation methods and formulation of an environmental and social management plan to be followed during construction and operation phase of the project. IEE here is hence an important tool to identify and handle the issues concerned with the environment that may arise due to such projects. IEE report also addresses the

environmental management requirements of the Government of India (GOI) and the Asian Infrastructure Investment Bank.

IEE study is limited to the area around the deemed areas of direct influence area of project road networks and key construction activities such as site clearing, removal of trees, excavation, filling, grading and embankment formation, excavation for utility trenches, subgrade preparation, base course and asphalt overlay, shoulder, and construction of permanent structures like retaining walls, culverts, and drains. The IEE also covers ancillary activities like temporary project facilities like labour accommodation, storage areas, plant/machinery sites, stock yards etc.

1.8 The Methodology for Conducting IEE Study

The methodology adopted complies with the Asian Infrastructure Investment Bank Environmental and Social Framework. The study was carried out using reconnaissance surveys, field visits, consultation with stakeholders, review of existing data, analysis of alternatives, identification of adverse impacts, and preparation of environmental and social management and monitoring plans. Various steps involved in conducting the EIA study for the project are given below.

Task 1: Screening:

It is a process of analyzing the project w.r.t environmental and social risks and to assess whether EIA study is required or not. EIA Notification, 2006 in India mandates the polluting projects as mentioned in schedule of the notification to undertake EIA study and obtain prior environmental clearance. However, road improvement projects are not included in schedule of the notification, thus the notification is not applicable on the project and environmental clearance is not required. Other acts Wildlife Act 1972 and CRZ Notification 2011 are also not applicable on project thus EIA study is not required to be carried out for the project. Rehabilitation works on the roads not falling within the forest area. Thus, the project does not involve any forest land diversion.

The project is obtaining financial aid from AIIB and is required to follow the AIIBs' ESF requirements. ESF classifies all developmental projects into four categories based on the magnitude and significance of associated environmental and social risks, i.e. A, B, C & F1. Proposed project is spread over large spatial extent, traverse through heavily populated areas, may impact the assess to the properties for short duration. involves tree cutting, involve working within RoW of roads lying within forest area and some resettlement and rehabilitation of people and traversing close to Kangla Fort & other archaeological protected monuments, thus the project was considered for conducting the environmental assessment. However, the project region is habituated area and is majorly urban land use, does not involve diversion of any forest land or notified environmental protected area, does not impact any critical habitat or protected flora & fauna, does not involve any vibration intensive activity close to archaeological monuments in project areas, thus the impacts are anticipated to be moderate, site specific and short term. Considering these, the project has been assigned Category B and accordingly IEE-ESMP report is prepared for the project. The findings of IEE will guide the effective development of the specific EMP and appropriately facilitate the implementation of safeguard measures.

Task 2: Scoping:

PWD, Government of Manipur has defined the terms of reference for conducting the EIA study for the project. Terms of reference have provided scope for conducting the EIA study. EIA study has been carried out as per the terms of references provided by PWD, Government of Manipur, guidelines of MoEF&CC for conducting EIA study for linear projects (highways) and AIIB's ESF, 2019.

Task 3 Field Reconnaissance Survey and Review of Earlier Studies

The field reconnaissance survey has been carried out to understand the environmental and social setting of the project area; identify the existing pollution sources in project area which can enhance the impact of project cumulatively; and to identify the environmental and social sensitive features along the alignments which can get impacted due to project implementation and operation.

Task 4: Review and Assessment of Applicable Environmental Regulations

A detailed analysis of various rules/regulations and guidelines applicable to the proposed project vis-à-vis centre (GoI), state (GoM) statutory requirements and AIIB's ESF were reviewed and referred to for assessing current environmental impacts that are likely to emanate. Based on this analysis, an environmental legal framework is designed for the project.

Task 5: Delineation of Study Area for Assessment

Study area of the project has been delineated considering the nature and the area of the development. Nature of the project is linear, and the development is confined within the project RoW. Project RoW in case of road projects is highly variable depending on the location. Thus, study area of the project is divided into two zones, i.e., core zone and the buffer zone.

Core Zone: Core zone is defined as the area where the project development works are proposed to be undertaken and will include the following areas.

- Project RoW (road corridor): Approx. 85 % of the work is proposed within the existing alignment except at few stretches wherein it is proposed to acquire extra land for improvement works. RoW of existing roads varies between 3.33-22.25 m (single lane to two lane roads). Additional land is proposed to be acquired at locations where RoW of 5.75 m is not available. Out of 547.281 km roads, approx. 459 km road area is majorly having the available RoW of 5.75 m but in 88 km length there are constraints in available RoW intermittently.
- This will also cover location of temporary site for batching plant, labour accommodation, material storage, starting of plant & machinery etc.

Table 3: RoW of Existing Roads

S. No.	Class of Road	Existing RoW		
		Minimum	Maximum	Average
1	SH	10.95	25.25	16.50
2	MDR	8.40	15.45	11.0
3	ODR	8.10	16.45	11.15
4	IVR	3.33	13.74	6.45

Buffer Zone: Buffer zone considered for assessment of the impact due to road project includes following.

- Area of 10 m width on either side of the alignment/corridor and other temporary facilities as most of the impacts are localized. Majorly impact will be on the properties/infrastructure/utilities lying along the project road network. However, the study area impact zone is considered up to 5 km on both sides of road alignment to allow for coverage of indirect and induced impacts and a larger analysis of land use and other environmental features. Assessment is carried out on the following environmental components: terrestrial and aquatic ecology, soil, water, air, noise, and socio-economic aspects.
- 10 km radius area around the alignment is also considered but only for assessment of the impact on Notified environment protected areas like national parks, wildlife sanctuaries, Migratory wildlife/bird corridor, Ramsar wetlands etc. But no such area exists within 10 km radius of the project road alignments and thus no impacts are envisaged.

Task 6: Assessment of Baseline Environmental and Social Conditions

This task comprises a collection of primary and secondary baseline data for physical, biological, and socio-economic conditions in study area. The secondary sources¹ of information was utilized for giving a

¹ Secondary source of information for various socio-economic parameters were collected from government departments like Census of India, Department of Industries, Department of Economics and Statistics, Department of Agriculture, Directorate of Settlements and Land

generic snapshot of socio environment features. Also, existing environmental and social quality/features along the proposed project were assessed based on a walk-through survey, public consultations etc. Source of the baseline data collected during IEE study is given in Table 4 below.

Table 4: Primary and Secondary Information Sources

Information	Sources
Technical information on existing road features and proposed Rehabilitation work. Inventory of road features; viz. water bodies community structures, environmentally sensitive location areas, congested locations, etc.	PWD, Design Consultant, Ground physical surveys and graphics Consultants
Climatic Condition	Indian Meteorological Department, ENVIS Website, NIC, Primary data Collection. Conducting Micro Meteorology
Geology, Seismicity, Soil, and Topography	Geological Survey of India, SOI Toposheets, Primary data collection
Land Use/ Land Cover	Survey of India (SoI) Toposheet, Observation during the survey.
Drainage Pattern	Survey of India Topo sheet and field Observation
Status of forest areas, Compensatory afforestation norms, etc.	Forest Department
Status of Fishing Activity	District Fisheries Offices at Imphal East & Imphal West Districts
Air quality Noise, Soil, and Water	Onsite monitoring and Analysis of Field samples during the field visit
Borrow Areas, Quarries and other. construction material source	Observations from site inspection surveys, PWD
River geomorphology, hydrology, drainage, flood Patterns	Feasibility report, field observations
Social Survey	The Secondary data collected for the project and the project influence area is from reliable secondary sources such as websites of central and state government, published documents from various departments. Initial social screening was conducted to identify the likely impacts and identify the potential impacted families and persons, Common Property Resources, agriculture land, access to services, etc. Using available RoW records with Revenue Department, the social team plotted the boundaries of private properties within the proposed RoW. A structured questionnaire was prepared to carry out the census survey covering all (100%) of the families displaced as a result of development of the project within the proposed RoW/ Col. To collect the information of socio-economic profile of the affected population

Task 7: Stakeholder consultations

Stakeholder consultations have been carried out for the project with the project affected people, local

Records etc. This helped to understand the socio-economic profile of the project area with respect to indicators like population growth rate, literacy rate, work force participation rate (WFPR) etc. in comparison with the project districts and state.

people, and the revenue officials to understand their concerns due to project development and suggestions for improvement of the project.

Stakeholder consultations were held between 28.01.2023 to 31.03.2023 at 80 locations in project region. Local and beneficiary population, Government departments/agencies, road users, project-affected persons and environment & social consultant of the project attended the meeting and addresses all the queries related to the project, survey procedure, possible impact due to project development, compensation to be provided etc. and reply were given to the queries of the stakeholders. These consultations allowed the stakeholders and road designers to understand road features and construction methods that will enhance road upgrading and minimize potential impacts. Information gathered was integrated into the project design and formulating mitigation measures and environmental and social management plan. A detailed description of public consultation is presented in Chapter 7.

Task 8: Prediction of Environmental Impacts (including social impacts)

Likely impacts that would arise due to the construction of the proposed project were identified for each project activity, through changes in the physical, biological, or socio-economic environment. The assessment considered both positive and negative impacts at different stages of project development.

Task 9: Preparation of Environment Management Plan (EMP)

A comprehensive Environmental Management Plan (EMP) was prepared which includes mitigation measures to avoid, reduce, mitigate, or compensate for all the identified negative impacts and enhancement measures for positive impacts, with related institutional arrangement, implementation schedule and cost estimates provided.

Task 10: Preparation of Environmental Management Budget

Based on the impact assessment for the environmental components, a suitable budget has been estimated to compensate for the temporary and permanent impacts that are likely during the project implementation. The budget also includes compensatory afforestation measures for the loss of avenue trees due to project.

Task 11: Environmental Safeguard Clauses in the Bid Document

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

1.9 Structure of IEE-ESMP Document

IEE report has been structured under various headings/subheadings and titles as depicted below.

Chapter 1- Introduction: Briefs the Project rationale, Objective of the project, the project status of the project and the purpose of conducting the IEE.

Chapter 2- Legal Policy Framework: The applicable Government of India and Manipur State regulatory requirements for this project has been discussed along with necessary clearance to be obtained by the contractor has been detailed.

Chapter 3- Project Description: This chapter covers the detailed description of the project, such as, the type of project, need for the project, project location, project alignment, project components, utilities affected due to project, amenities requirement for project, land requirement, implementation schedule and the estimated cost of the project.

Chapter 4- Description of the Environment: The environmental baseline condition for various environs namely Physical, Biological and Social conditions has been detailed for the project area.

Chapter 5- Analysis of Potential Environmental Impact and Mitigation Measure: Various

anticipated impacts during the project implementation have been discussed along with suitable mitigation measures.

Chapter 6- Stakeholder Consultation and Information Disclosure: This chapter covers the details and outcome of the stakeholder consultations carried out for the project as per guidelines of Gol and AIIB.

Chapter 7- Grievance Redress Mechanism: The GRM proposed for this project along with the roles and responsibilities of the GRM members are discussed in detail.

Chapter 8- Environmental and Social Management Plan: For the identified Environmental & Social Impacts, suitable management/ mitigation measures have been provided to minimize the impacts with roles and responsibilities for implementing the same. Various training modules for environmental & social awareness and ESMP implementation have been discussed. A suitable budget provision has been estimated based on the prepared ESMP.

Chapter 9 – Conclusion and Recommendations: Based on the conducted environmental assessment and its finding, a suitable conclusion chapter along with recommendations has been detailed.

2. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

2.1 Introduction

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

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

2.2 National Institutional Settings of Environmental Regulations in India

The notification of the Government of India in the erstwhile Ministry of Environment and Forests vide number S.O. 1533 (E) dated the 14th September, 2006 (hereinafter referred to as 'EIA Notification,2006'), the Central Government imposed certain conditions and thresholds on the undertaking of some projects or expansion or modernization of such existing projects entailing capacity addition, in any part of India listed in Schedule to the EIA Notification, 2006 unless Prior Environment Clearance has been accorded by the Ministry of Environment, Forest and Climate Change (MoEF&CC) or the State Level Environment Impact Assessment Authority (SEIAA) or accordance with the procedure specified in the EIA Notification, 2006 and subsequent amendments. However, improvement of road project does not fall in the schedule of the said notification and does not require environmental clearance. The environmental regulatory framework in India is depicted in **Figure 4**.

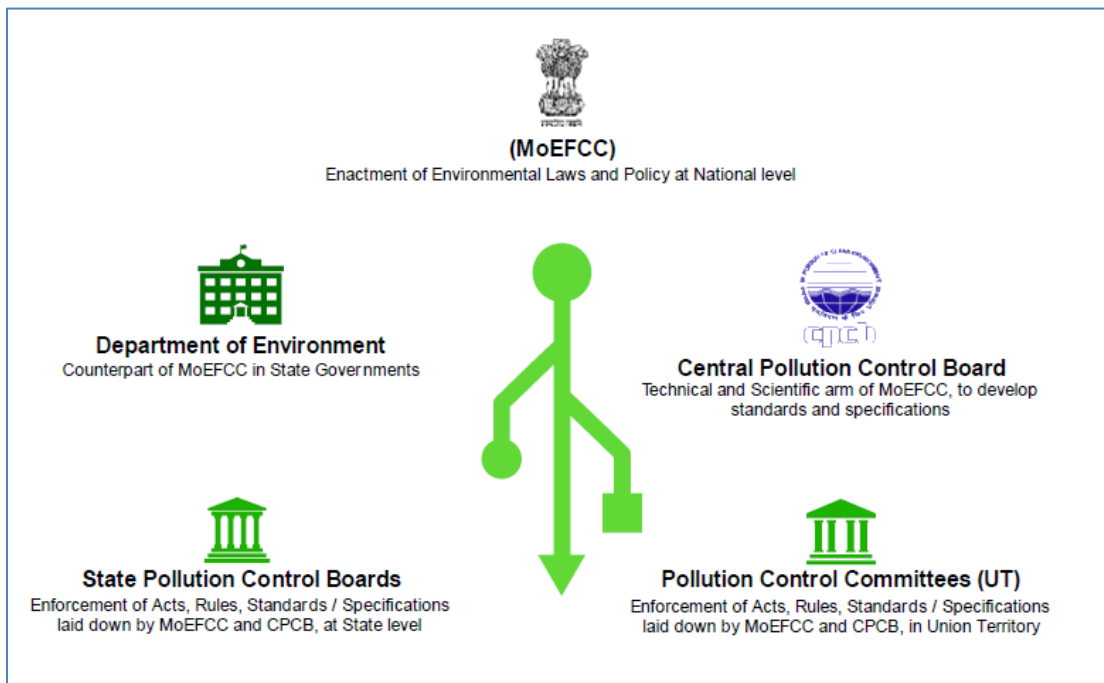


Figure 4: Environmental regulatory framework in India

2.3 National (India) Environmental Policies and regulatory Framework

To understand the extent of the environmental and social assessment for the proposed project, applicable laws, legislation, and policies have been reviewed and provided in subsequent sections.

2.3.1 National Environment Policy, 2006

The National Environment Policy (NEP) is intended to be a statement of India's commitment to making a positive contribution to international efforts. The National Environment Policy is a response to our national commitment to a clean environment, mandated in the Constitution in Articles 48 A and 51 A (g), and strengthened by judicial interpretation of Article 21. It is recognized that maintaining a healthy environment is not the state's responsibility alone, but also that of every citizen. A spirit of partnership should thus be realized throughout the spectrum of environmental management in the country. The National Environment Policy is intended to be a guide to action in regulatory reform, programs and projects for environmental conservation, and review and enactment of legislation, by agencies of the Central, State, and Local Governments. The dominant theme of this policy is that while conservation of environmental resources is necessary to secure livelihoods and well-being of all, the most secure basis for conservation is to ensure that people dependent on particular resources obtain better livelihoods from the element of conservation, than from degradation of the resource. The policy also seeks to stimulate partnerships of different stakeholders, i.e., public agencies, local communities, academic and scientific institutions, the investment community, and international development partners, in harnessing their respective resources and strengths for environmental management.

2.3.2 The Environment (Protection) Act, 1986

The Environment (Protection) Act, 1986 is widely regarded as comprehensive or umbrella legislation for environment in its entirety. The responsibility for implementation of the provisions of the EPA has to a large extent been entrusted to the regulatory agencies created under the Air and Water Acts. Department of Environment (DoE) was created in 1981 in the Central Government to act as a nodal agency for environmental protection and development in a coordinated manner. The principal environmental Regulatory Agency in India is the Ministry of Environment Forests & Climate Change (MoEF&CC) of the Government of India. MoEF&CC formulates environmental policies and accords environment clearances for the large projects (sector-wise listing has been done by MoEF&CC for e.g., Area development, Highways, Petrochemicals, etc.). State Department of Forest & Environment and Pollution Control Boards/Committees are enforcing authorities at the State level to resolve environmental issues arising due to any infrastructure project including road projects. The provisions of this act are applicable to the project.

2.3.3 Environmental Impact Notification, 2006 and its Amendments

The Ministry of Environment and Forests (now known as Ministry of Environment, Forest, and Climate Change) has issued Environmental Impact Assessment notification on 14th September 2006, as a major tool for minimizing the adverse impact of rapid industrialization on environment. As per this notification, all projects and activities are broadly categorized into two categories - Category 'A' and Category 'B' based on the spatial extent of potential impacts and potential impacts on human health and natural and manmade resources. All projects or activities included as Category 'A' in the Schedule shall require prior environmental clearance from the Central Government in the Ministry of Environment, Forest, and Climate Change (MoEF&CC) on the recommendations of an Expert Appraisal Committee (EAC) constituted by the Central Government for the purposes of this notification. All projects or activities included as Category 'B' in the Schedule will require prior environmental clearance from the State/Union territory Environment Impact Assessment Authority (SEIAA). The road improvement projects are not included in the schedule list of EIA notification, 2006 hence the proposed project does not require to apply for Environment Clearance. However, project activity like mining (for establishment of new quarries) may attract EC requirements.

2.3.4 CRZ Notification 2011

Ministry of Environment and Forest issued a Coastal Zone Regulation Notification in 1991 to regulate

the activities in coastal areas and to protect its pristine and fragile environment. The 1991 notification was suppressed by a new notification in 2011 and now new CRZ notification 2019 is being considered for areas wherein Coastal Zone Management Plan (CZMP) 2019 is approved. However, project area does not fall in CRZ area and thus the notification is not applicable on the project.

2.3.5 The Forest Conservation Act, 1980 along with the Forest Conservation Rules, 2022

The Act prohibits the State Government or any other authority, without the prior approval of the Central Government, from de-reserve the Reserved Forests or permitting use of any forest land or any portion thereof for non-forest purposes. It further prohibits without the prior approval of the Central Government, to assigned by lease or otherwise, any forest land or portion thereof to any private entity not owned, managed, or controlled by the Government and further than no forest land or portion thereof may be cleared of naturally grown trees including for afforestation. Project does not fall under any Reserved/Protected Forest area Hence Forest clearance is not applicable for the project.

Tree Cutting Requirement:

Manipur Forest Rules, 1971: Rules requires protection of forest areas and preventing indiscriminate felling of trees in forest area. No tree as per the current survey fell in the forest area.

Guidelines for Felling of Trees from Non-Forest Areas Issued in Compliance of Supreme Order Dated 12.05.2001: These are guidelines to regulate the felling of trees in non-forest areas. There are 5345 trees in the ROW which would require to be removed/cut. Requisition & Cutting Permission under Progress.

2.3.6 The Wildlife (Protection) Act, 1972

The Act provides for Preservation and Conservation of wildlife, birds, plants, and environment in biodiversity rich areas by notifying them as Protected Areas (PA) either as Wildlife Sanctuaries (WLS) or National Parks (NP) or Conservation Reserves (CR) or Community Reserves (CoR). The State Government and the Central Government both have the powers to notify WLS & NP. The Act provides for constitution of National and State Board of Wildlife with the Prime Minister of India and Chief Ministers of States as their respective Chairpersons. For activities within a conservation reserve, a recommendation from the Standing Committee of NBWL would be required after obtaining the permission from the CWLW with the approval of the State Government (in consultation with SBWL). The Supreme Court vide order dated 13.11.2000 in Centre for Environment Law, WWF-1 v. Union of India, WP(C) 337/1995 has prohibited the de-reservation/ de-notification of WLS & NP without the approval of the Supreme Court. The proposed project does not pass through any protected area like WLS, NP etc. or its ESZ, thus act is not applicable on the project and wildlife clearance is not required for the project.

2.3.7 The Water (Prevention & Control of Pollution) Act, 1974 amended in 1988.

The Water (Prevention and Control of Pollution) Act, 1974 resulted in the establishment of the Central and State Pollution Control Boards whose responsibilities include managing water quality and effluent standards, monitoring water quality, prosecuting offenders and issuing licenses for construction and operation of certain facilities. The consent to be established and consent to operate from State Pollution Control Board/Pollution Control Committee are required by user agency under this act.

2.3.8 The Air (Prevention & Control of Pollution) Act 1981 as amended in 1987.

The Act provides for preservation of air quality and control and abatement of air pollution, constitution of Boards, functions, and powers of the boards, for setting of standards of air quality and standards for emissions of air pollutants into the atmosphere from industrial plants and automobiles, penalties for violation and process for appeals etc. It is mandatory to obtain prior consent of the State Pollution Control Board before establishing or operating any industrial plant in an Air Pollution Control Area. CPCB has issued directions for harmonization of classification of industrial sectors under red/orange/green/white categories vide Notification dated 7th March 2016, and additional guidelines vide notification dated 12.01.2021 and notification dated 30.04.2021.

As per these guidelines, activities requiring consents to establish and operate under Air and Water Acts from SPCB are:

- Setting up of batching plant, hot mix plant
- Setting up and Operation of quarry, stone crushers

2.3.9 The Noise Pollution (Regulation and Control) Rules, 2000 and its Amendment in Rules (Noise Amendment rules 2010)

The Union Government has laid down statutory norms to regulate and control noise levels to prevent their adverse effects on human health and the psychological wellbeing of the people. The rules titled Noise Pollution (Regulation and Control) Rules, 2000 came into force on February 14, 2000. Under the new regulation, different areas and zones are to be identified as industrial, commercial, and residential or silent areas and anyone exceeding the specified noise level would be liable for action. Noise standards as per the rules for different land use are provided in Table 5.

Table 5: Ambient Air Quality Standards WRT Noise (Noise Rules, 2000)

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

Note:

1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night-time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is defined as an area comprising not less than 100 meters around hospitals, educational institutions and courts. The silence zones are zones, which are declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four-abovementioned categories by the competent authority.

*dB (A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A “decibel” is a unit in which noise is measured.

“A” in dB (A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

Source: Noise Pollution (Regulation and Control) Rules, 2000

In view of various difficulties being faced in society due to noise pollution, the Central Government amended. The Noise Pollution (Regulation and Control) Rules, 2000, and came out with The Noise Pollution (Regulation and Control) (Amendment) Rules, 2010. Through this amendment, stress has been laid on making the nighttime less noisy and peaceful. Restrictions have been imposed on use of horns, sound emitting construction equipment and bursting of firecrackers during nighttime. Community loudspeakers now include not just 'Public Address System' but also any 'Sound Producing Instruments'.

As per Noise Pollution (Regulation and Control) Rules, 2000, under the title Noise from construction and civil engineering works, noise from construction sites is generally far worse than noise originating from factories. There are two main reasons for this. One is that wherever construction takes place, like erection of roads, bridges and buildings noise emissions levels are higher. The other is that civil engineering equipment is inherently noisy. The worst of these pieces of equipment, from the noise generation point of view, are given in Table 6.

Table 6: Noise Limit for Automobiles at Manufacturing Stage

S. No.	Categories of Vehicles	Limits in dB(A)
1	Motorcycle, scooters, and three-wheelers	80
2	Passenger cars	82
3	Passenger or commercial vehicles of up to 4 MT	85
4	Passenger or commercial vehicles of above 4 MT and up to 12 MT	89
5	Passenger or commercial vehicles exceeding 12 MT	91

In the era of fast urbanization of buildings and roads, the demolition, and the repair activities along with the huge machines used for the purposes create a great deal of noise to the annoyance of the people living near the sites of construction. Hence such works are also a potential source of noise pollution. Precautions in Construction Activities. –

- Acoustic barriers should be placed near construction sites.
- The maximum noise levels near the construction site should be limited to 75 dB (A) Leg (5 min) in industrial areas and to 65 dB (A) Leg (5 min) in other areas.
- There should be fencing around the construction site to prevent people coming near the site.
- Materials need to be stockpiled and unused equipment to be placed between noisy operating equipment's and other areas.
- Constructing temporary earth and around the site using soil etc., which normally is hauled away from the construction site.

2.3.10 The Motor Vehicles Act 1988 and its Amendment 2019

In 1988, amendment of the Indian Motor Vehicle Act empowered the State Transport Authority to enforce standards for vehicular pollution prevention and control. The authority also checks emission standards of registered vehicles, collects road taxes, and issues licenses. In August 1997, the “Pollution Under Control” (PUC) programme was launched in an attempt to crackdown on the number of vehicular emissions in the state. To date it has not been highly effective. The MV Act was recently amended in August 2019. This new act has increased fine for many offences to check the road accidents and improve the road safety in the country.

2.3.11 Movement of Hazardous Chemicals

Movement of hazardous chemicals by road is governed by the Central Motor Vehicle Rules, 1989 (rules 129 through 137). Besides regulations and precautions to be taken while transporting such goods, the rules stipulate availability of a Transport Emergency (TREM) Card with the driver of the carrier which shall provide information on hazardous nature of the chemical carried and also precautions required to handle emergencies such as spillage and fire. These rules are attracted by the proposed project as it may involve the procurement/storage/movement/transportation of the hazardous chemicals to be used in different applications during construction. The contractor must be aware of these rules and must follow accordingly.

2.3.12 The Ancient Monuments and Archaeological Sites and Remains Act, 2010

This Act provides for the preservation of ancient and historical monuments and archaeological sites and remains of national importance and for the regulation of archaeological excavations and for the protection of sculptures, carvings, and other like objects. According to this Act, areas within the radii of 100m from the “Protected Monument” are designated as “Prohibited Areas” and from and from 200m is designated as “Controlled /Regulated Areas”. No development activity (including building, mining, excavating, blasting) is permitted in the “prohibited areas.” Development activities likely to damage the protected monument are not permitted in the “controlled/regulated areas” without prior permission from the Archaeological Survey of India (ASI) if the site/remains/ monuments are protected by ASI or the State Directorate of Archaeology. No Centrally protected Ancient Monuments and Archaeological sites found within 300m of the proposed project corridor. However, there are archaeologically Protected Monument in the study area. Applicability of the act can be discussed with

State Competent Authority, ASI. This act may also be applicable due to any chance finding of artefacts during construction phase, if any.

2.3.13 Disposal of Fly Ash Notification 2009 and amended on 25th January 2016

The main objective of the Fly Ash Notification is to conserve the topsoil, protect the environment and prevent the dumping and disposal of fly ash discharged from coal-based power plants. The fly ash notification makes essential the use of fly ash in road construction activities. As per the amendment of the Notification dated 25th January 2016, “No agency, person or organization shall, within a radius of 300 km of a thermal power plant undertake construction or approve design for construction of roads or flyover embankments with topsoil; The guidelines or specifications issued by the Indian Road Congress (IRC) as contained in IRC specification No. SP: 58 of 2001 as amended from time to time regarding use of fly ash shall be followed and any deviation from this direction can only be agreed to on technical reasons if the same is approved by Chief Engineer (Design) or Engineer-in-Chief of the concerned agency or organization or on production of a certificate of ‘fly ash not available’ from the Thermal Power Plant(s)”. The amendment further states “The cost of transportation of ash for road construction projects within a radius of 100 km from a coal or lignite based thermal power plant shall be borne by the thermal power plant and the cost of transportation beyond the radius of 100 km and up to 300 km shall be shared equally between the user and the thermal power plant”. The time period to comply with the provisions of the amendment by all concerned authorities was 31st December 2017. It is proposed to use fly-ash for the construction purpose for the proposed project as feasible.

2.3.14 Other Legislations

In addition to the above discussed major environmental regulations there are many other legislations relevant to the proposed project which are listed below in Table 7 and Relevance, applicability, and responsible agencies of all these has been discussed in the Table 8 & 9

Table 7: Other Environment and Social Legislations

<ul style="list-style-type: none"> • Workmen Compensation Act, 1923, • The Public Liability Insurance Act, 1991, • The Explosives Act (& Rules), 1884 (revised in 1983), • Contract Labour (Regulation & Abolition) Act, 1970, • Minimum Wages Act, 1948, • Payment of Wages Act, 1936, • Equal Remuneration Act, 1979, • Child Labour (Prohibition & Regulation) Act, 1986, • The Building & Other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 • Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016 as amended, • The Manufacture, Storage, and Import of Hazardous Chemicals Rules, 1989, • Solid Waste Management Rules, 2016, • Construction and Demolition Waste Management Rules, 2016, • Mines & Minerals (Regulation and Development) Act 1957 and amendments, • Payment of Gratuity Act, 1972 • Code of Social Security, 2020 	<ul style="list-style-type: none"> • E-Waste (Management) Rules, 2016, • Building and Other Construction Workers (Regulation of Employment and Conditions of Services) Act and Rules, • The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation, and Resettlement Act, 2013 etc. • Biomedical Waste Management Rules 2016 and amendments • Batteries Waste Management Rules, 2022 • Minor Mineral and concession Rules, 1960 • The Mining Act, 1952 • Petroleum and its amended rules, 2019 • The Chemical Accidents (Emergency Planning, Preparedness, And Response) Rules, 1996 • Permission for water extraction from CGWA under section 3 of Environment (Protection) Act, 1996 • The Scheduled Tribes and Other Traditional • Forest Dwellers Act, 2006 • Employee State Insurance Act; Employees P.F. and Miscellaneous Provision Act, 1952 • Maternity Benefit Act, 1951 • The Manipur Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Rules, 2015
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<ul style="list-style-type: none">• The Occupational Safety, Health, and Working Conditions Code, 2020• Workmen Compensation Act, 1923• RFCTLARR (Removal of Difficulties) Order, 2015• The Manipur Panchayat Act, 1994• The Right to Information Act, 2005	<ul style="list-style-type: none">• Scheduled Caste and Scheduled Tribes Orders (Amendment) Act, 2002• National Tribal Policy, 2006
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Table 8: Summary of Relevant Environmental Legislation

S. No	Regulation	Purpose	Regulatory Authority	Responsibility for Obtaining Clearance/ Consent	Remarks
01	The Environmental (Protection) Act, 1986, and the Environmental (Protection) Rules, 1987-2002 (various amendments)	Umbrella Act for Protection and improvement of the environment. Under this act rules have been specified for discharge/ emission of effluents and different standards for environmental quality	MoEF&CC, State Department of Environment & Forest, Central Pollution Control Board (CPCB) and State Pollution Control Board (SPCB)	EAP-PWD/ DPR Consultant	Applicable
02	The EIA Notification, 2006 & subsequent amendments	a. All New State Highway Projects and b. State Highway Expansion projects in Hilly terrain (above 1,000 m MSL) and or Ecologically Sensitive Areas require prior Environmental Clearance	State EIA Authority (SIEEA) /MoEF&CC	EAP-PWD/ DPR Consultant	Not Applicable
03	Wildlife Protection Act, 1972	If project is located within protected area or eco-sensitive zone (ESZ) of protected area	National Board for Wildlife (NBWL)	EAP-PWD/ DPR Consultant	Not Applicable
04	Forest (Conservation) Act, 1980 and subsequent amendments	To regulate the diversion of forest land for non-forest use	State Environment and Forest Department, MoEF&CC	EAP-PWD/ DPR Consultant	Not Applicable
05	Ancient Monuments and Archaeological sites & Remains Act 1958	To protect the Historical/cultural ASI notified monuments/sites	Archaeological Survey of India, (ASI), National Monument Authority (NMA)	EAP-PWD/ DPR Consultant	Regulation pertains to structures/institutes declared as protected under the act by the ASI/NMA. Act is not applicable for monuments/sites protected under the state government notifications which are not covered under the Union Governments act.
06	The Water (Prevention and Control of Pollution) Act, 1974	Measure to be taken during project cycle especially construction phase towards prevention of water pollution	State Pollution Control Board, CPCB	Contractor	Applicable, Consent shall be taken for establishment of batching plant, hot-mix plant, stone crushers, new quarries etc.
07	The Air (Prevention and Control of Pollution) Act, 1981	Measure to be taken during Project cycle especially during construction phase towards prevention of air pollution	State Pollution Control Board, CPCB	Contractor	Applicable, Consent shall be taken for establishment of batching plant, hot-mix plant,

S. No	Regulation	Purpose	Regulatory Authority	Responsibility for Obtaining Clearance/ Consent	Remarks
					stone crushers, new quarries etc.
08	Noise Pollution (Regulation and Control) Act, 1990 and subsequent amendments	Construction machinery and vehicles conform to the standards for construction. Measure to be taken during project cycle especially during construction phase towards prevention of air pollution	State Pollution Control Board, CBCB	Contractor	Applicable
09	Wetlands (Conservation and Management) Rules, 2017	To regulate the diversion or deterioration of Notified Wetland Sites	Wetland Authority; MoEF&CC	EAP-PWD/ DPR Consultant	Not Applicable as the project does not impact any Ramsar or Notified Wetland.
10	The Motor Vehicle Act. 1988 and subsequent amendments	All vehicles/equipment used for construction will need to comply with the provisions of this act.	State Motor Vehicles Department	Contractor	Applicable
11	Solid Waste Management Rules, 2016	Effective management and disposal of various waste during construction and operation stage	MoEF&CC and various concerned departments	Contractor	Applicable
12	Construction and Demolition Waste Management Rules, 2016	To be identified at project level during detailed E&S assessment	State Pollution Control Board, CBCB	Contractor	Applicable
13	The Explosives Act (& Rules), 1884	To regulate usage of the explosives	Chief Controller of Explosives	Contractor	Not Applicable as usage of explosives for blasting purpose is not anticipated
14	Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016	To regulate generation, storage & disposal of hazardous waste	State Pollution Control Board	Contractor	Applicable
15	The Manufacture, Storage and import of Hazardous Chemicals Rules, 1989 as amended	To regulate the storage of any hazardous chemicals	Authorities as Described in Schedule -5 of the Rules (MoEF&CC, CPCB, CCE, DC, CIM)	Contractor	Applicable but NOC may not be required
16	Biomedical Waste Management Rules 2016 and	To regulate generation, storage, and disposal of bio-medical waste	State Pollution Control Board	Contractor	Applicable for the bio-medical waste to be generated from the first aid centers at labour

S. No	Regulation	Purpose	Regulatory Authority	Responsibility for Obtaining Clearance/ Consent	Remarks
	amendments, 2016				accommodation plan
17	Batteries (Management & Handling) Amendment Rules, 2010	To regulate the handling, storage, and disposal of lead-acid batteries. Consumers and bulk consumers (100 or more lead-acid batteries in a year) will follow the rules and bulk consumers will file the return annually.	State Pollution Control Board	Contractor	Applicable for the management & disposal of lead acid batteries
18	E-Waste (Management) Rules, 2016	To regulate generation, storage, and disposal of e- waste	State Pollution Control Board	Contractor	Applicable for the management & disposal of e-waste
19	Plastic Waste Management Rules 2016	To regulate generation, storage, and disposal of plastic waste	State Pollution Control Board	Contractor	Applicable for the management & disposal of plastic waste
20	Guidelines to regulate and control ground water extraction in India, 2020	To regulate the extraction/withdrawal of ground water	Central Ground Water Authority	Contractor	Applicable if water for construction purpose and domestic water requirement of labour/staff is met using ground water from the newly installed wells by contractor or existing wells being used directly by contractor
21	The Mining Act, 1952	This rule will be applicable if sand/ earth/ aggregates or any other minor mineral will be extracted for the project. It is likely that there may be a requirement for the establishment of a new quarry and borrow areas for the project.	Department of Mining, GoM	Contractor	Applicable
22	Mines & Minerals (Regulation and Development) Act 1957 and amendments,	This rule will be applicable if sand/ earth/ aggregates or any other minor mineral will be extracted for the project. It is not likely that there may be a requirement for the establishment of a new quarry and borrow areas for this project & material may be procured from licensed vendor preferably. However, it will be applicable if any new borrow area or quarry is established	Department of Mining, GoM	Contractor	Applicable
23	Petroleum and its	This rule will be applicable as the project	Petroleum and Explosives	Contractor	Applicable

S. No	Regulation	Purpose	Regulatory Authority	Responsibility for Obtaining Clearance/ Consent	Remarks
	amended rules, 2019	may involve storage and handling of petroleum products equal to more than threshold quantities specified in the rule and permission from PESO may be required.	Safety Organization (PESO)		
24	The Building & Other Construction Workers (Regulation of Employment & Conditions of Service) BOCW Act, 1996	Key legislations providing guidelines for onsite labour and worker management and welfare during construction	District Labour Commissioner	Contractor	Applicable
25	The Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013	If acquisition of land/ asset/ loss of livelihood for acquisition of land is involved.	GoI and GoM	EAP/PIU-PWD	Applicable
26	The STs and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006	Consent of community is required to procure forest clearance for a project if the sub- project requires diversion of forest land where rights of Primitive Tribal Groups or Primitive Agricultural Community may get hampered	Ministry of Tribal Affairs	EAP/PIU-PWD	Not Applicable as no forest land will be diverted for the project
27	The Scheduled Castes and the Scheduled Tribes (Prevention of Atrocities) Act, 1989	Act protects scheduled castes/ scheduled tribes from (a) wrongful occupation or cultivation of any land owned by them or allotted to them or lands notified by any competent authority to be allotted to, a member of a Scheduled Caste or a Scheduled Tribe and transfer of land allotted to scheduled castes/ scheduled tribes; (b) wrongful dispossession of a member of a Scheduled Caste or a Scheduled Tribe from his land or premises or interference with the enjoyment of his rights over any land, premises or water; and (c) from any	Ministry of Tribal Affairs	EAP/PIU-PWD	Applicable as the project area is inhabited by the tribal people (Kabui Clan of Naga Tribe)

S. No	Regulation	Purpose	Regulatory Authority	Responsibility for Obtaining Clearance/ Consent	Remarks
		forceful removal/causing of a Scheduled Caste or a Scheduled Tribe to leave his house, village or other place of residence			
28	The Antiquities and Art Treasures Act, 1972 and Indian Treasure Trove Act, 1878, Amended in 1949	In case of sudden encounter with anything valuable at any stage of project cycle.	District Collector/Commissioner	PMU/PIU	Applicable
29	Contract Labour (Regulation and Abolition) Act, 1970	Regulation to manage and registration of contractual labour.	Ministry of Labor & Employment	Contractor	Applicable
30	Child Labour (prohibition and Regulation) Act, 1986;	Aims to eradicate any kind of child abuse in the form of employment and prohibit the engagement of children in any kind of hazardous employment, who have not completed 14 years of age.	Ministry of Labour & Employment	Contractor	Applicable
31	Minimum Wages Act, 1948	The provision of the Minimum Wages Act, 1948 applies to every employer that employs more than 1000 employees in a state.	Ministry of Labour & Employment	Contractor	Applicable
32	Workmen Compensation Act, 1923	This Act provides for payment of compensation to workmen (or their dependents) in case of personal injury caused by accident or certain occupational diseases arising out of and in the course of employment and resulting in disablement or death.	Ministry of Labour & Employment	Contractor	Applicable
33	Payment of Wages Act, 1936;	This Act applies to all persons employed, whether directly or through contractors, in a factory or certain specified industrial or other establishments.	Ministry of Labour & Employment	Contractor	Applicable
34	Equal Remuneration Act, 1979	The Act is a Central Legislation and applies to the whole of India. The objective of the Act is to provide for protection against discrimination of women workers on the ground of sex, about the payment of equal remuneration in the matter of employment.	Ministry of Labour & Employment	Contractor	Applicable

S. No	Regulation	Purpose	Regulatory Authority	Responsibility for Obtaining Clearance/ Consent	Remarks
35	Inter-State Migrant Workmen's (Regulation of Employment & Conditions of Service) Act, 1979	Enforced during constriction	Ministry of Labour & Employment	Contractor	Applicable

Table 9: Permissions/Clearances Required for the Project

S. No.	Permissions/Clearances	Acts/Rules/Notifications/Guidelines	Concerned Agency	Responsibility	Time required
A. Pre-Construction Stage					
1	Permission for cutting of trees.	Forest Conservation Act (1980) Procedural Guidelines developed by the Department of Environment, Government of Manipur under the orders of the Honorable High Court Tree removal will be guided as per state government rules.	State Forest Department for trees felling in forest areas and non-forest Areas (Compensatory tree plantation to be done as per the direction of Forest Department)	Public Works Roads Department, Manipur	Approx. 3 months
2	Permission to construct along Archaeological Monuments in Study Area if required by ASI/NMA (no significant activity or vibration intensive activity planned within 300 m of these monuments, works to be carried out are only improvements works within the existing RoW)	To protect the Historical/cultural ASI notified monuments/sites	NMA/ASI	Public Works Roads Department, Manipur	NA
B. Implementation Stage					
1	Consent to establish and operate hot mix plant, Crushers, Batching plant, quarry, STP installation (if any)	Air (Prevention and Control Pollution) Act, 1981, Water (Prevention and Control of Pollution) Act 1974	Manipur State Pollution Control Board (To be obtained before installation)	Contractor	Approx. 3 months
2	Authorization for disposal of hazardous waste and Bio-medical waste	Hazardous Waste (Management and Handling) Rules 2016 and its amendments and Bio-medical Waste Management Rules 2016	Manipur State Pollution Control Board (To be obtained before installation)	Contractor	Approx. 3 months
3	Pollution Under Control Certificate	Central Motor and Vehicle Act of 1988	Department of Transport, Government of Manipur authorized. testing centers	Contractor	Can be. obtained instantly from verified PUC centers
4	Employing Labour/Workers	The Building and Other Construction Workers (Regulation and Employment Conditions of Service) Act, 1996 and Contractual Labour Act 1970	Ministry of Labour & Employment	Contractor	Approx. 3 months
5	Extraction of Ground Water	Guidelines to regulate and control ground water extraction in India, 2020	CGWA	Contractor	Approx. 3 months
6	Construction over a surface water body and	--	Irrigation Department,	Contractor	Approx. 3

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S. No.	Permissions/Clearances	Acts/Rules/Notifications/Guidelines	Concerned Agency	Responsibility	Time required
	Extraction of Surface Water		Water Resources Department, and IWAI (for declared national waterways only)		months

2.4 International Treaties and Relevance to the Sub-Project

India has signed most international treaties, conventions and protocols on environment, pollution control, bio-diversity conservation, and climate change, including the RAMSAR Convention, the Rio de Janeiro Convention on Biodiversity Diversity, and the Kyoto Protocol on Climate Change. There are 20 major global Multilateral Environmental Agreements (MEAs) to which India is a signatory and are discussed in the sections below:

2.4.1 Ramsar Convention on Wetlands, 1971

The Convention on Wetlands (Ramsar, 1971) is an intergovernmental treaty whose mission is “the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world”. The Convention on Wetlands is an intergovernmental treaty adopted on 2 February 1971 in the Iranian city of Ramsar, on the southern shore of the Caspian Sea. Thus, though the name of the Convention is written “Convention on Wetlands (Ramsar, Iran, 1971)”, it has come to be known popularly as the “Ramsar Convention”. Ramsar is the first of the modern multilateral environmental agreements on the conservation and sustainable use of natural resources, and compared with more recent ones, its provisions are relatively straightforward. It is unusual in establishing commitments at site level as well as at the level of national policy. Closest Ramsar wetland to the project is Loktak lake which is approx. 16 km from the project area in SW direction. Other than Ramsar wetland, Important wetland identified by Government of Manipur in Imphal East and West Region are given below. However, none of these wetlands are notified till date. Two wetlands (Yaral Pat & Waithou-Phumnom Pat Wetland of Imphal East District) are under process of notification by Manipur State Wetland Authority, Government of Manipur. The proposed project alignment will not impact the Ramsar wetland or notified wetland by State of Manipur.

Table 10: Important Wetlands in Imphal East and West Region by Government of Manipur

S. No.	Name	Lake Type	District	Area-sq.km
1.	Tankha Pat	Natural	Imphal West	1.29
2.	Karam Pat	Natural	Imphal West	0.57
3.	Karang Pat	Natural	Imphal West	0.50
4.	Yaral Pat	Natural	Imphal East	0.4
5.	Heingang Pat	Natural	Imphal East	2.75
6.	Lempel Choi Pat, Andro	Natural	Imphal East	0.55
7.	Sannapat, Andro	Natural	Imphal East	0.49

Lamphel Pat Wetland falls in the project area in Imphal West region; however, this wetland is yet not notified and does not also fall in the list of Ramsar Protected wetland. The wetland stores water drained from the Lamphel Reserve Forest and the Nambul River. It brought down the temperature and controlled or mitigated flood by storing the excess water from Nambul River. Now all these have been affected by uncontrolled anthropogenic activities and negligence. However due to siltation, human encroachment and dumping of waste materials in the wetland, the Lamphelpat has lost its original form and is in bad condition. Siltation and dumping of waste materials have made it shallower and water plants and weeds have wholly covered the wetland. Wetland once was lush green and supported wide variety of flora and fauna including Kombirei which is an endangered flowering plant of Manipur. However due to the encroachment and dumping of waste, flora and fauna of the wetland has been drastically impacted. Heingang pat, also known as Ibudhou Marjing’s Pat, is another wetland in the project area. It was also once a serene wetland and people used canoes to navigate in the water and fish, he said. Marjing Ching is in the north of the wetland, bounded by Heingang Khong and Hannabi Ching in the south and southeast side respectively. Heingangpat has about 120 Paris in area, but only 40 Paris are remaining as wetland. About 50 percent of the total wetland area has been turned into fish farms. Other than this many water bodies, streams and nallahs existing in Imphal has been encroached for various development. No expansion or acquisition of land is proposed to be undertaken in the wetland region or any such waterbody for this project.

2.4.2 Convention on Biological Diversity, 1992

The Convention on Biological Diversity (CBD), known informally as the Biodiversity Convention, is a multilateral treaty. The convention has three main goals: the conservation of biological diversity (or biodiversity); the sustainable use of its components; and the fair and equitable sharing of benefits arising from genetic resources. Its objective is to develop national strategies for the conservation and sustainable use of biological diversity, and it is often seen as the key document regarding sustainable development. The convention was opened for signature at the Earth Summit in Rio de Janeiro on 3-14th June 1992 and entered into force on 29 December 1993. The United States is the only UN member state which has not ratified the convention. It has two supplementary agreements, the Cartagena Protocol and Nagoya Protocol. The Cartagena Protocol on Biosafety to the Convention on Biological Diversity is an international treaty governing the movements of living modified organisms (LMOs) resulting from modern biotechnology from one country to another. It was adopted on 29 January 2000 as a supplementary agreement to the CBD and entered into force on 11 September 2003.

There are several endangered and critically species in State of Manipur, however the project area being urban, the project region does not house any significant flora & fauna. Convention on Biological Diversity, 1992 is applicable for the conservation of the RET species present in the area.

2.4.3 Convention on the Conservation of Migratory Species of Wild Animals, 1979

The Convention on the Conservation of Migratory Species of Wild Animals, also known as the Convention on Migratory Species (CMS) or the Bonn Convention, is an international agreement that aims to conserve migratory species throughout their ranges. The Agreement was signed under the auspices of the United Nations Environment Programme and is concerned with conservation of wildlife and habitats on a global scale. The CMS Family covers a great diversity of migratory species. Imphal valley is one of the most fertile regions of Manipur and support various water bodies in form of rivers, wetland, nallahs, streams etc. which provide habitat to various kind of flora and fauna including avifauna. Various migratory birds are reported close to the waterbodies during wintering time especially near the wetlands Some of those bird species are Ferruginous duck (Ferruginous Pochard); Garganey; Northern Shoveler; Northern Pintail; Green-winged Teal; Ferruginous Duck; Glossy Ibis; Brown Shrike; Paddy field Warbler; Bluethroat; Siberian Stonechat; Citrine Wagtail; White Wagtail; Western/Eastern Yellow Wagtail, Lesser Whistling Duck; Little Grebe; Eurasian Moorhen; Eurasian Coot; Grey-headed Swamphen; White-breasted Waterhen; Pheasant-tailed Jacana; Grey Heron; Great Egret; Little Egret; Cattle Egret; Black-headed Ibis; Indian Pond-Heron; White-throated Kingfisher; Striated Grassbird; Barn Swallow; Red-vented Bulbul; Asian Pied Starling; Common Myna; Oriented Magpie-Robin; Eurasian Tree Sparrow; Paddy-field Pipit.

Migratory birds are found mostly in the peripheral areas of the valley, wetlands and in paddy fields. The project, however, is in the urban areas and no migratory birds are found around the project area.

2.4.4 Kyoto Protocol, 1997

The Kyoto Protocol was an international treaty which extended the 1992 United Nations Framework Convention on Climate Change (UNFCCC) that commits state parties to reduce greenhouse gas emissions, based on the scientific consensus that (part one) global warming is occurring and (part two) that human-made CO₂ emissions are driving it. The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. There were 192 parties (Canada withdrew from the protocol, effective December 2012) to the Protocol in 2020. The Kyoto Protocol implemented the objective of the UNFCCC to reduce the onset of global warming by reducing greenhouse gas concentrations in the atmosphere to "a level that would prevent dangerous anthropogenic interference with the climate system" (Article 2).

The Kyoto Protocol applied to the seven greenhouse gases listed in Annex A: carbon dioxide (CO₂), Methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF₆), Nitrogen trifluoride (NF₃). Nitrogen trifluoride was added for the second compliance period during the Doha Round. Proposed project will overall reduce emission of CO₂, and

which further result in less impact of greenhouse gas.

2.4.5 Vienna Convention for the Protection of the Ozone Layer

The Vienna Convention for the Protection of the Ozone Layer is a multilateral environmental agreement signed in 1985 that provided frameworks for international reductions in the production of chlorofluorocarbons due to their contribution to the destruction of the ozone layer, resulting in an increased threat of skin cancer. During the 1970s, research indicated that man-made chlorofluorocarbons (CFCs) reduce and convert ozone molecules in the atmosphere. CFCs are stable molecules composed of carbon, fluorine, and chlorine that were used prominently in products such as refrigerators. The threats associated with reduced ozone pushed the issue to the forefront of global climate issues and gained promotion through organizations such as the World Meteorological Organization and the United Nations. The Vienna Convention was agreed upon at the Vienna Conference of 1985 and entered into force in 1988. The Vienna Convention provided the framework necessary to create regulatory measures in the form of the Montreal Protocol. Proposed project will reduce emission of CO₂, and which further result in less impact of greenhouse gas.

2.4.6 Montreal Protocol on Substances that Deplete the Ozone Layer

The international treaty called The Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal Protocol) is gradually eliminating the production and consumption of ozone depleting substances to limit their damage to the earth's ozone layer. The Montreal Protocol is signed by 197 countries – the first treaty in the history of the United Nations to achieve universal ratification – and is considered by many the most successful environmental global action. The United States signed the Montreal Protocol in 1987 and has been a leader in guiding the successes of the treaty. Over the past 30 years, EPA has been a proud contributor to the broad coalition that developed and implemented flexible, innovative, and effective approaches to protect the stratospheric ozone layer. In 1995, the United Nations named September 16 the International Day for the Protection of the Ozone Layer, also known as World ozone day. Proposed project will reduce the emission of CO₂, and which further result in less impact of greenhouse gas.

2.4.7 The Kigali Agreement amendment, 2016

The Kigali Amendment to the Montreal Protocol is an international agreement to gradually reduce the consumption and production of hydrofluorocarbons (HFCs). It is a legally binding agreement designed to create rights and obligations in international law. The Montreal Protocol was originally created to preserve and restore the ozone layer, and it worked. The Protocol was an agreement between participating countries to phase out certain ozone depleting gases. HFCs were used to replace the substances banned in that agreement because they have zero impact on the ozone. However, HFCs are powerful greenhouse gases that contribute to climate change, so this amendment adds HFCs to the list of chemicals that countries promise to phase down. Proposed project will reduce the emission of CO₂, and which further result in less impact of greenhouse gas.

Summary of the international treaties/convention/declaration on environment are given below in Table 11

Table 11: International Treaties/ Conventions/ Declarations on Environment

Sl. no	International Treaties/ Conventions/ Declarations	Description
1.	United Nations Conference on the Human Environment - Stockholm 1972	To coordinate sustainability environment global efforts and safeguard to the promote natural
2.	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1975	Its aim is to ensure that international trade in specimen of wild animals and plants does not threaten their survival

Sl. no	International Treaties/ Conventions/ Declarations	Description
3.	Ramsar Convention, 1971, 1975	The Convention on Wetlands is the intergovernmental treaty that provides the framework for the conservation and wise use of wetlands and their resources
4.	The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes, 1989	The Convention aims to protect human health and the environment against the adverse effects resulting from the generation, transboundary movements and management of hazardous wastes and other wastes
5.	United Nations Conference on Environment and Development (UNCED), 1992, 2002	The conference had three objectives (Agenda – 21, Rio Declaration and Millennium Development Goals), to secure renewed political commitment for sustainable development, to assess the progress and implementation gaps in meeting previous commitments, and to address new and emerging challenges
6.	Framework Convention on Climate Change (FCCC), 1992 Kyoto Protocol, 1997	It operationalizes the United Nations Framework Convention on Climate Change by committing industrialized countries to limit and reduce greenhouse gas (GHG) emissions in accordance with agreed individual targets
7.	The Vienna Convention, 1985 Montreal Protocol on Ozone depleting substances, 1992	It sets binding progressive phase out obligations for developed and developing countries for all the major ozone depleting substances, including chlorofluorocarbons (CFCs), halons and less damaging transitional chemicals such as hydrochlorofluorocarbons (HCFCs)
8.	Convention on Biological Diversity, 1992 Cartagena Protocol on Biosafety, Ratified on 17th January, 2003	It is an international treaty governing the movement of living modified organism (LMO) resulting from modern biotechnology from one country to another
9.	Convention to Combat Desertification, 1996	It is the only binding international agreement linking environment and development to sustainable soil management
10.	Rotterdam Convention on Prior Informed Consent Procedure for certain Hazardous Chemicals in International Trade, 2002	It is a multilateral treaty to promote shared responsibilities in relation to importation of hazardous chemicals

2.5 AIIB Environmental & Social Framework Requirements

AIIB recognizes that environmental and social sustainability is a fundamental aspect of achieving development outcomes consistent with its mandate to support infrastructure development and interconnectivity.

- AIIB screens and categorizes each proposed project based on their environmental and social risks and impacts.
- Identifies actions to avoid, minimize, mitigate and/or offset impacts.
- Includes provisions for disclosure of information and public consultation.
- Every project should have Grievance Redress Mechanism (GRM) accessible to the general public/ community.

The Environmental and Social Framework, 2016 and its amendment Feb 2019/Nov 2022 of AIIB, includes an Environmental and Social Policy (ESP) and Environmental and Social Standards (ESSs). The key objectives of the ESF are.

- Ensure the environmental and social soundness and sustainability of each project.
- Support integration of environmental and social aspects of projects into the decision-making process by all parties
- The Environment and Social Framework applies to all projects.

The IEE study is being carried out in accordance with the AIIB's ESP which sets forth mandatory environmental and social requirements for each Project and ESSs which set out more detailed mandatory environmental and social requirements relating to the following AIIB ESF November 2022

- ESS 1: Environmental and Social Assessment and Management
- ESS 2: Involuntary Resettlement
- ESS 3: Indigenous Peoples

Based on the proposed alignment and reconnaissance survey outcome, the ESS I and ESS 2 are applicable for this project.

ESS 1 (Environmental and Social Assessment and Management). Aims to ensure the environmental and social soundness and sustainability of projects and to support the integration of environmental and social considerations into the Project decision-making process and implementation. ESS 1 is applicable if the Project is likely to have adverse environmental risks and impacts or social risks and impacts (or both). The scope of the environmental and social assessment and management measures are proportional to the risks and impacts of the Project. ESS 1 provides for both quality environmental and social assessment and management of risks and impacts through effective mitigation and monitoring measures during the course of Project implementation. The ESS 1 defines the detailed requirements of the environmental and social assessment to be carried out for any project to be financed by the AIIB.

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

Category A: A Project is categorized A if it is likely to have significant adverse environmental and social impacts that are irreversible, cumulative, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works and may be temporary or permanent in nature. The Bank requires the Client to conduct an environmental and social impact assessment (ESIA) or equivalent environmental and social assessment, for each Category A Project and to prepare an ESMP or ESMPF, which is included in the ESIA report for the Project. The ESIA for a Category A Project examines the Project's potentially negative and positive environmental and social impacts, compares them with those of feasible alternatives (including the "without Project" situation), and recommends any measures needed to avoid, minimize, mitigate, or compensate for adverse impacts and improve environmental and social performance of the Project.

Category B: A Project is categorized B when: it has a limited number of potentially adverse environmental and social impacts; the impacts are not unprecedented; few if any of them are irreversible or cumulative; they are limited to the Project area; and can be successfully managed using

good practice in an operational setting. The Bank requires the Client to conduct an initial review of the environmental and social implications of the Project. On the basis of this review, the Bank, in consultation with the Client, determines the appropriate instrument for the Client to assess the Project's environmental and social risks and impacts, on a case-by-case basis. The Bank may determine that an environmental and social assessment or another similar instrument is appropriate for the Project. The scope of the assessment may vary from Project to Project, but it is narrower than that of the Category A ESIA. As in the case of a Category A Project, the assessment examines the Project's potentially negative and positive environmental impacts and recommends any measures needed to avoid, minimize, mitigate, or compensate for adverse impacts and improve environmental performance of the Project.

Category C: A Project is categorized C when it is likely to have minimal or no adverse environmental and social impacts. The Bank does not require an environmental and social assessment but does require the Client to conduct a review of the environmental and social implications of the Project.

Category FI: A Project is categorized FI if the financing structure involves the provision of funds to or through a financial intermediary (FI) for the Project, whereby the Bank delegates to the FI the decision-making on the use of the Bank funds, including the selection, appraisal, approval and monitoring of Bank-financed projects. The Bank requires the FI Client, through the implementation of appropriate environmental and social policies and procedures, to screen and categorize projects as Category A, B or C, review, conduct due diligence on, and monitor the environmental and social risks and impacts associated with the Bank financed projects, all in a manner consistent with this ESP. A Project categorized as FI is also subject to: (a) the Environmental and Social Exclusion List and applicable host country national laws for all the Bank-financed projects; and (b) the applicable ESSs for the Bank-financed projects that are classified as Category A projects (and if the Bank so determines, some or all of the Bank-financed projects that are classified as Category B projects).

ESS 2 (Involuntary Resettlement). Is applicable if the Project's screening process reveals that the Project would involve Involuntary Resettlement (including Involuntary Resettlement of the recent past or foreseeable future that is directly linked to the Project). Involuntary Resettlement covers physical displacement (relocation, loss of residential land or loss of shelter) and economic displacement (loss of land or access to land and natural resources; loss of assets or access to assets, income sources or means of livelihood) as a result of: (a) involuntary acquisition of land; or (b) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers such displacement whether such losses and involuntary restrictions are full or partial, permanent or temporary. The ESS 2 defined detailed requirements of resettlement planning of the projects involving involuntary resettlement. Project development is majorly confined to existing RoW of the roads but at some places, some land acquisition is required and thus the ESS is applicable on the project. Social Consultant has been appointed by PWD to identify important social aspects such as places of worship, other community assets, socio-economic set up, related to land acquisition and resettlement. The Social Consultant shall prepare a Social Impact Assessment and a Resettlement Action Plan (RAP) in accordance with AIIB's ESP and ESS 2.

ESS 3 (Indigenous Peoples). It is applicable to the project involving the impact on indigenous people. There are no indigenous tribe but tribal population inhabitants the area and thus this ESS also is applicable to the project and warrants preparation of Tribal Management Plan. Major ST community found in the project area is Kabui Clan of Nagar Tribes (Rongmei). But these tribes are not indigenous and are working within the mainstream community in project region.

2.6 Category of the Project as per AIIB's Framework & MOEF&CC Notification 2006 and amendments

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

Clearances from MoEF&CC/SEAC/SIEEA.

The proposed project covered improvement of multi-level of roads with total length are 547.281 km. Based on the topographic survey it has been reported that the maximum elevation is 786.00 meters above mean sea level (MSL). Thus, as per EIA Notification, 2006, proposed project does not require environmental clearance.

The project road has been evaluated and it is found that all the three ESS, I, e ESS1, ESS 2 and ESS 3 are applicable on the project and the project is categorized as Category B project in accordance with the AIBB Environmental and Social Policy (ESP) and Environmental and Social Standards (ESS). This categorization was primarily based on the following considerations:

- Project road is an existing road for most of the stretch and upgrading activities are limited to the available RoW with minimal land acquisition at some locations,
- Anticipated impacts from road upgrading are mostly site-specific and easily mitigated through proper design and good construction practices, majority of the activities have short-term duration impacts during construction phase.
- Project road does not fall in the core zone of any protected areas in the state.
- Moderate impact on local and regional biodiversity i.e., habitat fragmentation, degradation and loss, endemic and invasive species, over exploitation of biological resources, hydrological changes, increase in pollution load in water bodies, tree felling involve, and induced climate impact are anticipated.
- Impact involving social issues i.e., involuntary resettlements, temporary loss of livelihoods, impact on indigenous peoples, impact on community and households, Vulnerable groups, etc. at only few locations.
- Moderate Impact on land and natural resource, change in land-use patterns, Cultural resource, land acquisition, structure affected, etc.

3. PROJECT DESCRIPTION

3.1 Introduction

Project involves improvement of existing state road network of 547.281 km Greater Imphal Region of Manipur State to improve the socio-economic conditions in the region and reduce the required recurring cost for period maintenance of the roads. This chapter details the project description for proposed project, project components, amenities required, implementation schedule and project cost.

3.2 Project Intent and Area

The proposed project area is the Greater Imphal Region comprising of Imphal West and Imphal East Region. Imphal city is the capital of the Manipur state, and the economy of the state is lifeline of the States' Economy. Road infrastructure is one of the major factors which influences the economy of the any area. The proposed project involves upgradation of the existing street road network. The existing street road network currently is not in good condition and comprises of bituminous roads with flexible pavements. The area receives heavy rainfall, and the roads get damaged easily due to heavy rains. Due to these damages, it is required to undertake the periodic maintenance and repair works. State Road is mainly comprised of the State Highways, MDRs, ODRs and IVR. This poor condition of the roads impacts the quality of life of people in terms of travel time, traffic congestion, wastage of fuel, poor air quality, health hazards due to poor air quality etc.

Project area, i.e., Greater Imphal region is the part and parcel of Imphal Valley (also Manipur Valley), a pull-apart basin. Area is flat land sloping from north to south and drained by Imphal, Iril, Kongba, Nambul and Naga Rivers. The aforesaid rivers are the primary drains which carry most of the water of the Greater Imphal area. There are also abandoned river channels locally called Turel Amanbi (Turel Amanbi means old river) of Imphal river. Waishel Maril is the temporary stream draining the southwestern part of the Greater Imphal. Imphal River is the one of the upstream of Irrawady River System and Nambul River empties to the Loktak Lake. The existing drainage in the project area is not in good condition and not connected properly with primary drain. There is missing link of drainage system along the project roads. At various locations, the drain is choked and not functioning properly. The efforts to provide better roads are not only focused on improving the pavement (overlay and road reconstruction) but also in planning the construction of subsurface drainage infrastructure to be able to drain water that can weaken the pavement of the road from within. Land use along the project road is urban settlements and water bodies majorly. Project roads RoW varies between 3.33-22.25. Many places, RoW is also encroached and there exist various structures within RoW. In addition, approx. 2 CPRs² and 5345 tees are falling within project Road RoW and will also be impacted (partially or fully) due to the project development.

3.3 Project Components

Broadly proposed project has following three components. Salient features of the proposed project are provided in Table 3.1. Details of the project roads, bridges and proposed, c/cross sections for the different roads and bridges are attached as Annexure 1.

- (i) Upgradation of about 483.388 km of existing roads into Cement Concrete roads including construction of lined drain, Utilities carrying chamber (to accommodate the various utilities), Cross utility duct, road safety work, junction development, walkway, and street lighting. The detail of proposal is mentioned below,

State Highways (18.120 km) {*White Topping – 8.269 Kms, Short Panel Concrete – 9.851 Kms*}

Major District Roads (68.249 km), {*Pavement Quality Concrete- 6.367 Kms, Short Panel Concrete – 61.882 Kms*}

Other District Roads (14.480 Km), {*Pavement Quality Concrete- 0.717 Kms, White Topping – 1.107*}

² As per survey till date

Kms, Short Panel Concrete – 12.656 Kms}

Internal Village Road/ local street (382.539 km) {*White Topping – 0.239 Kms, Short Panel Concrete – 205.657 Kms, Interconnected block pavement- 176.643 Kms*}

- (ii) Upgradation of about 63.893 Km {*State Highways (2.269 Kms), Major District Road (3.743 Kms), Other District Road (5.312 Kms) and Internal Village Roads (52.569 Kms)*} of existing road running along the Riverbank with provision of New Bituminous layers overlay over FDR (Full depth reclamation) of existing roads including construction of lined drain, Utilities carrying chamber, Cross utility duct, road safety work, junction development, walkway, and street lighting.
- (iii) Construction of new bridges (26 Nos.), Rehabilitation and maintenance of old bridges (50 Nos.) and construction of cross drainage (65 Nos.) in the project area to increase the road connectivity on closer intervals, maintain the existing bridge for longer span of time and to enhance the drainage capability.

Table 12: Summary of Proposed Improvement Works

Sr. No.	Description	Improvement Proposals
1	Design Speeds	For SH: 50-60 Kmph, MDR: 50-60 Kmph, Collector street/ ODR: 40 Kmph, Local Street /IVR :30 Kmph
2	Design Length	The project has a finalized length of 547.281 Km. <ul style="list-style-type: none"> • 172.858 Km in Imphal West, • 141.032 Km in Imphal East Package A • 122.209 Km in Imphal East Package B • 111.182 Km in Highway South Division
	Pavement	Roads to be improved as Short Panel Concrete with Profile correction = 166.883 Kms Short Panel Concrete with FDR = 123.163 Conventional PQC over DLC = 7.084 Kms White Topping on 4 lanes = 9.615 Kms Interlocking Concrete Block Pavement = 176.643 Kms Flexible Pavement = 63.893 Kms
3	Proposed Cross Sections	A total of 17 Typical cross sections have been prepared detailing about the PROW, Carriageway, Land Use and Type of pavement proposed.
4	Major junction	There are total of 13 major junctions in which, <ul style="list-style-type: none"> • 8 in Imphal West, • 2 in Imphal East Package A • 3 in Imphal East Package B • 0 in Highway south division.
5	Minor junction	There are total of 552 minor junctions in which, <ul style="list-style-type: none"> • 266 in Imphal West, • 66 in Imphal East Package A • 74 in Imphal East Package B • 146 in Highway south division.
6	Footpath	To be Provided based on availability of right of way
7	Streetlight	Solar Powered Street light to be provided along the roads
8	Bridges	The bridges are to be, Reconstructed /New Constructed (parallel to existing old bridges)- 26 Nos. Repair and Rehabilitation- 50 Nos.

Sr. No.	Description	Improvement Proposals
9	Culverts	The total 65 numbers of Box Culvert (1.2x1.2 m) size cross drainage is considered.
10	Lined Drain	Both Side RCC Cover Drain/Walkway and PCC Side Drain have been proposed all along the project stretch. Except there is no provision for lined drains in open areas.
11	Utility Chambers	Utility chambers has been proposed for single side and both side of the road for carrying local utilities. Also, cross utility duct (300mm) has been provided at every 75m interval for crossing of utilities in future
12	Road Safety	Road safety- marking, pavement marker, retroreflective tape, bollards, cautionary and mandatory road signages has been provided

3.3.1 Investigations Undertaken

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

- topographic surveys.
- traffic surveys.
- road and pavement condition survey and inventory.
- culverts and bridges condition survey and inventories.
- hydrology studies for new bridge structures.
- Geotechnical investigations & subsoil exploration for structures; and
- Existing utilities surveys.

3.3.2 Proposed Interventions Under the Project

Since the project constitutes of approx. 547.281 km of road and each road is unique due to several factors like its feature, service, traffic handling, level of service, constructability etc., different methods of improvements are considered as per the site conditions. Suggested improvement measures are provided below:

- Curvature improvement and realignment: Curve improvement and realignment is proposed at a limited location as road network lies in heavy built-up area. Curve improvement is proposed at the locations wherever possible without affecting the existing habitants unless it is utmost necessary and major and minor intersections.
- Widening: Widening is proposed throughout the road network wherever the minimum required width of 5.75 m was not available. The majority of locations, width is available. Approx 13.28805 ha of land is required for widening purposes in patches.
- Improvement of junctions: There are many junctions due to dense road network and the junctions at all locations are proposed to be improved especially in terms of safety measures like, traffic warning signages in advance, speed reducing measures, road markings, railings, etc. to vigilant the driver approaching the school, hospital, mandir/masjid/church etc.
- Provision of Drainage: In the project RCC covered drains and PCC side drains have been proposed along the project road.
- Provision of Utility Chamber along the road: Utility chambers have been proposed for single side and both side of the road for carrying local utilities. Also, cross utility duct (300mm) has been provided at every 75m interval for crossing of utilities in future.
- There are 85 bridges in the scope of the project road network, out of which 50 bridges are proposed for repair and rehabilitation and 26 bridges for proposed for reconstruction/new

construction at shifted location, 8 bridges and under construction and 01 bridge is newly constructed.

- Provision of Cross Drainage Structures: It is proposed to provide 65 new culverts in addition to the existing culverts (Box Culvert (1.2x1.2 m) size).
- Road Safety Measures: Road safety features like Road signages, Road markings, delineators, road studs, crash barriers, rumble strips, pedestrian guard rails and street lighting are proposed to be provided.
- Pavement Improvement: It is proposed to provide rigid pavement throughout the project road network except for the roads along the riverbank which will be flexible pavement after improvement also.

3.3.3 Proposed Pavement Improvement Options

Rigid Pavement is proposed for almost all the project road network as per traffic, design CBR values except for the roads along the rivers where it is proposed to provide flexible pavement only. Following options have been proposed for improvement of the project roads depending on the site conditions.

Pavement design for new rigid pavement has been carried out in accordance with IRC: 58-2015, IRC :15-2017 and IRC: SP:76-2015. Flexible Pavement is also recommended for the roads which runs along the river and design has been carried out based on IRC:37-2018 and for the dead-end roads interlocking pavement concrete blocks has been proposed whose design recommendation is taken from IRC: SP:63-2018. Seven types of pavements have been proposed for the project.

1. **Pavement 1 (For SH/MDR/ODR):** Short Panel Concrete of 170 mm thickness laid over the existing bituminous surface by correcting the undulations and repairing the potholes and cracks (if applicable) by providing 75 mm of Bituminous Macadam.
2. **Pavement 2 (For SH/MDR/ODR):** Short Panel Concrete of 170 mm thickness laid over 150 mm of Full Depth Reclamation Layer (FDR) used for stabilizing the road with poor conditions such as no bitumen layer, exposed aggregate layer, excessive cracks, and settlement in the road.
3. **Pavement 3 (For Important roads with heavy Traffic):** 200 mm of Pavement Quality Concrete of M40 grade Concrete, laid over 150 mm of Dry Concrete Layer of 150 mm.
4. **Pavement 4 (For IVR Roads):** Short Panel Concrete of 130 mm thickness laid over the existing bituminous surface by correcting the undulations and repairing the potholes and cracks (if applicable) by providing 75 mm of Bituminous Macadam.
5. **Pavement 5 (For IVR Roads):** Short Panel Concrete of 130 mm thickness laid over 150 mm of Full Depth Reclamation Layer (FDR) used for stabilizing the road with poor conditions such as no bitumen layer, exposed aggregate layer, excessive cracks, and settlement in the road.
6. **Pavement 6 (For IVR Roads):** Interlocking concrete paver blocks of 80 mm thickness having M40 grade of concrete is laid over a compacted 30 mm of sand mortar (1:10) layer.
7. **Pavement 7 (For Roads along riverbank):** Flexible pavement having a bitumen concrete layer of 30 mm, laid over 50 mm of Dense Bound Macadam which will be constructed over 300 mm FDR layer. A stress absorbing membrane is proposed between the DBM and FDR layer.

The soil has been consolidated over the decades and will provide a firm base for construction of road if the underneath soil is not disturbed. The Minimum CBR for design is considered as 4 % for rigid pavement and 8% for flexible pavement.

The construction by excavating the existing material is not recommended as it might lead to settlement, the pavement proposal is done in such a way that there is minimum disturbance to the existing soil.

Level of Service

The project deals with the strengthening/reconstruction of pavement, moreover the roads pass through heavily built-up areas and to minimize the R&R and Land Acquisition, the roads are proposed within existing available roadway width.

No capacity improvement of Project roads is considered. However, the existing carriageway is less than standard single lane and intermediate lane and the improvement of roads as per codal standards and to be built from property line to property line of houses this will result in increase in road capacity.

Generally, the urban roads are designed for “C” Level of Service which represent stable flow condition. Design service volume for different categories of the project roads is given below.

Table 13: Service Volume and Carriageway Configuration

S. No.	Type of Carriage Way	Total Design Service Volume for Different Categories of Urban Road		
		Arterial	Sub Arterial	Collector
1	2- Lane (One Way)	2400	1900	1400
2	2- Lane (Two Way)	1500	1200	900
3	3- Lane (One Way)	3600	2900	2200
4	4- Lane Undivided (Two Way)	3000	2400	1800
5	4- Lane Divided (Two Way)	3600	2900	--

3.3.4 Design Standards for the Project Road

The Indian Road Congress (IRC) design standards will be followed in consultation with ToR, while formulating the road design standards. As the project road networks pass mainly through plain terrain, the ruling design speeds considered for the different types of the road are 50-60 kmph for SH, 50-60 kmph for MDR, 40 kmph for collector streets and 30 kmph for local streets. The purpose of formulation of design standards is to avoid any inconsistency in design during road construction and operation.

3.3.5 Pre-Project Development Works

Utility diversion

Utilities falling within RoW may need to be diverted away in advance to avoid damage to such utilities during the excavation/ construction phase. Electric Post, Lamp Post, Telephone Pole, Transformer, HT crossing, water pipelines etc. has been observed on project road. For identification of underground utilities, Ground Penetration Radar based survey is used. Utility shifting shall be carried out through the concerned agency and after obtaining their permission. Alternate shall be developed for the stakeholder's prior disruption of the utilities. Further public shall be prior informed about the disturbance of utilities and some alternative arrangement shall be made to minimize the impact. Utility ducts along the roads and cross utility ducts are being developed as project components and the UG utilities can be shifted to the ducts.

Demolition Works

Structures which are falling within the project RoW shall be removed/demolished. No of impacted structures and the community property resources as per survey conducted till date is 493 which will be impacted due to the project³. Further CPR existing along the project roads is given below.

Table 14: Detail of Sensitive Location Adjacent to PIA

Sensitive Location Adjacent to PIA	Imphal West	Imphal East	Highway South Division	Total
School	50	156	20	226
College	12	11	4	27
Library	4	2	2	8

³ Details can be referred from SIA report.

Health Centre/Clinic	10	7	3	20
Hospital	18	7	2	27
Temple	7	5	1	13
Mosque	1	10	-	11
Church	5	12	2	19
Police Station	5	3	-	8
Cremation Ground/Burial Ground	60	44	30	134
Total	172	257	64	493

Site Clearing and Vegetation Removal

Clearing and grubbing will be carried out before commencement of construction works. Project Right of Ways has approx. 5345 trees which are required to be removed or transplanted. For each tree cut/transplanted, compensatory afforestation works will be carried out as per guideline of State Forest department/ Concerned Divisional Forest Offices.

3.3.6 AIIB Funded Components

AIIB will contribute 80% of funding requirement for the project. Components to be covered under AIIB funding include all proposed interventions except land acquisition cost and other project components falling in 20% fraction to be funded by State Government of Manipur.

3.4 Existing Traffic and Traffic Projections

To understand the traffic patterns, volume, traffic volume generated and other characteristics of traffic in the project network, traffic surveys were conducted and are provided below.

Table 15: Details of CVC traffic Survey

Rode Code	Road Name	AADT (Number)	AADT (PCU)	AADT Commercial Vehicles (Nos)	AADT Commercial Vehicles (PCU)
Imphal West Division					
IW - 01	Imphal - Kangchup Road	67626	66330	2790	3693
IW - 02	Watham Leirak Road	7,566	7,235	647	1002
IW - 03	Nagamapal Road	68434	77212	1415	1633
IW - 04	Thangmeiband Road	67156	74264	2212	2544
IW - 05	Takyel Ghari Road	17011	15035	926	1256
IW - 06	Rims Road	33449	30262	1176	1522
IW - 07	Mi Road	6401	5959	610	937
IW - 08	Sorbon Thingel Road	16190	13839	336	349
IW - 09	Moirang Myum NH37 to kwakeithel Road	9051	7692	212	233
IW - 10	RIMS Road	33939	37999	814	930
IW - 11	Polem Leikai Road	18790	16079	690	789
AD - 03	Fci - Nh 02 Road	11915	10574	789	1104
Imphal East Division					
IE - 01	Imphal - Yairipok Road	43000	45551	1706	2434
IE - 02	Dingku Road	55000	60453	2169	2959
IE - 03	Tinseed Road	33561	25612	1504	2267
IE - 04	Indo - Myanmar Road	26878	23295	1017	1234
IE - 05	Porompat No. 1	20496	22418	1028	1357
IE - 06	Singjamei - Kongba Road	24831	21891	1373	2037
IE - 07	Minuthong Hatta Road	12220	11745	276	293
AD - 01	Muslim Girls Hostel	14641	13012	1636	2048
AD - 02	Ahallup - Sangakpham Road	19382	16944	1283	1588
Highway South Division					
HSD - 01	Noaremthong - Khagempalli Road	21219	18569	1198	1721
HSD - 02	Pishumthong - Singjamei Road	23131	19897	909	1129

Rode Code	Road Name	AADT (Number)	AADT (PCU)	AADT Commercial Vehicles (Nos)	AADT Commercial Vehicles (PCU)
HSD - 03	Kwakeithel - Ningthemcha Karong Road	13251	11253	609	785
HSD - 04	Chingamakha - Canchipur Road	16010	13583	574	726

Source: Traffic Study

Traffic Growth Rate: The traffic growth rate assessment is made based on the past socio-economic data for the state, registered motor vehicle data from MoRT&H Road Transport Yearbook and population census data. Growth rates considered for the project is given in Table 16 and as per the growth rates, traffic projections have been calculated and provided in Table 17

Table 16: Adopted growth rates for Forecast.

	2021-2025	2026-2030	2031-2035	2036-2040	2041-2045	2046-2050	2051-2055	2056-2057
BUS	1.13	1.01	0.91	0.82	0.74	0.67	0.60	0.54
2 Axle	6.09	5.48	4.93	4.44	4.00	3.60	3.24	2.91
3 Axle	6.09	5.48	4.93	4.44	4.00	3.60	3.24	2.91
MAV	6.09	5.48	4.93	4.44	4.00	3.60	3.24	2.91
LCV	5.73	5.15	4.64	4.17	3.76	3.38	3.04	2.74
Taxis	6.88	6.19	5.57	5.01	4.51	4.06	3.65	3.29
2 wheelers	5.51	4.96	4.46	4.02	3.62	3.25	2.93	2.64
Cars/Jeeps	6.67	6.01	5.40	4.86	4.38	3.94	3.55	3.19
Tractors	5.73	5.15	4.64	4.17	3.76	3.38	3.04	2.74
Trailers	5.73	5.15	4.64	4.17	3.76	3.38	3.04	2.74
Others	3.55	3.19	2.87	2.59	2.33	2.09	1.88	1.70

Table 17: Projected Traffic

Year	IW-01		IW-02		IW-03		IW-04	
	Imphal - Kangchup Road		Watham Leirak Road		Nagamapal Road		Thangmeiband Road 4	
	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU
2022	67626	66330	7566	7235	68434	77212	67156	74264
2027	88934.87	87407	9940	9521	89434	100991	88093	97428
2032	113962.8	112207	12727	12212	113954	128772	112629	124583
2037	142623.7	140653	15918	15300	141883	160430	140667	155624
2042	174697.4	172530	19489	18762	172983	195697	171982	190301
2047	209847	207506	23402	22563	206915	234183	206237	228239
2052	247642.6	245156	27610	26656	243253	275408	243010	268970
2057	287589.5	284985	32058	30989	281517	318824	281815	311955

Year	IW-05		IW-06		IW-07		IW-08	
	Takyel Ghari Road		Rims Road		MI Road		Sorbon Thingel Road	
	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU
2022	17011	15035	33449	30262	6401	5959	16190	13839
2027	22375	19838	44176	40072	8437	7870	21270	18245
2032	28681	25505	56823	51669	10833	10127	27227	23428
2037	35908	32020	71355	65027	13584	12724	34041	29373
2042	44003	39337	87668	80054	16670	15643	41657	36036
2047	52881	47383	105595	96600	20057	18855	49994	43347
2052	62435	56060	124919	114467	23706	22320	58950	51218
2057	72541	65256	145389	133422	27568	25994	68407	59545

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Year	IW-09		IW-10		IW-11		AD-01	
	Moirang Myum NH37 to kwakeithel Road		RIMS Road		Polem Leikai Road		FCI - NH 02 Road	
	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU
2022	9051	7692	33939	38012	18790	16079	148577	10574
2027	11866	10121	44487	49895	24679	21190	192657	13940
2032	15163	12976	56830	63812	31584	27203	244341	17904
2037	18930	16248	70916	79702	39479	34097	303429	22453
2042	23135	19911	86628	97436	48300	41821	369449	27555
2047	27735	23928	103797	116819	57954	50295	441694	33156
2052	32673	28249	122208	137609	68321	59414	519271	39189
2057	37883	32818	141618	159532	79266	69059	601159	45575

Year	IE-01		IE-02		IE-01		IE-01	
	Imphal - Yairipok Road		Dingku Road		Tinseed Road		Indo - Myanmar Road	
	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU
2022	43000	45552	55000	60453	33561	25612	26878	23295
2027	56611	60033	72528	79723	44096	33813	35252	30596
2032	72609	77067	93163	102409	56458	43494	45067	39179
2037	90940	96597	116842	128440	70604	54631	56288	49017
2042	111464	118476	143389	157621	86422	67147	68825	60037
2047	133965	142473	172528	189646	103745	80915	82545	72123
2052	158168	168294	203906	224127	122360	95770	97280	85128
2057	183756	195601	237111	260609	142024	111519	112835	98884

Year	IE-015		IE-016		IE-017		AD-018		AD-02	
	Porompat No. 1		Singjamei - Kongba Road		Minuthong Hatta Road		Muslim Girls Hostel		Ahallup - Sangakpham Road	
	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU
2022	20496	22418	24831	21891	12220	11745	14641	13012	19382	16944
2027	26891	29464	32597	28827	16028	15447	19190	17114	25431	22311
2032	34382	37727	41697	36981	20491	19795	24516	21932	32518	28619
2037	42940	47174	52097	46326	25592	24773	30596	27448	40615	35845
2042	52495	57729	63713	56791	31288	30343	37382	33619	49655	43935
2047	62944	69278	76421	68265	37521	36445	44800	40380	59543	52804
2052	74158	81677	90063	80609	44214	43005	52759	47649	70156	62342
2057	85990	94764	104461	93661	51277	49936	61153	55329	81354	72425

Year	HSD-01		HSD-02		HSD-03		HSD-04	
	Noaremothong - Khagempalli Road		Pishumthong - Singjamei Road		Kwakeithel - Ningthemcha Karong Road		Chingamakha - Canchipur Road	
	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU	AADT Nos	AADT PCU
2022	21219	18569	23131	19897	13251	11253	16010	13583
2027	27899	24519	30439	26271	17368	14805	20997	17882
2032	35742	31532	39026	33784	22187	18977	26838	22935
2037	44721	39588	48861	42417	27689	23757	33510	28725
2042	54768	48627	59872	52107	33830	29106	40959	35207
2047	65776	58558	71940	62755	40544	34969	49106	42315
2052	77611	69259	84920	74232	47748	41275	57849	49961
2057	90118	80592	98642	86390	55346	47940	67074	58046

Source: Traffic Study

3.5 Analysis of Alternatives

3.5.1 Alternative Construction Methodology

PWD, Government of Manipur has undertaken detailed project study for the project and is preparing the DPR for the project. As per the DPR report, each project road is unique. Project roads are different in terms of RoW, strength, composition, CBR etc. Accordingly, DPR consultant has considered various options for improvement and rehabilitation of the project roads to meet the objective of the project, i.e., construction of climate resilient road network throughout the project region which requires no or minimal maintenance contrary to the existing scenario. Various alternates considered are discussed in length below:

3.5.1.1 Full Depth Reclamation (FDR):

A pavement rehabilitation method in which existing pavement crust to a pre-determined depth of the underlying materials are uniformly pulverized and blended with different types of additives, compacted to the required density to produce a homogeneous stabilized and improved base course and provided with a layer of wearing coat as per design. Full-depth reclamation of flexible pavement, also referred to as FDR, is a rehabilitation method that involves recycling an existing asphalt pavement and its underlying layer(s) into a new base layer.

FDR process begins with using a road reclaimer to pulverize an existing asphalt pavement and a portion of the underlying base, subbase, and/or subgrade and uniformly blended with a stabilizing material such as Portland cement and additive to provide an upgraded, homogeneous material. Finally, the stabilized material is compacted in place with rollers. The result is a stiff, stabilized base that is ready for a new flexible or rigid surface course. By using in-place materials, FDR does not require the existing pavement to be removed from the site, unless a small amount of material must be removed to retain the existing elevation. Full-depth reclamation also reduces the amount of new material to be hauled to the site compared with methods that require granular material to be trucked to the site.

3.5.1.2 Thin White Topping

White topping is the covering of an existing asphalt pavement with a layer of Portland cement concrete. White topping is divided into types depending on the thickness of the concrete layer and whether the layer is bonded to the asphalt substrate. The principal purpose of an overlay is either to restore or to increase the load carrying capacity or both, of the existing pavement. In achieving this objective, overlays also restore the ride-ability of the existing pavements which have suffered rutting and deformations, in addition to rectifying other defects such as loss of texture. In our country, bituminous overlays have been popularly constructed in the past mainly due to abundant supply of bitumen, its amenability to stage construction and manageable traffic conditions, in terms of volume and axle loads in addition to the comfort levels of construction methods among engineers. It also makes economic sense to make bituminous pavements as it was relatively cheaper. In recent times all these advantages are reversed viz., petroleum industry is using refined processing technology leading to reduction in the production of bitumen leading to increased imports, favorable cost economics of cement concrete and rapidly changing traffic scenario (in terms of volume as well as axle loads). In addition, rapid developments in concrete material technology and mechanization (both in concrete production & its laying) are favoring concrete overlays as a sustainable option.

Conventional white topping is designed and constructed like a new rigid pavement without assuming any composite action. Conventional white topping treats the existing bituminous surface as a sub-base like Dry Lean Concrete (DLC) and to this extent the condition of existing bituminous surface does not matter significantly, except that bituminous surface should not suffer from any isolated damages like subsidence or material related problems.

3.5.1.3 Interlocking Concrete Block Pavement

Interlocking Concrete Block are a pre cast concrete blocks in a specific shape and dimensions. These blocks have been used throughout the world. Since these blocks are made in factory, they are of a very

high quality and avoid the difficulties encountered in quality control.

The concrete blocks restrict the speed of vehicles to about 60 Km/h and prove to be a good match for the small/low volume roads, parking lots, bus stands, fuel stations, cycle tracks, residential streets etc. In India the laying of concrete blocks pavements is a low-cost solution. The cost of maintenance is much lower, the broken or damaged blocks can be easily replaced. These blocks do not deteriorate due to thermal expansion like in rigid pavement.

3.5.1.4 Conclusion

These all alternatives are considered and will be used for the rehabilitation and improvement as per the road condition, time availability, availability of material etc.

3.5.1.5 With Project and Without Project Scenario

Greater Imphal roads network project section involves improvement of the existing road. So, no alternative has been considered. On the basis of environmental social threat, we can say that Imphal roads network project acquires positive/beneficial impacts. "With" project scenario will greatly improve the environment and enhance social and economic development of the region compared to "Without" project scenario, which will further deteriorate the existing environment and quality of life of this region.

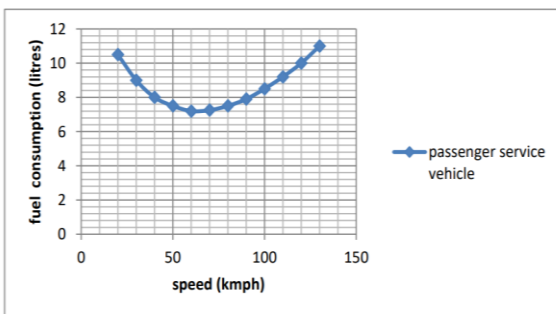
The existing road network has poor riding conditions with poor drainage conditions and poor geometry. The poor road conditions, population growth, increase in traffic volumes and the economic development along the project corridor would continue to occur and will exacerbate the already critical situation.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

Therefore, the no-action alternative is neither a reasonable nor a prudent course of action for the proposed project, as it would amount to a failure to initiate any further improvements and impede economic development. Hence "With" project scenario with minor reversible impacts is an acceptable option than the "Without" project scenario. The implementation of the project therefore will be advantageous to achieve the all-around development of the economy and progress of the State. Detailed analysis is given in Table 18.

Table 18: "With" & "Without" Project Scenario

Parameters	With Project	Without Project
Dust emissions	Air quality of the Project region will improve significantly as the road conditions will be improved due to which fugitive dust emissions resulting from the movement of the vehicles will reduce significantly. Some traffic characteristics, such as flow, queue length and delay-events, arise depend on the configuration of the junction, an intersection or a signalized roadway. The combinations of traffic and road characteristics determine average-fleet speeds during various driving cycles – free-flow, interrupted, congested and maximum. Thus, due to improvement of road conditions and junctions, speed of traffic will increase which will reduce the traffic congestion and traffic jams. Reduction in congestion in traffic will reduce the fuel consumption and vehicular emission and waiting time of the travellers/passengers. Thereby resulting in the positive impact on the air quality.	In "Without Project" scenario, heavy dust emission generation due to vehicular movement on poor pavements will continue to happen thereby leading to high PM concentration in the area.
Vehicular emissions	Vehicular emission depends upon various vehicle parameters like engine technology, operating speeds,	In "Without Project" scenario, additional vehicular

Parameters	With Project	Without Project
	<p>fuel type, road condition etc. In India emission standards and fuel quality has been improved a lot and now we are referring to Bharat Stage VI standards.</p> <p>Though the technology has been devised for the vehicular characteristics the bad pavement conditions, will always increase the pollution rates. Hence, such technology will not be effectively work if the pavement condition will not be good. It has been studied that emission is a function of fuel consumption and power generation by vehicle. If the pavement is in bad condition the amount of fuel requirement will be increased to produce the more power to drag the vehicle for same distance than the pavement with good condition, which leads to higher emission. In a study carried out “Effect of Road Deterioration” On Vehicle Emission” for Vidarbha region, shows that emission levels reduced by almost 20% in a smoother road as compared to a rough road.⁴</p>	<p>emissions will continue to generate due to heavy traffic congestion and low vehicle operating speeds. Travelling time due to congestion is sometime about 1.5-2.5 times more than normal time required for commuting which led to increase in fuel consumption and vehicle operation. Also, in low speed and repeated stopping and idling condition, vehicular emissions are more⁵ and can be seen from the graphs in the foot note. These graphs are taken from a study</p>



4 **Figure 2** Relationship between speed and fuel consumption

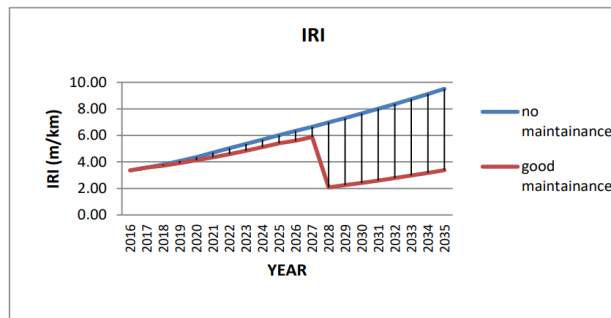


Figure 3 Effect of maintenance on IRI of the pavement

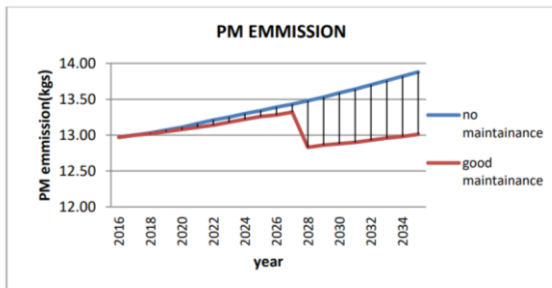


Figure 5 Effect of maintenance on particulate matter emission

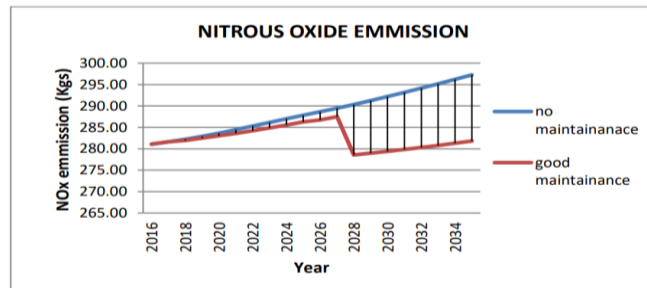


Figure 6 Effect of maintenance on nitrous oxide emission

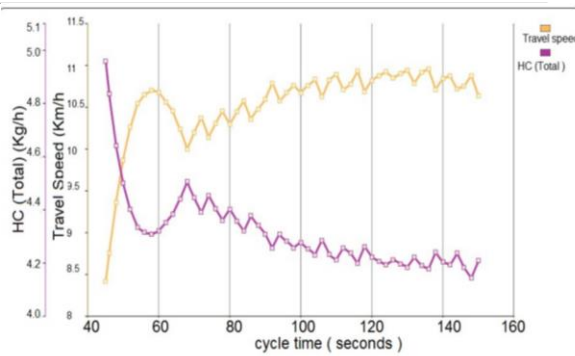


Figure (3) The relation between cycle time, travel speed and (HC)

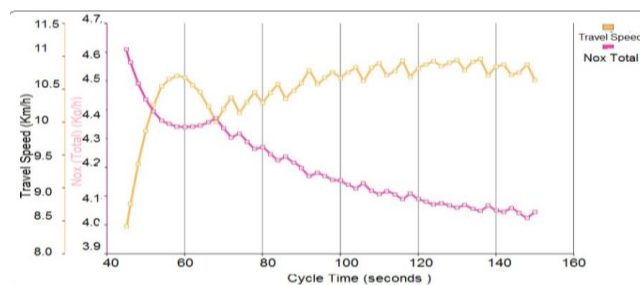


Figure (4) The relation between cycle time, travel speed and (NO_x)

Parameters	With Project	Without Project
	<p>In the study IRI was calculated (International Rouchness index) using formula. $IRI = 0.593 + 0.0471D$ ($42 < D < 312$)</p> <p>And results of the study show the impact of speed and IRI on the emissions. From the graphs given in the foot note above, it is evident that PM and other emission levels are lower if the roads are maintained properly</p>	<p>“Evaluating the Negative Impact of Traffic Congestion on Air Pollution at Signalized Intersection”. This study shows how the vehicular emissions are impacted due to low speeds in urban settings.</p>
Noise Level	<p>Traffic noise is directly linked to the road conditions, traffic speed, traffic flow, volume, type of vehicles etc. Traffic composition of the study area shows that traffic comprises of light vehicles majorly and the percentage contribution of Commercial vehicle is less than 5% on most of the project roads. But then also area experience high traffic congestion and noise. This is due to poor road conditions, vehicles idling in jams and low traffic speed. High traffic volume. Project development will overall reduce the noise levels by improving the road conditions, reducing the traffic jams, honking requirement, noise from long queue of idling vehicles in traffic jams etc. However, noise may also increase as the increase in noise level result from increase in speed of vehicle which is likely to increase due to improvisation of the road condition. But there is regulated vehicular speed levels in the project area which can keep check on the vehicular speed and resulting noise due to higher speed</p>	<p>In “Without Project” scenario, high noise levels in the project area due to the traffic jams, vehicular movement on congested roads continue to exist. As per the baseline study noise levels in the project area are higher than the prescribed standards in Noise Rules 2000 (Leq 50.8 to 62.2 dB(A), Lday 59.4 to 67.6 dB(A) and Lnight 41.8 to 56.5 dB(A).</p>
Quality of Life (Travel Time, Traffic congestion, polluted environment)	<p>Traffic in project area mainly comprise of Cars and two wheelers as people in the area depend highly on their personal vehicle for commuting due to lack of proper public transportation system. Due to which the traffic volume is higher on the roads. Further the available roads are narrow and in poor conditions which further reduce the smooth traffic movement in project region. Roads type in area are classified as ODR and MDR but the infrastructure is not sufficient as per the classification. In addition, there is encroachment also on the roads further narrowing available RoW. All these factors result in availability of narrow roads of poor pavement conditions and high traffic volume. All this led to traffic congestion leading to high travelling time, high vehicular emissions, high noise levels etc. All these have direct impact on</p>	<p>Quality of life of people in project area will continue to be impacted in “Without Project” scenario. People will continue to waste time in traffic jams, will continue to get expose to higher vehicular emissions, PM emissions and higher noise levels. Value of time of passengers will continue to decrease.</p>

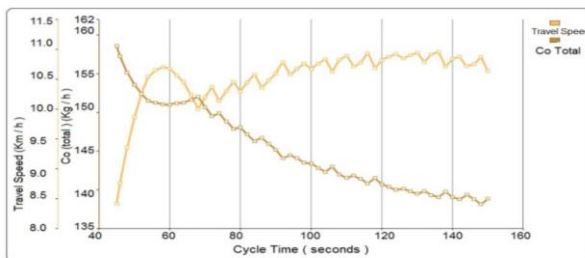


Figure (5) The relation between cycle time, travel speed and (CO)

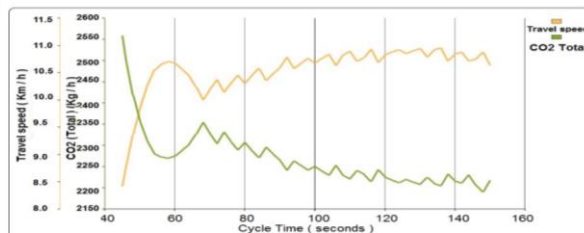


Figure (6) The relation between cycle time, travel speed and (CO2)

(source: [BCEE4201900454](https://www.researchgate.net/publication/351111111) Done (iop.org))

Parameters	With Project	Without Project
	<p>mental and physical health of the community. Project will significantly improve the road conditions thereby improving the traffic movement in the area and improving overall quality of life of people. People in the project area also welcomed the project and are positive towards the project development. Improvement of road conditions will raise the standard of living and the rates of the properties in project area are also likely to increase with improvement in road infrastructure quality.</p> <p>Stakeholder consultations were carried out in the project area and large acceptance of the project was viewed among the people. People are happy with the project and anticipate that the traffic and drainage conditions in the project area will significantly improve with this project. Also, the project involves construction of utility duct which will be very beneficial as no excavations will be required in future to lay down utilities like transmission line, pipelines etc. The project will overall bring improvement in quality of life of people</p>	
Vehicle Operating Cost	<p>Project will overall improve the road conditions which will reduce the travel time of the passengers, maintenance requirement of vehicles, fuel consumption of vehicle, leading to reduced vehicle operating cost. As per Cost Benefit Analysis study conducted for the project, savings of INR 1836 million is estimated over the period of 20 years in vehicle operating cost.</p>	<p>People are spending higher cost of operating vehicle as in the congested roads of city, fuel consumption is more. People spend 20% more vehicle comparatively in traffic jams as per a study. Thus, people have to spend more on fuel to reach the distance which could be covered in lesser fuel and lesser money of roads are good and congestion free. Further due to repeated acceleration and deacceleration, there is higher wear and tear of the vehicle engine and machinery thereby increasing the vehicular maintenance cost</p>
Ecology	<p>Project will lead to cutting of more than 5345 trees, leading to significant impact on flora and the fauna associate with these trees. However, permission has been obtained from concerned agency for removal of these tree. In addition, it is proposed to carry out the compensatory afforestation for the tree to be cut. This impact is long term but can be reduced by careful planning and undertaking large scale compensatory afforestation in project area and maintaining the plantation survival rates</p>	<p>No impact is anticipated on ecology, however the flora along the roads remains covered with dust due to high PM emissions which blocks the stomatal openings and reduce the rate of transpiration and growth of flora.</p>
Microclimate	<p>Cutting of 5345 trees in project area will impact the capacity of CO2 absorption (930 MT CO2 absorption</p>	<p>Area will continue to experience high GHG emissions and vehicular</p>

Parameters	With Project	Without Project
	<p>reduction in 8 years)⁶ and O₂ production (5043 MT of O₂ production loss in 8 years) in the project area. CO₂ is one of the potent GHG gas and increase in its concentration brings the heating effect in the area. Also, trees provide the shades and bring in the cooling effect due to regular transpiration. Removal of such large no of trees from project area may bring in the slight increase in temperature. However, it is proposed to undertake the transplantation and compensatory afforestation works along the project roads and in project area. This will reduce the impact to an extent.</p> <p>Also, it is expected the heat emissions from the road surface will increase due to construction of concrete pavement as Concrete pavements have a much higher albedo than asphalt due to their light grey colour compared with black pavements⁷. Thus, concrete pavements will additionally raise the local temperature, but adoption of reflective concrete pavements can reduce the albedo and thereby reducing the heating effect.</p> <p>However, on top of all, GHG emissions are expected to be reduced due to reduced fuel consumption, reduced vehicular emissions in traffic jams contributing to the positive impact and reducing the GHG emissions significantly. As per a study in “International Journal of sustainable transportation)⁸, extending the life of pavement through preventive maintenance can reduce greenhouse gases by up to 2 percent; transportation agencies can cut spending by 10 percent to 30 percent; and drivers can save about 2 percent to 5 percent in fuel consumption, tire wear, vehicle repair and maintenance costs because of smoother surfaces. The study also found that thin overlay leads to the greatest overall reduction in carbon dioxide emissions -- 2 percent -- because of a large decrease in road roughness. The crack seal method led to the lowest emission reduction -- 0.5 percent -- but all preventive maintenance methods reduce emissions overall</p>	<p>emissions due to current pavement conditions. Also release of heat from the vehicle idling in the traffic jam continue to be there.</p>

⁶ CO₂ absorption/fixation rate @ 48 pounds/year/adult tree, average age of mature tree is considered as 8 years.
O₂ production rate @ 260 pounds/year/adult tree, average age of mature tree is considered as 8 years.

Concrete constituent	Albedo
White Portland cement.	0.87
Ground granulated blast-furnace cements.	0.71-0.75
Gray Portland cement.	0.32-0.47
Coal fly ash.	0.28-0.55
Dark grey riverbed sand (quartz, clay minerals, mica).	0.20
Black and red rock (granite).	0.19
White rock (plagioclase).	0.49
Limestone fine aggregate.	0.42
Limestone coarse aggregate.	0.42
Gold and white rock (chert, iron impurities).	0.55
Fine grain natural gravel	0.62
Concrete composed of ordinary Portland cement, fine aggregate from crushed limestone, and light-colored slag cement.	0.64
Concrete composed of white cement and sand from crushed limestone.	0.64

⁷ Albedo values for different concrete constituents (Portland cement and aggregates) and concretes.

Specimen	Albedo no shadow effect (dimensionless)	Albedo with shadow effect (dimensionless)	Air temperature [C°]	Surface temperature [C°]	
Conventional friction course	New	0.119	0.120	30.6	41.0
	Aged	0.156	0.157	30.5	40.0
Porous asphalt concrete	With pavement markings	0.101	0.102	30.0	40.0
		0.194	0.196	30.0	38.5
Recycled asphalt concrete, containing exhausted extinguishing powders	0%	0.123	0.124	31.3	38.2
	3%	0.117	0.118	31.3	37.0
	6%	0.125	0.127	31.3	36.0

Pavement albedo and temperature.

⁸ [Keeping roads in good shape reduces greenhouse gas emissions: Delaying pavement maintenance boosts emissions and costs -- ScienceDaily](https://www.sciencedaily.com/news/energy-environment/2014/08/keeping-roads-in-good-shape-reduces-greenhouse-gas-emissions-delaying-pavement-maintenance-boosts-emissions-and-costs-081414.htm)

Parameters	With Project	Without Project
Water logging and Drainage	Manipur is known for its valley and the waterbodies. There are several waterbodies in the area in form of river, ponds, nalla, streams etc. However, majority of these are encroached in the project area leading to poor drainage condition in the area. Area suffers from water logging, stagnation and urban flooding during heavy rains impacting the mobility severely. The project includes proposal of construction of drains along all the road and connecting it to nearby water body. This will help in carrying the run-off to the drainage system relieving roads from flooding during heavy rains and will improve the mobility.	Currently many water bodies, wetlands and nallahs have been encroached for construction of buildings, shops, temporary structures etc. Further drains are not cleaned and remain clogged with waste. Capacity of drainage system is also insufficient. It led to frequent waterlogging in area during rains making commuting a difficult task. Also, road conditions further worsen due to ponding/flooding

3.6 Material Sourcing

Detailed investigation of material availability shall be conducted with the project contractor after award of the packages. However, material survey is conducted at DPR stage and as per the study, Detail of the material required, and the source is given in the table below.

Table 19: Material Required

Material	Source	Quantity ⁹	Distance from the Project Region-km	Mode of Transportation	Capacity of the Transportation Vehicle-cum
Sand	Existing Quarries at Dimapur	583,348.42 cum	100	Trucks	4.8
Aggregates	Different quarries & Stone crushers are available near project locations	1,783,117.12 cum	20-45	Trucks	5
Steel	Assam	47,908.65 Tonnes	500	Trucks	8
Bitumen	Haldia	31,003.48 cum	1600	Trucks	8
Cement	Assam & Meghalaya	534,068.18 Tonnes	500	Trucks	8
Concrete	Batching Plants	993,766.39 cum	2-10	Transit Mixers	6

3.7 Amenities Requirement

3.7.1 Water Requirement

Water will be required for meeting the domestic water requirement of construction workers and for construction purposes. It is estimated that approx. 1000 people may be employed during peak period of construction including skilled, non-skilled and semi-skilled workers. It is anticipated that as per the previous project experience, most of the labour will be brought in from other states and will reside in the camps/residential accommodation. Thus, for labour, domestic water requirement is considered as 80 LPCD. For 1000 labour water requirement will be 80 KLD (0.08 MLD). However, this is peak time

⁹ These are indicative calculations as per the current details available and estimations carried out.

requirement. Source of water requirement can be supplied water from tankers, ground water or piped water supply. For construction purpose water will be required for soil compaction, mixing cement, curing purposes etc. Tentative water requirement using thumb rules is given below.

Water Required for Construction

Soil/sand quantity: 583,348.42 cum

Density: 1900 kg/cum

Weight of sand: 1,10,83,61,998 kg

Water required for soil/sand compaction: $1,10,83,61,998 * 6/100 = 6,65,01,719.88$ liters = **66 ML**

Cement: 534,068.18 Tonnes = 534,068180 kg

Water required for mixing 50 kg cement = 30 liters

Water required for cement mixing = 32,04,40,908 liters = **320 ML**

Concrete: 993,766.39 cum

Water required for curing: 150 liter/cum of concrete = 14,90,64,958.5 liters = **149 ML**

Total water required = 66 + 320 + 149 = 535 ML

Construction time: 3 years = 1095 days

Water required per day = 0.49 MLD

Water required for water sprinkling: 4 liters/sq m/day.

Active area per day: 50,000 sq m/day

Water required for sprinkling per day: 2,00,000 liters/day = 0.2 MLD

Total water required for construction per day: 0.69 MLD.

3.7.2 Land requirement

The total land 13.28805 Ha to be acquired, out of which 7.88415 (Imphal West) & 5.40390 (Imphal East) is private land, Land Acquisition under progress as per RFCTLARR 2013 and Manipur State Act. No forest land is impacted in the proposed project stretch.

3.7.3 Manpower Requirement

The proposed project will involve hiring of 500-1000 workers including skilled, semi-skilled and non-skilled labour. Most of labour as per the past project experience will be contracted labour from other states.

3.8 Temporary Facilities

Land for temporary facilities like casting yards, labour accommodation, storage yards etc. shall be arranged by the contractor. Siting criteria for establishing these facilities is provided as Annexure 2 with this report.

3.9 Waste Management System

Solid Waste: All infrastructure projects leads to generation of Construction and Demolition Waste. Since the project involves improvement and upgradation of roads, no waste material is expected to be generated due to excavation or road construction. However, there may be generation of demolition waste due to dismantling of structures within the RoW which is estimated to be approx. 58425 cum. This waste shall also be used for construction purposes or may be given to other construction projects in the project area or may be disposed off as per the requirements of the local bodies in the project area. Metal waste, wood waste and other recyclable waste shall be sold to authorized recyclers.

Municipal solid waste may be generated from projects during construction phase especially at labour

camps & kitchens. Anticipating 1000 no of labour during peak time and 0.2 kg of waste/labour, it is anticipated that approx. 200 kg of MSW will be generated during construction phase. This waste shall be managed by the waste management agencies in the project area. There are various waste processing units in the state to which this waste can be given. However, the MSW needs to be segregated as per requirement of these agencies at source. Labour and staff shall be made aware of such at source segregation to ensure effective waste segregation of the MSW. Lot of waste in form of discarded PPE may also be generated which shall be treated as MSW and shall be disposed accordingly.

Other waste many include hazardous waste in form of used oil, waste oil, greased cotton, filters, discarded lead acid batteries, empty cans of the paints/fuel/oils etc. This waste shall be disposed off through authorized vendors only. Plastic and paper packaging & office waste generated shall be collected and sold to the recyclers. Bio-medical waste, if any from first-aid centre shall be disposed off in accordance with the Bio-Medical Waste Management Rules, 2016.

Sewerage may also be generated from the labour camps. Approx 64 KLD (0.064 MLD) shall be generated from the labour camps/construction site. This sewage shall be disposed off through septic tanks or modular STP shall be installed for treatment of the sewage. STP treated water shall be used for construction purposes, sprinkling, landscaping etc.

3.10 Implementation Schedule

The project has been planned to be constructed in 3 years of time by optimum and efficient use of resources. Project activities shall be scheduled in a way to minimize the impact on the stakeholders. Road selection for reconstruction/improvement shall be such that the cumulative impact is minimal. People shall be provided with proper ramps to access their properties during road improvement works. Noisy activities shall be strictly carried out during daytime. Noise activity near the educational institutions shall preferably be carried out during holiday time.

3.11 Project Cost

The estimated total project cost is approximately INR 3219.645 crore. Break-up of the cost is given in Table 20 below.

Table 20: Summary of Project Cost in INR

Sr. No	Item No.	Description	Imphal West	Imphal East Package-A	Imphal East Package-B	HSD	Total Amount (Rs. In Crores)
1	GENERAL	i) Establishment for Employer/Construction Supervision Consultants/ Civil Contractor	3.453	3.385	3.274	3.274	13.386
2	ROAD WORK	i) Paver Block	34.132	27.721	20.200	18.177	100.229
		ii) Short Panel Concrete / White Topping	126.439	107.655	70.789	67.555	372.438
		iii) Conventional Rigid Pavement	9.861	0.000	0.000	0.000	9.861
		iv) Flexible Pavement of Riverside Roads	5.785	13.513	40.399	11.649	71.346
		v) Junctions	11.044	2.546	2.889	5.445	21.924
3	STRUCTURES	i) Reconstruction Bridges, Rehabilitation and Repair of existing bridges	18.856	30.413	34.249	31.781	115.299
		ii) Cross Drainage (Culvert)	3.122	3.122	2.465	2.136	10.845
		iii) Drainage, Utility Corridors and chambers, including Dismantling of Drain	438.659	314.216	265.310	247.137	1265.323
		iv) Bus stops	0.200	0.175	0.125	0.125	0.625
4	TRAFFIC MANAGEMENT & SAFETY	i) Traffic Signs, Marking and Other Road Appurtenances (Cable Duct, Streetlight, Jersey Barrier and Concrete Bollard)	47.965	42.566	47.996	29.193	167.720
		ii) Road Safety & Traffic Management during construction	4.919	4.030	3.338	3.157	15.444
5	FINANCE PLUS ELEMENTS	i) Community amenities structures	13.790	11.443	11.925	11.383	48.540
		ii) Procurement of Mechanical equipment's for Road Maintenance	2.639	2.639	2.639	2.639	10.556
A	Total Civil Work Cost		720.864	563.422	505.598	433.652	2223.537
B	CONSULTANCY CHARGES	Consultancy Charges @ 3% on (A)	21.626	16.903	15.168	13.010	66.706
		GST @ 18% (CGST 9 %+ SGST 9%) on Consultancy Charges	3.893	3.042	2.730	2.342	12.007
		Administrative Charges. PIU charges @1.0% on (A)	7.209	5.634	5.056	4.337	22.235
		Labour cess Charges @1.0% on (A)	7.209	5.634	5.056	4.337	22.235
C	MAINTENANCE	For rigid pavement with 5 years Maintenance Period including structures: 0.25% of the Contract Price for the first, second and third year, 0.5% of the Contract Price for fourth, fifth Year (on A)	12.615	9.860	8.848	7.589	38.912
D	RIGHT OF WAY & SAFEGUARDS	i) Land Acquisition and Rehabilitation & Resettlement @ 6% (on A) (Displacement of WHH/SC/ST/Trible	43.252	33.805	30.336	26.019	133.412

Sr. No	Item No.	Description	Imphal West	Imphal East Package-A	Imphal East Package-B	HSD	Total Amount (Rs. In Crores)
		Families/BPL/Shopkeepers etc.) including Social Safeguard Consultant (NGO)					
		ii)Utility Shifting @3% (on A)	21.626	16.903	15.168	13.010	66.706
		iii)Forest & Environmental Safeguard Cost	10.593	8.643	7.489	6.814	33.539
E	CENTAGES & TAXES	GST @ 18% (CGST 9 %+ SGST 9%) @ Payable on Civil Cost only (on A)	129.756	101.416	91.008	78.057	400.237
		Price Contengencies@7.5% on (A)	54.065	42.257	37.920	32.524	166.765
		Physical Contengencies@1.5% on (A)	10.813	8.451	7.584	6.505	33.353
TOTAL PROJECT COST			1043.519	815.971	731.961	628.193	3219.645

Table 21: Summary of Project Cost in US Million Dollars

Sr. No	Item No.	Description	Imphal west Cost in USD Million	Imphal East Package A Cost	Imphal East Package B Cost	HSD Cost	Total Cost
1	GENERAL	i)Establishment for Employer/Construction Supervision Consultants/ Civil Contractor	0.432	0.423	0.409	0.409	1.673
2	ROAD WORK	i)Paver Block	4.267	3.465	2.525	2.272	12.529
		ii)Short Panel Concrete / White Topping	15.805	13.457	8.849	8.444	46.555
		iii)Conventional Rigid Pavement	1.233	0.000	0.000	0.000	1.233
		iv)Flexible Pavement of Riverside Roads	0.723	1.689	5.050	1.456	8.918
		v)Junctions	1.380	0.318	0.361	0.681	2.740
3	STRUCTURES	i)Reconstruction Bridges, Rehabilitation and Repair of existing bridges	2.357	3.802	4.281	3.973	14.412
		ii)Cross Drainage (Culvert)	0.390	0.390	0.308	0.267	1.356
		iii)Drainage, Utility Corridors and chambers, including Dismantling of Drain	54.832	39.277	33.164	30.892	158.165
		iv)Bus stops	0.025	0.022	0.016	0.016	0.078
4	TRAFFIC MANAGEMENT & SAFETY	i)Traffic Signs, Marking and Other Road Appurtenances (Cable Duct, Streetlight, Jersey Barrier and Concrete Bollard)	5.996	5.321	5.999	3.649	20.965
		ii)Road Safety & Traffic Management during construction	0.615	0.504	0.417	0.395	1.930
5	FINANCE PLUS ELEMENTS	i)Community amenities structures	1.724	1.430	1.491	1.423	6.068
		ii)Procurement of Mechanical equipment's for Road	0.330	0.330	0.330	0.330	1.320

Sr. No	Item No.	Description	Imphal west Cost in USD Million	Imphal East Package A Cost	Imphal East Package B Cost	HSD Cost	Total Cost
		Maintenance					
A	Total Civil Work Cost		90.108	70.428	63.200	54.206	277.942
B	CONSULTANCY CHARGES	Consultancy Charges @ 3% on (A)	2.703	2.113	1.896	1.626	8.338
		GST @ 18% (CGST 9 %+ SGST 9%) on Consultancy Charges	0.487	0.380	0.341	0.293	1.501
		Administrative Charges. PIU charges @1.0% on (A)	0.901	0.704	0.632	0.542	2.779
		Labour cess Charges @1.0% on (A)	0.901	0.704	0.632	0.542	2.779
C	MAINTENANCE	For rigid pavement with 5 years Maintenance Period including structures: 0.25% of the Contract Price for the first, second and third year, 0.5% of the Contract Price for fourth, fifth Year (on A)	1.577	1.232	1.106	0.949	4.864
D	RIGHT OF WAY & SAFEGUARDS	i)Land Acquisition and Rehabilitation & Resettlement @ 6% (on A)(Displacement of WHH/SC/ST/Trible Families/BPL/Shopkeepers etc.) including Social Safeguard Consultant (NGO)	5.406	4.226	3.792	3.252	16.677
		ii)Utility Shifting @3% (on A)	2.703	2.113	1.896	1.626	8.338
		iii)Forest & Environmental Safeguard Cost	1.324	1.080	0.936	0.852	4.192
E	CENTAGES & TAXES	GST @ 18% (CGST 9 %+ SGST 9%) @ Payable on Civil Cost only (on A)	16.219	12.677	11.376	9.757	50.030
		Price Contengencies@7.5% on (A)	6.758	5.282	4.740	4.065	20.846
		Physical Contengencies@1.5% on (A)	1.352	1.056	0.948	0.813	4.169
TOTAL PROJECT COST			130.440	101.996	91.495	78.524	402.456

4. DESCRIPTION OF THE ENVIRONMENT

4.1 Introduction

This chapter presents the information on the existing scenarios/statuses of the environmental attributed in and near to the project corridor. Collection of baseline data on bio-physical, socio-economic aspects of the project area is a very important step for environmental assessment studies as it helps to: understand the existing baseline scenario/condition of the various environmental parameters which helps in evaluation of significance of the impact due to the proposed project on the various environmental components; and record the baseline scenario so as the impact due to project during & post-implementation can be carried out. The data/ features documented here have been collected through published data sources, field visits, interaction with local stakeholders and primary & secondary baseline environmental monitoring studies. The field visits include an inspection of sensitive locations, consultations with the locals/ communities, recording the visual observations and collection of primary data on air quality, noise level, water quality and soil quality. Secondary information was collected from the various stakeholders, government agencies, literature and publications (including internet information). Based on the secondary information, the data gap has been identified and it is fulfilled by collecting primary information, which includes baseline environmental monitoring for key environs (Biological and physical environmental components) and conducting FGD's, public consultation, etc. This chapter comprises of the following:

- Physical environmental components such as meteorology, geology, topography, soil characteristics, air quality, noise quality, surface, and sub-surface water quality, etc.
- Ecological environmental components such as terrestrial flora, fauna, and aquatic biodiversity; and
- The socio-cultural and economic environment in terms of demography, land use, etc.

4.2 Study Area

Proposed project is spread over a large spatial extent, i.e., Greater Imphal region comprising of Imphal East and Imphal West, having area of approx. 150 sq km. For purpose of the baseline data collection, entire project road network area is considered as study area. Baseline data is collected for the study area which is represented in Figure 5. Project area has majorly urban settings and passes through heavily populated area.

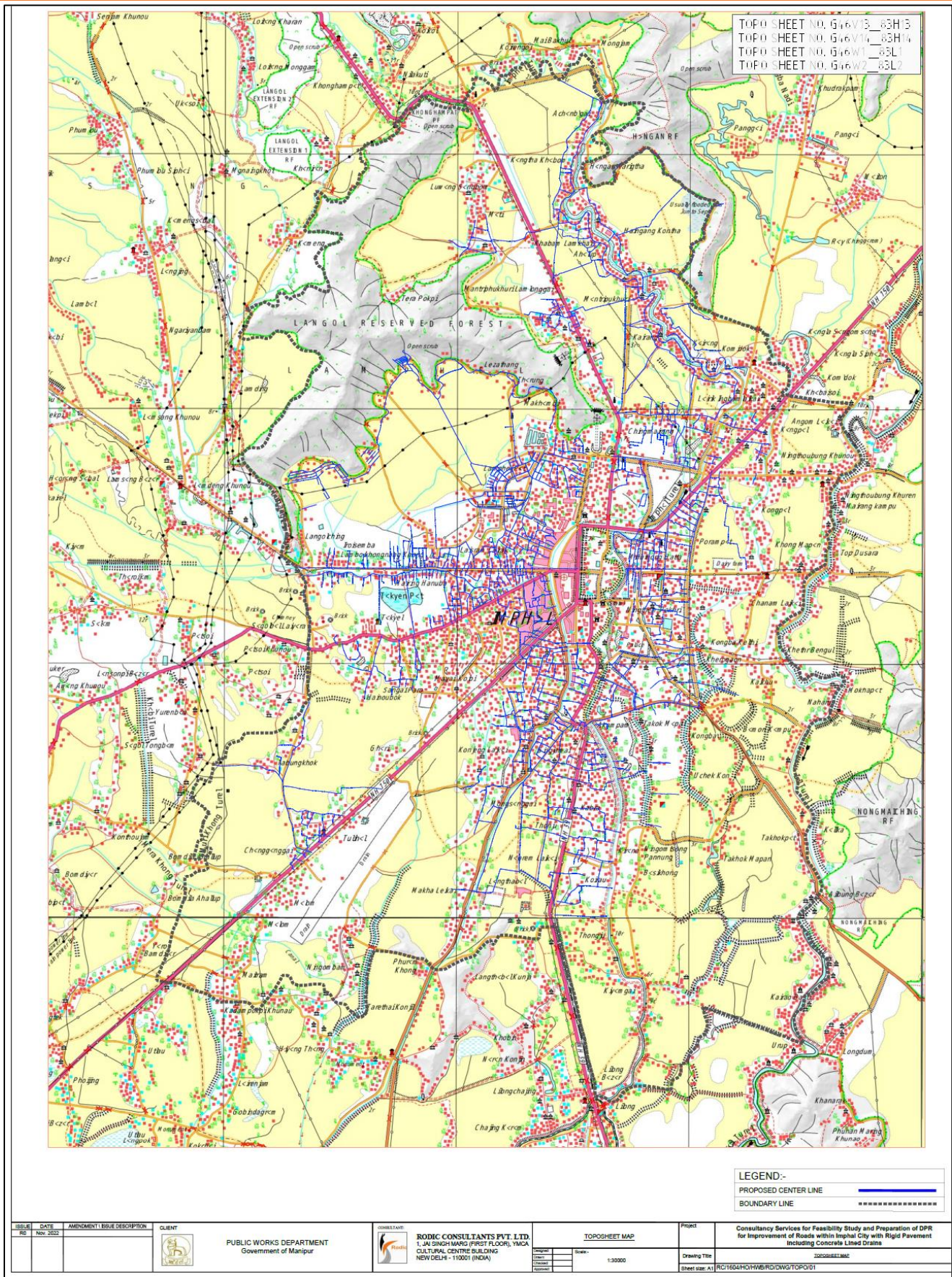


Figure 5: Study Area Presented on Toposheet

4.3 Environmental Sensitivity

Environmental sensitivity of the project area is given in Table 22

Table 22: Environmental Sensitivity of Project Area

S. No.	Environmental Sensitivity	Remarks
1.	National Park/Wildlife Sanctuary/Migratory corridors	Manipur state of India lies in the pathway Central Asia Flyway and East Asia Flyway
2.	Notified Important Bird Area	Migratory Corridor: Central Asia Flyway and East Asia Flyway are the two main flyway for the migratory birds of Manipur. As per the Birdlife International Red Data Book report, 55 bird species. out of 666 identified species recorded in Manipur are of conservation concern. Out of these 55 species: <ul style="list-style-type: none"> • 4 are listed as Critically Endangered, • 8 are listed as Endangered, • 15 are listed as Vulnerable and • the remaining 28 Near Threatened species are closed to qualifying as Threatened
3.	Ramsar/Notified Wetland	None in 10 km radius
4.	Other Wetlan	<ul style="list-style-type: none"> • Lamphel Pat and Heingangpat Pat live in project area but not notified. • Yaral Pat at 500 m in East direction but no project road • Waithou-Phumnom Pat Wetland at 6.5 km in SE direction
5.	State protected Archaeological/Cultural/ Heritage Places	Kangla Fort & other (Table 58 of IEE)
6.	Water Bodies	Project Area is drained by various rivers, nallahs, streams and include Imphal, Iril, Kongba, Nambul and Naga Rivers

4.4 Study Period

The study period considered for primary baseline data collection is winter season i.e., Nov 2022-Jan 2023. Meteorology data was also collected for one month (Jan 2023) Stakeholder consultation was undertaken during Jan-Feb 2023.

4.5 Data Collection

For the IEE study both primary and secondary data have been collected to establish the baseline scenario of project area. Standard methods and procedures have been strictly adhered to during this study for collection of primary baseline study which covers all aspects of the study, and includes sample collection, handling, laboratory analyses, data coding, statistical analyses, presentation and communication of results. Primary data is collected through the MoEF Accredited Environmental Laboratory "Eco steps Laboratory Pvt. Ltd".

Primary data on meteorology, ambient air quality, soil quality, water quality and noise level were collected from site during the baseline study period. Secondary data is collected from various departments like Indian Meteorological Department (IMD), Central Ground Water Board, Geological Survey of India, State Ground Water Department, State Pollution Control Board, Census of India and Local Forest Department, Non -Governmental Agencies etc.

4.6 Criteria for Selection of Monitoring Stations

Project involves improvement and rehabilitation of the road in project area. Methodology of improvement depends on the road condition and time of construction will vary from few days in case of paver blocks to approx. 45 days in case of FDR. Also, the project activities will be confine to the RoW of project road only which varies between 3.33 m to 22.25 m. Road reclamation/improvement works will be undertaken in few roads and in small patches instead of working on entire project area to manage the impact on mobility. Considering the spatial and temporal extent impacts are short term and will be confined majorly within the road under consideration at particular time. Houses/shops/utilities along the road are expected to be impacted majorly due to work in that particular area. Thus, for collection of baseline data, locations were selected within the project area. Due to larger spatial extent, i.e., more than 150 sq km area and similar land -use, environmental monitoring locations are selected in the major settlement areas covering the sensitive locations, residential areas, market areas and heavy traffic areas to get the representative data from all land use. Details of the environmental monitoring locations is given in Table 23

Table 23: Summary of Primary Baseline Data

Component	Parameters	No. of Sampling Locations	Total No. of Samples	Frequency
Ambient Air Quality	PM10 PM2.5 SO2 NO2 CO and other parameters as per NAAQS	16	64	Twice a week (24 hrs continuous) during Nov-Dec 2022
Noise	Leq day and Leq night	16	16	24 hrs continuous during Nov-Dec, 2022
Water Quality (Surface & Ground Water)	pH, Colour, Odour, Turbidity, TDS, Conductivity, Hardness as CaCO3, Nitrate as NO3-, Chloride as Cl-, Sulphate as SO4-- , Calcium as Ca++, Magnesium as Mg++, Iron as Fe+++, Fluoride as F-, Cyanide as CN-, Arsenic as As-, Mercury as Hg++, Lead as Pb++, Chromium as Cr+6, Copper, Total Coliform, Alkalinity (as CaCO3), Sodium (as Na+), Potassium (as K+), Dissolved Oxygen, BOD, COD	GW-16 SW-16	GW-16 SW-16	Once during January, 2023
Soil	Texture, Sand, Silt Clay, pH (10% Slurry), Conductivity, Organic Matter, Bulk density, Porosity, S.A. R, Bicarbonates, Calcium as Ca++, Magnesium as Mg++, Sodium as Na+, Potassium as K+, Phosphorus as P, Chloride as Cl-, Zinc as Zn++, Copper as Cu, Iron as Fe, Nitrogen, Organic Carbon, Sulphate as SO4-- , Sulphur as S, Fluoride as F-, Selenium as Se, Manganese as Mn++, Chromium as Cr+6, Nickel as Ni, CEC	16	16	Once during January, 2023
Ecology	Aquatic	--	--	Nov 2022-Jan 2023
	Terrestrial	Study area	Study	Nov 2022-Jan

			area	2023
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4.7 Physical Environment

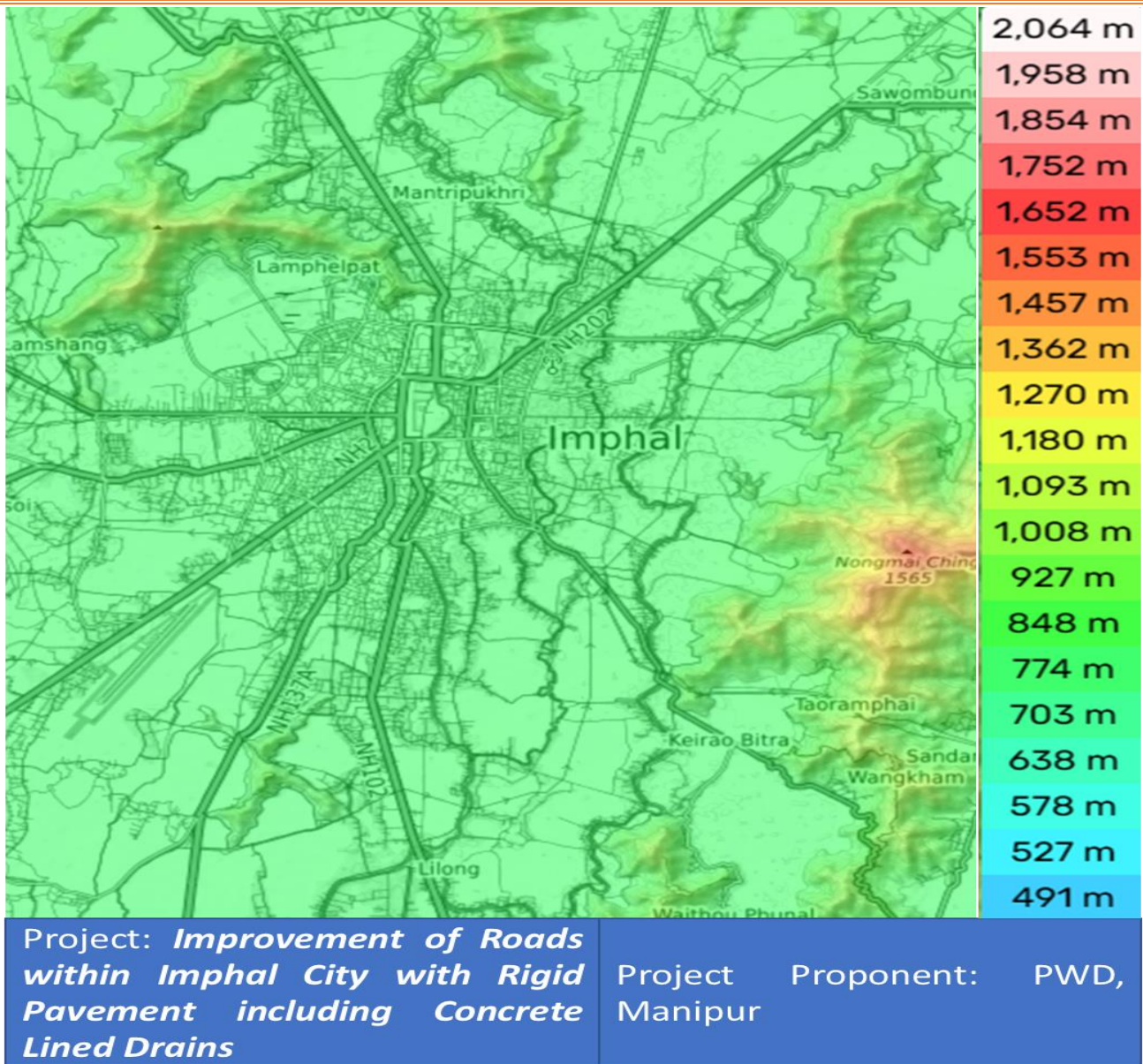
4.7.1 Physiography and Topography

Physiographically, the district of Imphal West shows three prominent units i.e., a tiny plain topography, hilly areas in the extreme north, central parts and marshy land in the southern parts of the district. The general elevation of the elevated area is around 790 m above mean sea level. Imphal East District is in the form of a valley, which is flat, elongated and tapering towards south with isolated hills. It is an intermountain valley surrounded by hillocks about 1,500 - 2,000 m high. The western part of the valley is flanked by abruptly rising hills while lying rolling hills bound the eastern side. The valley slopes down from north to south from an altitude of 880 to 770 m.a.m.sl.

Proposed project is planned to be developed in Greater Imphal region which comprises of parts of both Imphal East and Imphal West Districts of Manipur. Greater Imphal lies between 24.82°N latitude 93.95°E longitude in extreme northeastern India. It is located at an altitude of 786 meters above sea level. Greater Imphal is located majorly in the valley of the Manipur River and is surrounded by the north-eastern Hills.

The Greater Imphal valley is around 48.3 km in length and 32.2 km in breadth and lies in the centre of the state. Several hill ranges dot the valley, the biggest being the Langol Hill Range. The hills are generally irregularly serrated ridges, occasionally rising into conical peaks and flattened cliffs. After hills, the next important landform is valleys. The Greater Imphal valley is the product of erosion of weak zones, like fold-axes, fault-planes, fractures, joints and bedding-planes by the Thongjaorok River and its tributaries. Due to structural and lithological complexities, geomorphic features of the valley are highly variable. In the hilly area, the valley is narrow and form deep gorges, while sporadically they suddenly become wide and shallow, this may be due to the intersection of faults or sudden changes in the lithology. Middle and lower reaches of the valley are characterized by the presence of alluvial fans and terraces. In the plain area, the Greater Imphal valley is relatively wider with steep sides suggesting youthful stage. Greater Imphal region is drained by several rivers, including River Imphal, Iril, Thoubal, Khuga and Sekmai. Rivers like the Iril, Khuga Greater Imphal and Thoubal start from the hills surrounding the region and flow towards a north-south direction.

Map showing elevation level in the project area is given in Figure 6 below. From the map, it is concluded, the area more or less is flat sloping towards South and elevation varies from 770-800 m.



Source: Imphal East topographic map, elevation, terrain (topographic-map.com)

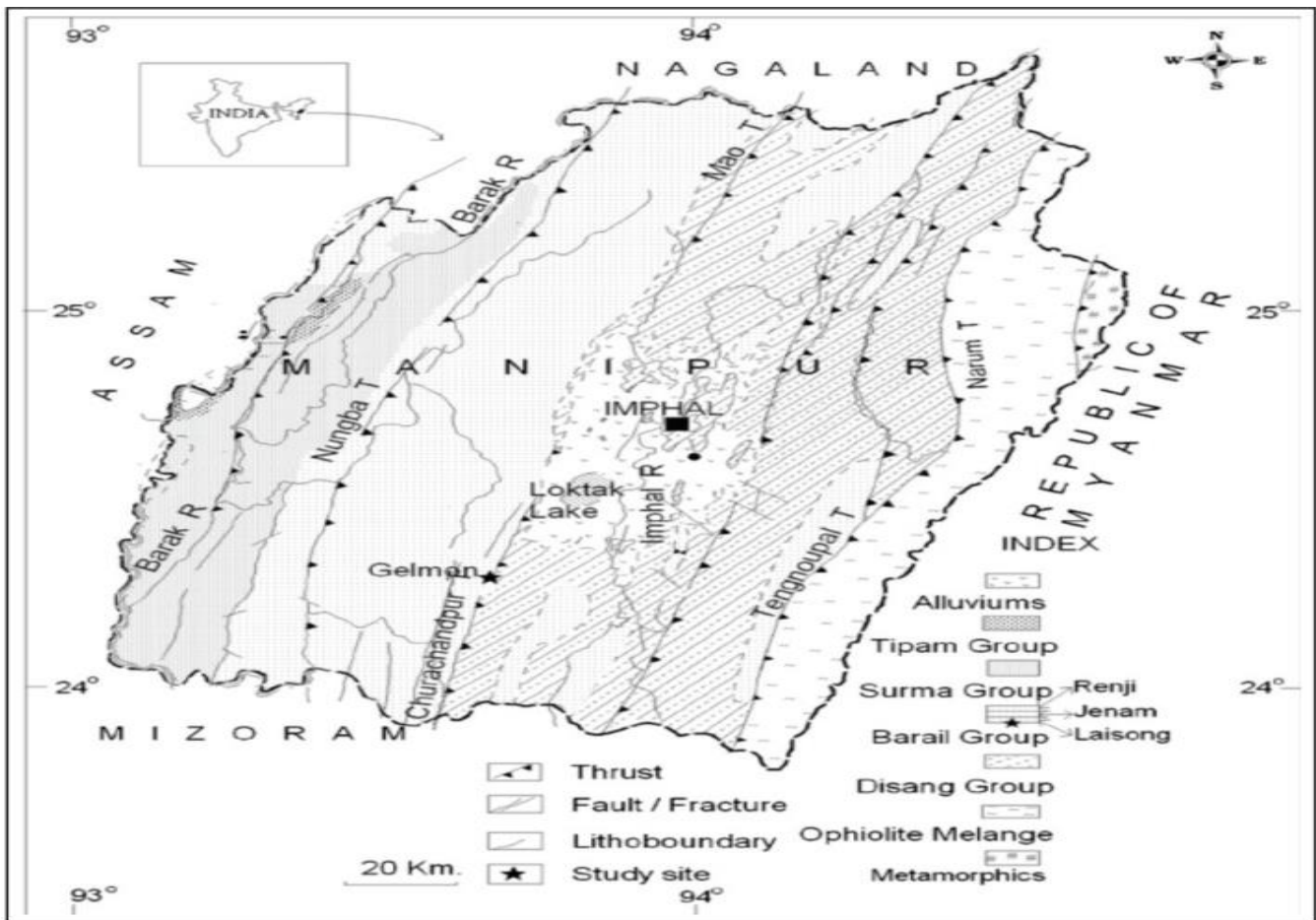
Figure 6: Elevation Map of Study Area

4.7.2 Geography and Geology:

The state is classified geographically into two regions, hills and open river valley, and has a total area of around 22 327 km², of which 20 089 km² (90% of total area) is covered by hills and 2238 km² (10% of total area) by a smaller valley. The hilly region comprises five districts, namely Senapati, Tamenglong, Churachandpur, Chandel and Ukhrul, whereas the open river valley area encompasses four districts, Imphal east, Imphal west, Bishnupur and Thoubal. Proposed project lies in Imphal East and West Districts which are open river valley area.

Geological formations in the Manipur region are divided into six groups namely Tipam, Surma, Barail, Disang, ophiolite-melangae suite and metamorphic complex. Geological formations of the state comprise one of the youngest mountain chains formed during Alpine –Himalayan orogeny and are constituted of cretaceous and tertiary sediments with a very little amount of metamorphic and igneous rocks associated with pelagic sediments like chert, limestone, shale, and sandstone sediments. Thus, Manipur constitutes a part of the Burmese Arc, which extends northward into the eastern syntaxial

bend of the Himalayas and southwards as extension of the Patkai and Kohima synclinoria trending NNE-SSW. Manipur hills are composed geologically of young rock formations due to the Tertiary upward displacement of the Himalayas from the shallow bed of the Tethys Sea. The rocks are sediments of Tertiary and Cretaceous age with minor igneous and metamorphic rocks. Furthermore, the Disang and Barail flysch sediments lie beneath much of the central part of Manipur state. The Disang, which is overlain by the Oligocene Barail formation, contains abundant carbonaceous matter. The Barail is succeeded by the predominantly argillaceous Surma and Tipam formations in the east, igneous rocks of the ophiolite zone intrude into the Disang assemblage. Topographically, Manipur comprises a ridge and furrow terrain where sediments derived from surrounding ridges are deposited in the furrows in the valley, lenses of argillaceous sediments are found. Imphal region is covered majorly by Barail and Disang Group formations. Geological map of Manipur and Project Affected Districts is given in Figure 7 and 8 below.



Source: Manipur Earthquake 2016: Relief to Recovery

Figure 7: Geology Map of Manipur State

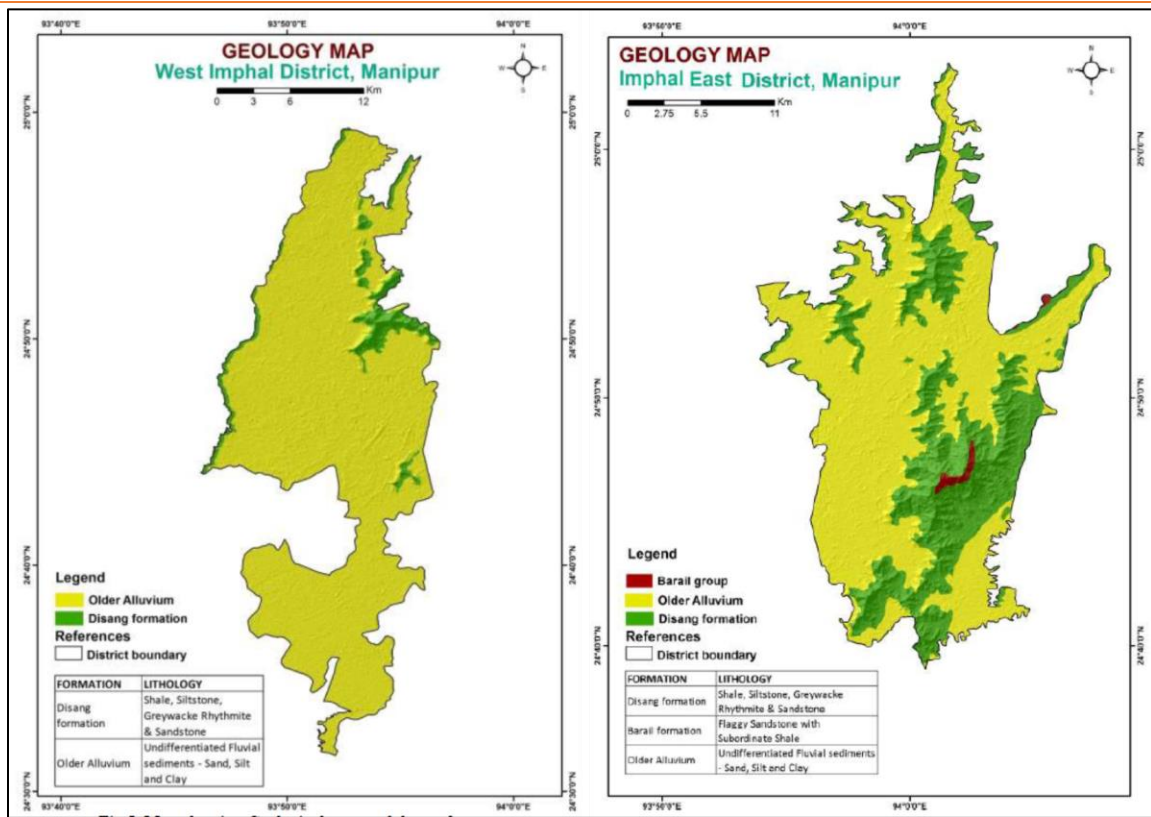


Figure 8: Geology Map of Imphal East and Imphal West Districts

4.7.3 Seismicity and Landslides

Manipur lies in the NE region of India, which is regarded as one of the most seismically active regions worldwide. The region has experienced several strong-magnitude earthquakes, which have caused immense damage to life and property. As a result, the Indian standard code of practice for earthquake resistant design of structures (IS: 1893 2002) has identified NE India, including Manipur, as a zone of most severe seismic hazard (i.e., zone V). All the districts of Manipur state falls in the seismic hazard zone V and can be referred from Figure 9 below.

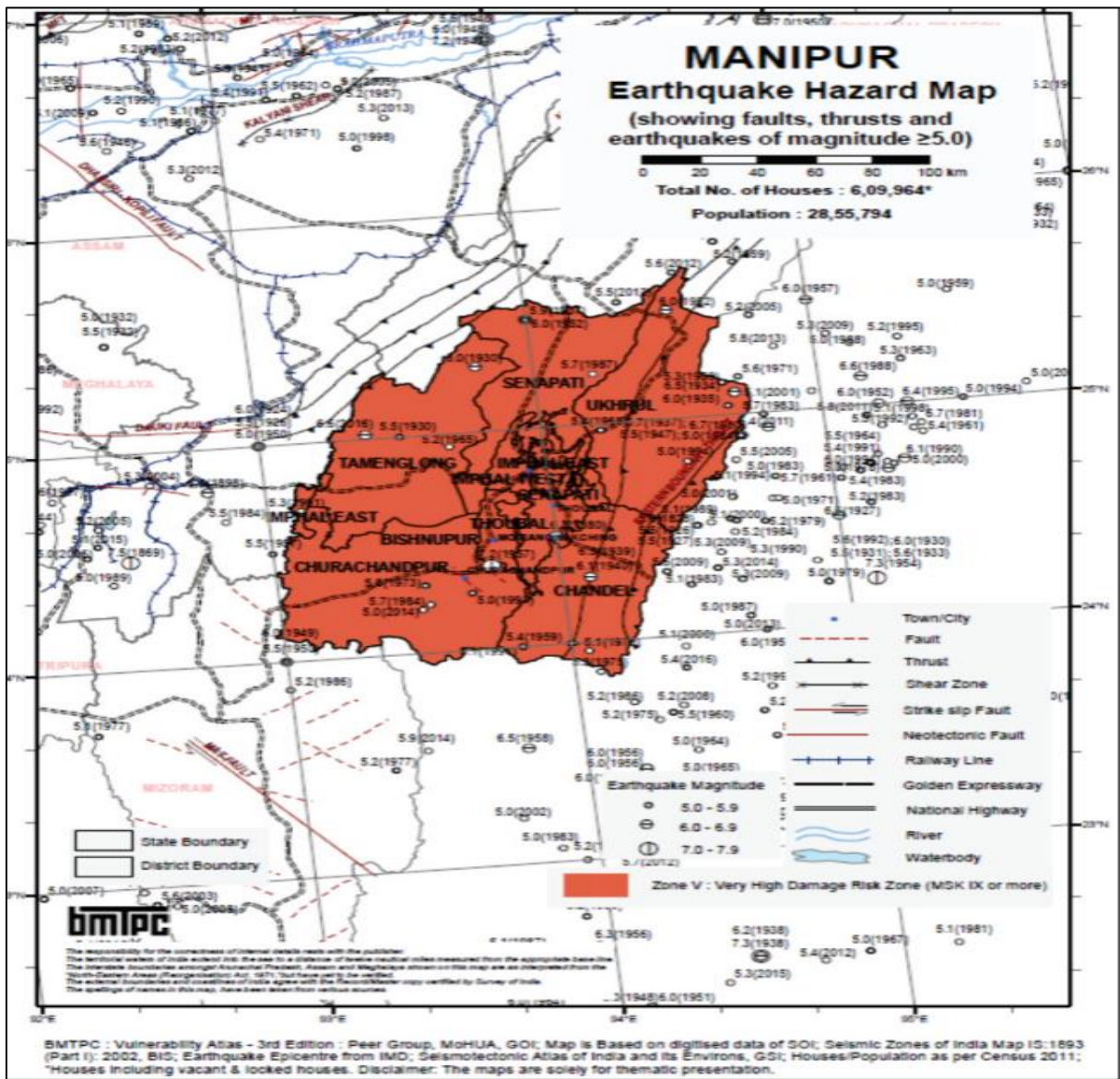
Seismological signature in Manipur is governed by the hills of the eastern frontier of India including Manipur whose isostatic and seismic balances are yet to be attained. Manipur falls in one of the most seismically active zones of the Trans-Asiatic Earthquake Belt. This is of tectonic origin associated with momentary relief of mechanical strain arising from mutual displacement (vertical and horizontal) of separate blocks of lithosphere where the Indo-Burma border may be a plate boundary between Indian and Burmeses plates. Tectonically, the whole of Manipur forms a part of the great geosynclines that apparently had original basin topography of ridges and furrows.

Past seismicity data show that the NE region has experienced two great earthquakes of magnitude 8.0 (1897 and 1950) and almost 16 large earthquakes of magnitude 7.0 over a period of 150 years. The high seismicity is due to collision tectonics between the Indian plate and the Eurasian plate in the north, and subduction along the Indo-Burmese Ranges (IBR) in the east. Although this region has experienced many strong earthquakes in the past, there is a lack of proper documentation of the damage caused by earthquakes that happened in Manipur prior to 1869. Probably the earliest documented earthquake in literature is that of the 1869 Cacher earthquake (Oldham 1882). This earthquake occurred in the Kopili fault of the Shillong Plateau on 10 January and was of magnitude 7.5 with an epicenter near the northern border of the Jaintia Hills, Meghalaya (Oldham 1882, Nandy 2001). It caused extensive damage to buildings in Imphal, and land fissures, liquefaction phenomena and sand venting were also reported.

Of the 1947 earthquake that was triggered in the eastern Himalaya (MW = 7.7) region, there were

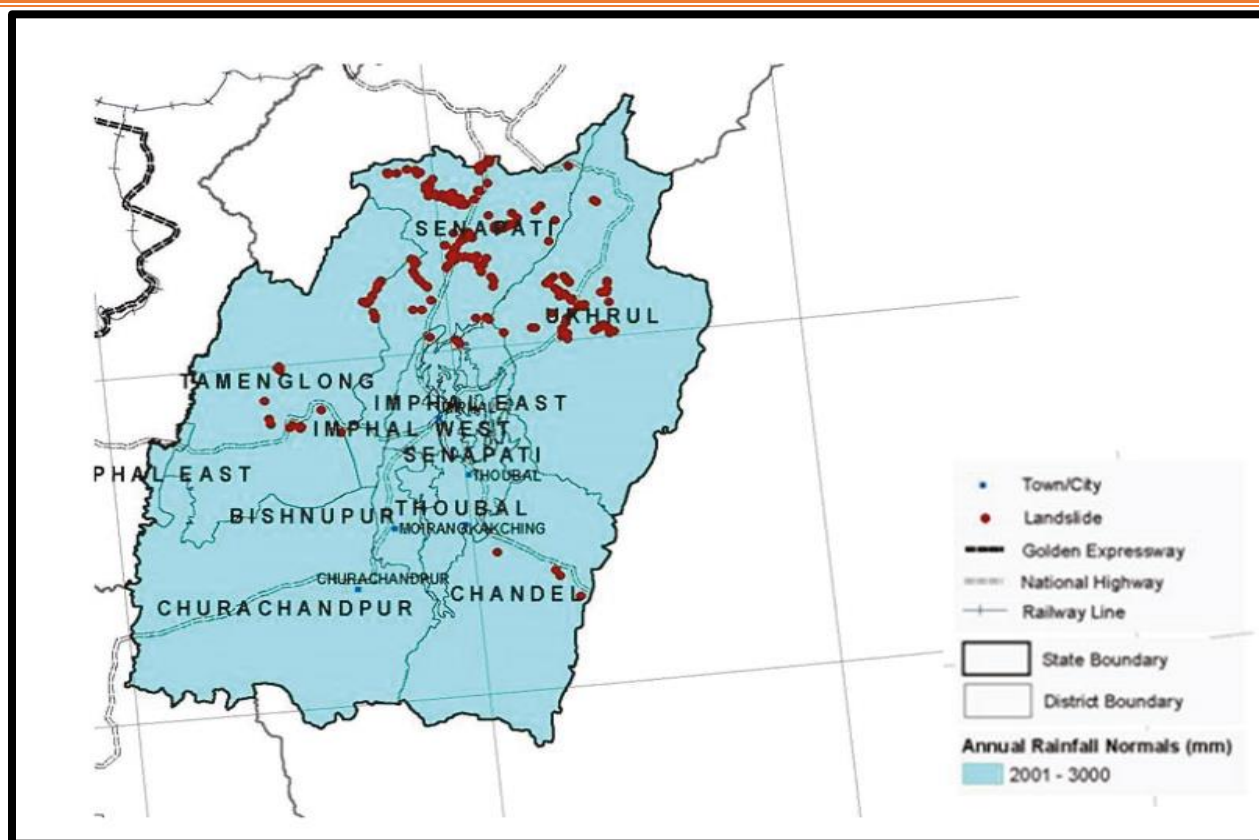
reports of wall cracking, rolling of cooking pots and movement of beds in Imphal. Further, during the 15 August 1950 earthquake (MW = 8.6), which occurred in the Mishmi tectonic block, wall cracks appeared in many buildings, temple bells rang due to structural shaking, and the sloshing of the Loktak lake surface (the biggest freshwater lake in eastern India) was observed (Ningthoukhongjam 2005, Manichandra 2007).

As Manipur is majorly a hilly state, landslides and mudslides are quite common. In 2004, several landslides affected Senapati District. Mudslides due to the construction of the Jiribam-Tupul Railway line have affected many families in Tamenglong District. Over the decades, due to an increase in population as well as construction in areas along the national and state highways, the incidences of landslides have shown a disturbing and damaging trend of occurrence with higher damage to life and property. Hill districts of Manipur i.e., Churachandpur, Tamenglong, Senapati, Ukhrul and Chandel are most vulnerable to landslides. Project Region being in valley is not prone to landslides. Landslide hazard map for Manipur is provided in Figure 10 below.



Source: - BMTPC vulnerability atlas

Figure 9: Earthquake Hazard Map of Manipur State



Source: - BMTPC vulnerability Atlas retrieved on 29 November 2019.

Figure 10: Landslide Hazard Map of Manipur State

4.7.4 Soil Types and Soil Quality:

Two major types of soils found in the Imphal East district are residual and transported, which cover both the hill and plain. The residual soils are either laterised or non-laterised. It contains rich portions of nitrogen and phosphate, a medium acidity and lesser amount of potash. The old alluvial is brought down by river Barrak basin and Jiri River and their tributaries from their lateritic water ship hills. The transported soils are of two types – alluvial and organic. Alluvial soil is majorly found in this district.

The soils have general clayey warm texture and grey to pale brown color. They contain a good proportion of potash and phosphate, a fair quantity of nitrogen and organic matter and are less acidic. The organic soils cover the low-lying areas of the valley. With dark grey color and clayey loam texture, these peaty soils have high acidity, abundance of organic matter, a good amount of nitrogen and phosphorous but are poor in potash. The soil in the area belongs to 4 orders, 8 suborders, 13 great groups and 23 subgroups. It is observed that inceptions are the dominant soils followed by Utisols, Entisols and Alfisols and occupy 38.4%, 36.4%, and 23.1% of the total geographical area of Manipur, respectively. Main Soil classification in the valley, i.e., in parts of Imphal East district: (i) Younger alluvial soil, (ii) Older alluvial soil, (iii) Red gravelly sandy and loamy soil, and (iv) Piety and saline soil. The valley area of the Imphal West district is found to be very fertile and is mainly underlain by alluvial soil of Recent origin.

The valley area of Greater Imphal (East & West) districts are fertile and is mainly made up of alluvial soil of recent origin. However, the soils are acidic with pH ranging between 4.5 to 6.8, rich in organic carbon. Availability of Nitrogen is medium to high, Phosphorus is low to medium, and Potassium is medium to high. The texture of soil varies from sandy to loam too clayey. The availability of Nitrogen is not in proportion to the reserve Nitrogen due to low rate of mineralization and crop is highly responsive to Nitrogen and Phos fertilizers. Initially, factors such as soil parent material, rainfall, and type of vegetation are the major determinants of soil acidity. Soil acidity problems are increasing in

areas of Imphal East to West District because of continuous cropping and use of acidifying fertilizers. On the other hand, though soils of Imphal West have moderate phosphorus as soil reserve, this is practically of no use to plants, as it is present in fixed or insoluble forms due to soil acidity. It also renders supplied phosphorus into insoluble form within a short period of time. All phosphorus ions either as primary orthophosphate ions or as secondary phosphate ions are subjected to fixation with hydroxides of Aluminium and Iron. In hills, where soils are rich in organic matter, the availability of Phosphorus is comparatively better which is mainly due to microbial activity. Soil quality map of project districts is given below in Figure 11.

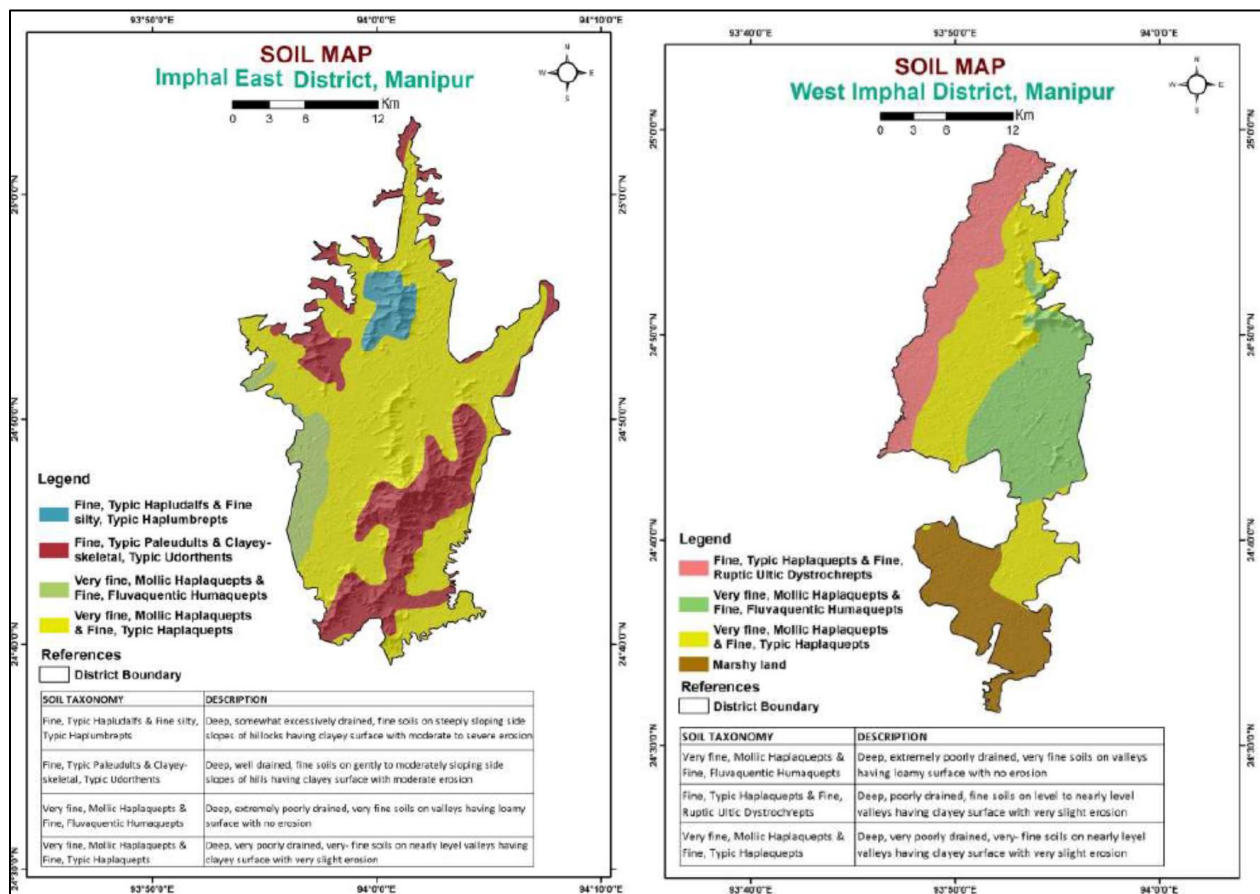


Figure 11: Soil Map of Imphal East and Imphal West District

Soil quality of the area is carried out for the project area. Total 16 samples were collected from the study area. Composite samples from different depths were collected and mixed to form a homogenous sample to extract the representative sample from each location. The details of soil sampling locations and analysis results are provided in Table 24. Laboratory report for soil sampling is attached as Annexure 3.

Table 24: Soil sampling locations

S. No	Locations	8	Chri makla Leikai pulchri
1	Kangla near remedy hospital	9	Luwang sangbam haotabi
2	The new light public school	10	Malom to hawairou road
3	Marjing polofarm road 33KV	11	NIIT manipur
4	Royal Academy of science	12	Central farm Lamphelpat
5	Lairkyengbam malcha leikai(salomthong)	13	Model higher secondary School
6	Near Ghanapriya women's college	14	The united progressive development
7	Chinganga kha canchipur road	15	Nearby Kongba Bazar

Table 25: Soil sampling Results (Locations 1-8), Jan 2023

Type	Soil 1	Soil 2	Soil 3	Soil 4	Soil 5	Soil 6	Soil 7	Soil 8
	Location	Location	Location	Location	Location	Location	Location	Location
Parameters	Kangla near remedy hospital	The new light public school	Marjing polo farm road 33KV	Royal Academy of science	Lairkyengbam malcha Leikai (salomthong)	Near Ghana Priya Women's college	Chinganga kha canchipur road	Chri makla leikai pulchri
Texture	sandy clay loam	sandy clay loam	sandy clay loam	sandy clay loam	sandy clay loam	sandy clay loam	sandy clay loam	sandy clay loam
Silt (%)	50	51	48	52	50	51	48	55
Clay (%)	37	34	35	36	36	37	42	36
sand (%)	13	15	17	12	14	12	10	9
pH	7.37	7.01	5.41	7.57	7.14	8.55	8.43	7.51
Conductivity (µs/cm)	157	388	237	212	501	240	225	402
CEC (meq/100g)	16.5	16.6	10.35	11.9	11.4	25	22.5	20.8
SAR	0.24	0.71	0.76	1.03	0.32	0.29	0.17	0.48
Na (mg/kg)	50	144.7	120	173.2	53.7	74.9	40	109.9
K (mg/kg)	45	169.6	140	197.9	146.5	199.7	175	199.8
Permeability(cm/sec)	2.1x10-3	1.8x10-3	1.6x10-3	1.4x10-3	1.6x10-3	2.2x10-3	1x10-3	1.4x10-3
WHC (%)	42.2	43.1	41.9	40.1	42.1	40.4	42	43
Porosity (%)	37.5	33.3	42.1	21.4	40	31.2	25	31.6
Bulk Density (gm/cc)	1.25	1.11	1.05	1.43	1	1.25	1.25	1.05
Ca (mg/kg)	3045.5	1679.8	921.6	1705.4	1252.5	4562.3	3406.1	2842.3
Mg (mg/kg)	121.5	897.2	607.4	264.5	569.5	169.8	607.4	703.8
Cl (mg/kg)	195.6	581.2	486.5	293	386.3	282.6	390.5	584.8
Available Phosphorus (mg/kg)	8.2	22.4	16.2	30.1	28.4	38.7	32.2	46.1
Available Nitrogen (mg/kg)	14.3	35.7	36.6	42.8	40.6	48.2	30.6	55.8
OM	4	1.63	4.4	2.1	1.37	3.43	2.72	5.06
Cd (mg/kg)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)
Pd (mg/kg)	11	14	13.8	10	12.3	10	11.7	13
Ni (mg/kg)	6	6.5	6	7	10	6	16	8
Zn (mg/kg)	24.5	11	9.5	19	16.5	25	38	18
Cu (mg/kg)	8.5	14.5	14.3	10	11.5	8	11	13
Fe (mg/kg)	3737.5	11387.5	10587.5	5925	8375	4773.8	8125	7637.5
Hg (mg/kg)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)

Table 26: Soil sampling Results (Locations 9-16), Jan 2023

Type	Soil 9	Soil 10	Soil 11	Soil 12	Soil 13	Soil 14	Soil 15	Soil 16
	Location	Location	Location	Location	Location	Location	Location	Location
Parameter	Luwang sangbam haotabi	Malom to hawairou road	NIIT manipur	Central farm Lamphelpat	Model higher secondary School	The united progressive development	Nearby Kongba Bazar	Naoremthong
Texture	sandy clay loam	sandy clay loam	sandy clay loam	sandy clay loam	sandy clay loam	sandy clay loam	sandy clay loam	sandy clay loam
Silt (%)	50	52	50	49	52	50	51	52
Clay (%)	37	38	36	39	39	38	37	37
sand (%)	13	12	14	12	9	12	12	11
pH	6.8	7.26	7.66	7.01	6.88	6.01	8.92	6.27
Conductivity (µs/cm)	190	185	368	262	201	233	21	22
CEC (meq/100g)	10.8	16.1	32.4	17.2	11.8	4.37	12.2	17.4
SAR	0.3	0.27	0.43	0.6	1.18	6.27	0.86	0.72
Na (mg/kg)	50	54.9	124.9	125	200	474.8	150	150
K (mg/kg)	40	149.8	199.9	75	25	55	20	80
Permeability(cm/sec)	2.1x10-3	1.8x10-3	1.6x10-3	1.8x10-3	1.6x10-3	2.4x10-3	1.5x10-3	1.9x10-3
WHC (%)	44	42.1	40.6	41.3	42.2	43.6	41.5	40.4
Porosity (%)	37.5	40	40.9	38.1	29.4	31.2	35.3	22.2
Bulk Density (gm/cc)	1.25	1.33	0.91	0.95	1.18	1.25	1.17	1.11
Ca (mg/kg)	1562.5	2041.2	4286	2083.7	1002	240	1362.6	1402.2
Mg (mg/kg)	340	655.2	1238.5	753.1	729	121.5	583.1	1190.2
Cl (mg/kg)	195.4	292.3	391	489.1	293.4	390.7	293.2	293
Available Phosphorus (mg/kg)	8.4	15.9	36.2	11.4	60.4	6.9	9.2	14.2
Available Nitrogen (mg/kg)	18.7	41.2	50.6	16.4	32.2	55.1	16.4	22.8
OM	3.09	0.31	0.25	1.73	1.94	2.52	2.47	3.62
Cd (mg/kg)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)
Pd (mg/kg)	12	11.8	9	11	13	10.8	11	9
Ni (mg/kg)	7.9	16	5.5	9	7.5	BDL(DL-2.0)	7	5.5
Zn (mg/kg)	15	16	50	7	18	BDL(DL-2.0)	68	15
Cu (mg/kg)	8.5	10.8	9.5	19.8	11	5	10	9
Fe (mg/kg)	8063	6875	6213	6185	8888	6188	9375	4750
Hg (mg/kg)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)

Analysis of soil quality on basis of the data collected is presented below.

Physical properties: Texturally the soils of study area are observed to be Sandy Clay Loam Soils. The Bulk Density (BD) of the soils was found in the 0.91-1.43 gm/cc. Water Holding Capacity (WHC) of study area soils was observed between 40.1 and 43.6%.

Chemical properties: The soil pH was found to be within range of 5.41 to 7.66, thereby indicating the soil are slightly acidic except at 3 locations where pH is more than 8. The organic matter content in sampled soil was observed as 0.25%-5.06% thereby implying that soils are deficient-rich in organic matter content.

Macronutrients: Available nitrogen content was observed in the surface soil between 14.3-55.8 mg/kg, thereby indicating that soil is low in available nitrogen content. Available phosphorus content was observed as 8.2 to 60.4 mg/kg, thereby indicating that soil is low-medium in available phosphorus. Available potassium content in the sampled soil was also observed as 20-199.9 mg/kg, thereby indicating that the soil is low to medium in potassium content.

4.7.5 Agriculture and Cropping Pattern

Agriculture being the main occupation of the people in the Imphal East District, it has an important place in the economy of the district. Agriculture sector contributes a major share to the total state domestic product and provides employment to about 63.95%¹⁰ of the total working force in the area. In fact, the domestic product fluctuates depending on the performance of agricultural sector. Despite the crucial importance of this primary sector in the economy of the area, the irregular and erratic behavior of monsoon accompanied by inadequate irrigation facilities have resulted in severe fluctuations in agricultural production. Agriculture becomes points of employment and income; agriculture plays a very crucial role in the economy. Area under crops in Imphal East District is 325.38 sq km.

The valley area of the Imphal West district is found to be very fertile and is mainly underlain by alluvial soil of Recent origin. This valley was once full of swamps and marshy land represented by the places having the word PAT meaning lake, like Lamphelphet, Takyelpat, Sangaipat, Kakwapat and Poiroupat.

Paddy is by far the most important crop of project area followed by maize and different types of millets, pulses and beans, mustard and sesamum, sugarcane, cotton, mesta, yams and sweet potatoes, chillies, ginger, turmeric, pineapple, and many other kinds, of fruits and vegetables.

4.7.6 Land Use

Land use of Imphal East and Imphal West Districts are given below in Table 27 and 28

Table 27: Land use of Imphal East District

SI No	Name of NQUIM Area	Area in Hectare
1	Imphal East District	70900
2	Imphal East I CD Block	23290
3	Imphal East II CD Block	47610
4	Net area sown	20520
5	Net Cultivated area	20448
6	Culturable Waste Land	26
7	Total Uncultivated Land	26
8	Net Irrigated Area	1530
9	Irrigated area by canals, Tank, Well, Tube Well	0
10	Irrigated area by other sources	1530
11	Irrigated area for All Crops	1537
12	Unirrigated area for all crops	26712
13	Gross Cropped Area	28249

¹⁰ CGWB Brochure Imphal East District, CGWB

Table 28: Land use of Imphal West District

SI No	Name of NQUIM Area	Area in Hectare
1	Imphal West t District	51900
2	Imphal West I CD Block	23290
3	Imphal West II CD Block	47610
4	Net sown area	21136
5	Net Cultivated area	21150
6	Net Irrigated Area	1049
7	Irrigated area by canals	637
8	Irrigated area by other sources	412
9	Irrigated area for All Crops	1100
10	Unirrigated area for all crops	21956
11	Gross Cropped Area	23056
12	Area under current Fallow	14
13	Land not available for cultivation	100

Project area lies in Greater Imphal Region comprising of both Imphal East and West District. Agriculture has the highest share of land use in the Greater Imphal area as most of the peripheral areas have not yet experienced the expansion of built up. Residential is the next dominant land use class which occupies about 27% of the total area of Greater Imphal. The residential area is spread across the core area particularly within the Imphal Municipal Corporation except in north-west portion of IMC, which is a low-lying area. The built-up is also spread along the Imphal-Kangochup Road, Imphal Aizawl road (NH 2), Imphal-Kakching Road (SH 70) and Imphal-Moreh Road (NH 102) in the west, south-west and southern direction of the Greater Imphal region, respectively. In the eastern direction, the residential areas are mostly restricted by the Kongba River. In the northern direction, Imphal-Dimapur Road (NH 2) and Imphal River have little impact on the spread of residential land use in a linear pattern. The urban sprawl is restricted by Langol Hill and the existence of cantonment areas in the north- west direction. The Greater Imphal planning area has a low share of industrial landuse and recreational areas as observed from table 6.1. Green areas such as the Langol Reserved Forest, occupy a large portion of planning area, i.e., 11% of total area of Greater Imphal situated in the north-west of the Greater Imphal area and Langthabal which situated in the southern part of the Greater Imphal area.

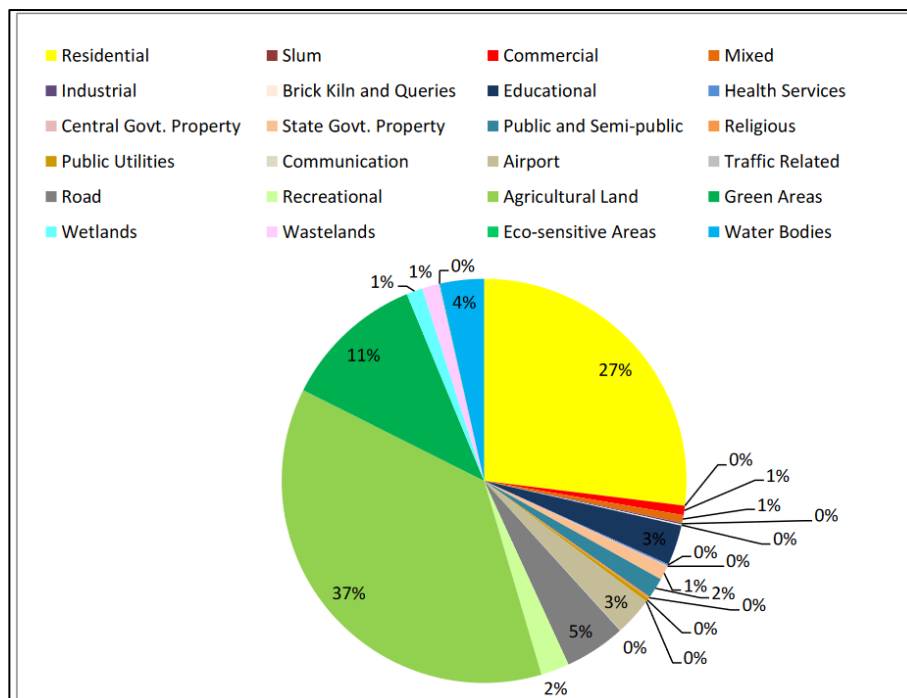


Figure 12: Land Use Land Cover Composition of Greater Imphal Region (2020)

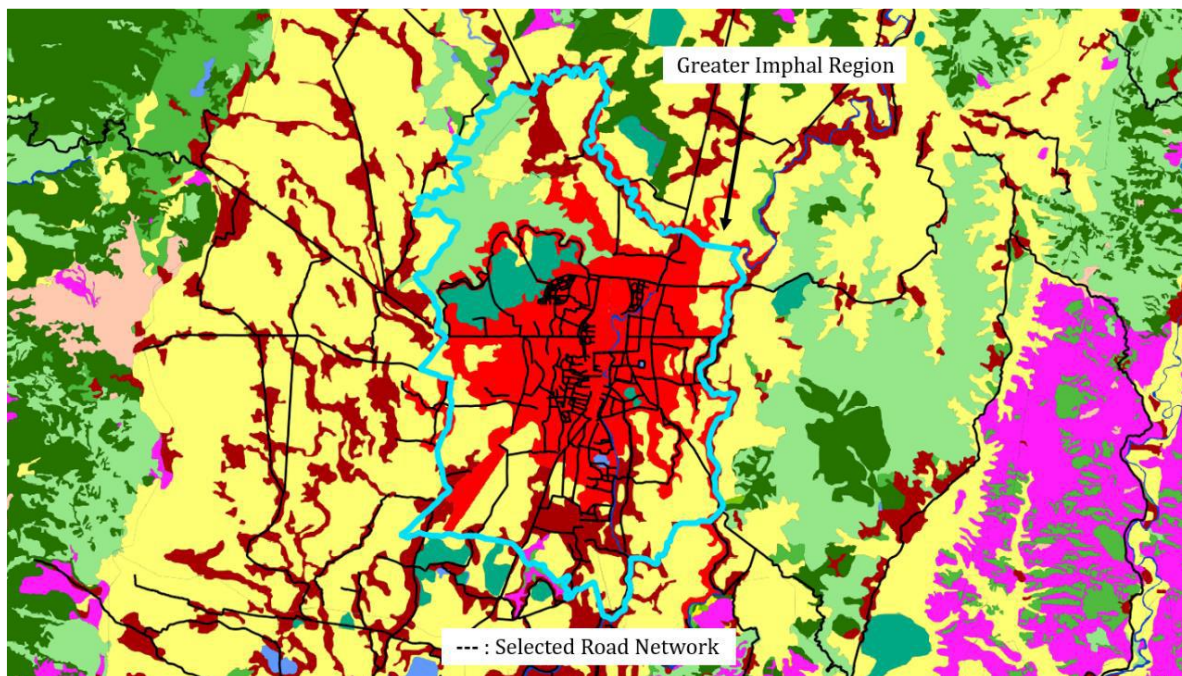


Figure 13: Land Use Land Cover Detail of Greater Imphal Region

Land use pattern of the project network is predominantly built-up urban area along with some stretches passing through agricultural area. The details of Land use pattern are given in table 29 below. Land Use Land Cover Map of Greater Imphal Region is presented in the figure below.

Table 29: Land use of Project Area

SI No	Land Use Class	Area percentage
1	Built-up Area	86.64%
2	Open Area	13.35%
3	Forest	0%

4.7.7 Drainage

Four major river basins comprise Manipur, the Barak River Basin (Barak valley) to the west, the Manipur River basin in central Manipur, the Yu River basin in the east, and a portion of the Laniye river basin in the north (Haokip 2007). The Manipur River basins contain the following major rivers: Imphal, Iril, Nambul, Sekmai, Chakpi, Thoubal and Khuga. All these rivers originate from the surrounding hills and deposit their sediment load into the Loktak lake. Project area (District Imphal West & East) lies in Manipur River Basin. Manipur Valley is drained by three major rivers viz: (i) Imphal river, (ii) Iril river, (iii) Thoubal river and many minor rivers such as: a. Sekmai river, b. Chakpi river, c. Khuga river, d. Nambul river, e. Nambul river, f. Wangjing river, g. Kongba river etc.

The various rivers either fall directly into or indirectly connected (through lakes) with Imphal river which is later on known as Manipur River. Thus, Manipur Valley is oriented with the Manipur River system. The catchment area of Manipur Valley can be divided into 9 Basins Name of the river basin Catchment area are: (i) Imphal River Basin 560 sqkm, (ii) Thoubal River Basin 920 sq km (iii) Iril River Basin 1260 sqkm, (iv) Sekmai River Basin 426 sqkm, (v) Khuga River Basin 458 sqkm, (vi) Wangjing River Basin 305 sqkm, (vii) Chakpi River Basin 660 sqkm, (viii) River systems which fall on Loktak Lake 980 sqkm, (ix) Other Rivers fall on Manipur River 763 sqkm and Total is 6332 sqkm.

Imphal West District is drained by Rivers Imphal, Nambul, Thoubal and their tributaries mainly. The Nambul River is made up of number of small streams on its upper course and flows through Imphal town dividing the town almost into two equal halves. The course of the rivers is short and falls in the

Loktak Lake.

The drainage pattern in Imphal East District is from north to south. Manipur River is the main drainage, which ultimately flows to the south towards Myanmar and falls into Chindwin River. The major tributaries of Manipur River basin flowing in Imphal valley are Imphal, Iiril, Nambul, and Sekmai rivers which originate from the surrounding hills. Sekmai River at Sekmaijin and that falls into the Chindwin River of Myanmar. The other rivers of Manipur River basin either fall directly into or indirectly connect with the Imphal River through these lakes.

Project falls in Greater Imphal region comprising of parts of Imphal East and Imphal West. Greater Imphal is the part and parcel of Imphal Valley (also Manipur Valley), a pull-apart basin. It is flat land sloping from north to south and drained by Imphal, Iiril, Kongba, Nambul and Naga Rivers. The aforesaid rivers are the primary drains which carry most of the water of the Greater Imphal area. There are also abandoned river channels locally called Turel Amanbi (Turel Amanbi means old river) of Imphal river. Waishel Maril is the temporary stream draining the southwestern part of the Greater Imphal. Imphal River is the one of the upstream of Irrawady River System and Nambul River empties to the Loktak Lake. Drainage Geo-morphology map of the project districts and drainage map of project area is shown in Figures below. Details of the water bodies intercepted by project roads are given below in Table 30

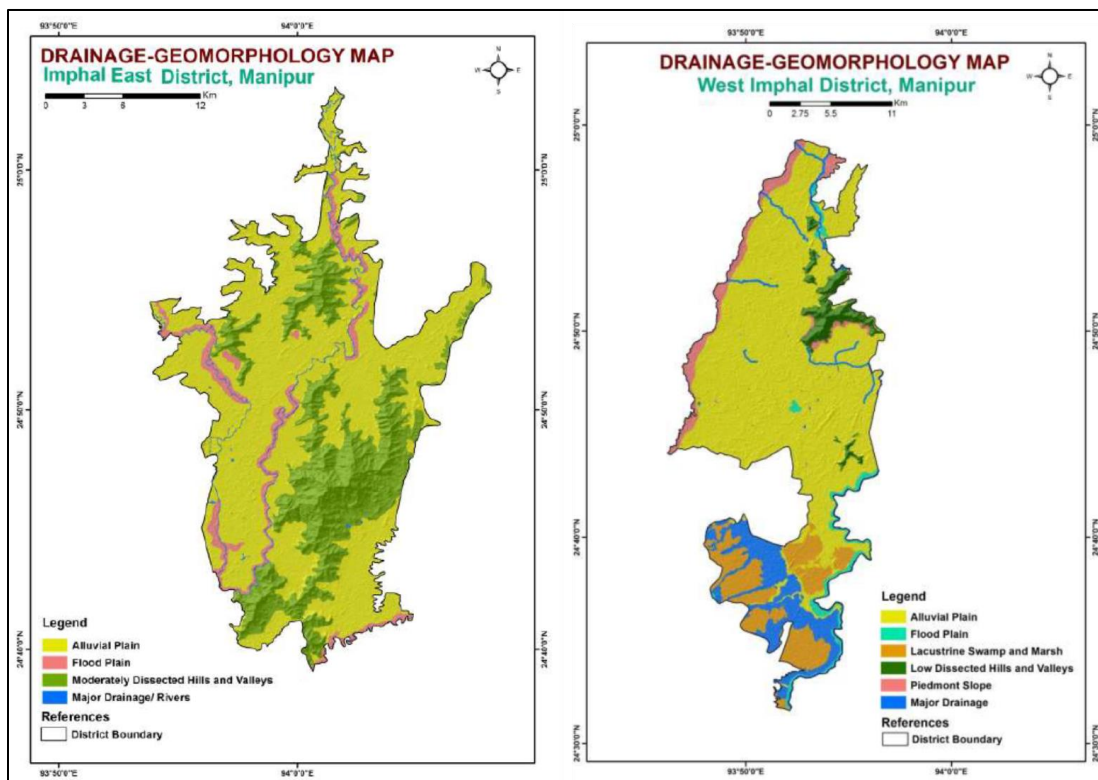


Figure 14: Drainage-Geomorphological Maps of Project Districts

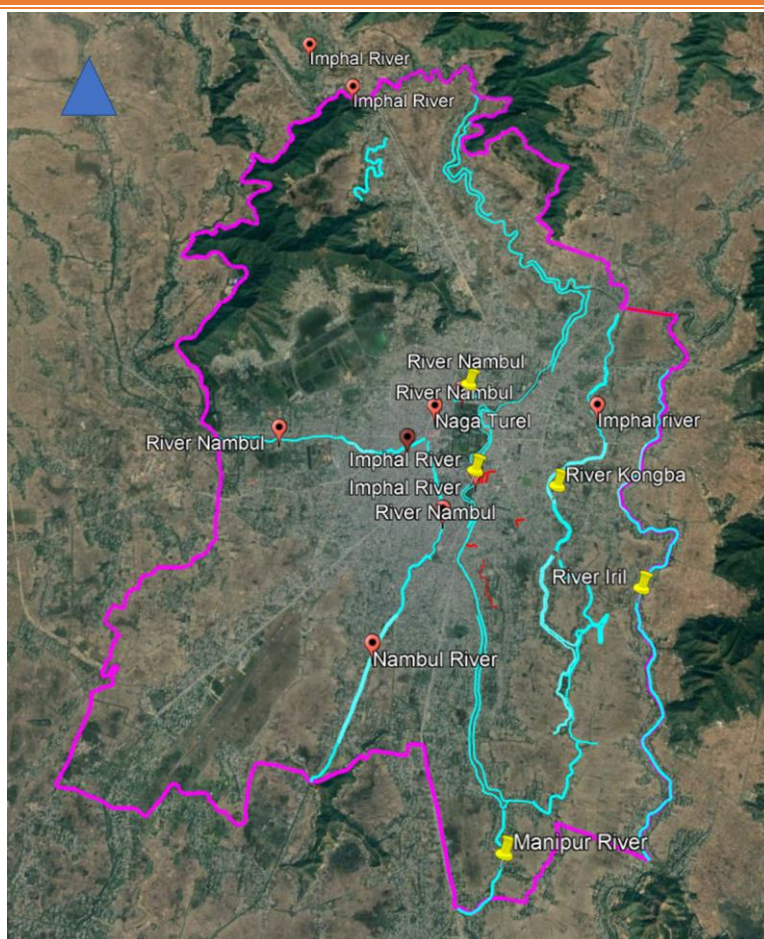


Figure 15: Drainage Map of Imphal West District

Table 30: Surface Water Bodies Intercepted by Project Roads

S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
1.	SH- Imphal Yairipok road	Kangla Thangapat	0-0.319km	Still water body	Use for ceremonial purposes
2.	SH- Imphal Yairipok road	Kangla pond	0.340-0.390km	Still water body	Use for ceremonial purposes
3.	SH- Imphal Yairipok road	Pureiromba Khongnangkhong Thangapat Part-1	0.537-0.729km	Still water body	Use for ceremonial purposes
4.	SH- Imphal Yairipok road	Pureiromba Khongnangkhong Thangapat Part-2	0.737-0.886km	Still water body	Use for ceremonial purposes
5.	SH- Imphal Yairipok road	Meihoubam Lampak pond 1	2.489-2.511km	Still water body	Use for ceremonial purposes
6.	SH- Imphal Yairipok road	Meihoubam Lampak pond 2	2.541-2.567km	Still water body	Use for ceremonial purposes
7.	SH- Imphal Yairipok road	Kongba khetri leikai pond	3.229-3.244km	Still water body	Use for household commodities
8.	SH- Imphal Yairipok road	Kongba Bazar pond	3.534-3.605km	Still water body	Use for household commodities
9.	SH- Imphal Yairipok road	YGC Club ponds	3.652-3.826km	Still water body	Use for household commodities

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
10.	SH- Imphal Yairipok road	Khergao small pond near Tangtang car wash	3.930-3.945km	Still water body	Use for household commodities
11.	SH- Imphal Yairipok road	Shiripukhri (Pond)	4.101-4.157km	Still water body	Use for household commodities
12.	SH- Imphal Yairipok road	Pond opposite to Mandan Mohan Temple	4.336-4.353km	Still water body	Use for household commodities
13.	SH- Imphal Sagolmang Saikhul road	Imphal River	0-2.142km	North to South	Various Purpose
14.	MDR- Thangat Mapal road	Wangkhei Thangapat	0.054-0.582km	Still water body	Use for ceremonial purposes
15.	MDR- Tinseed road	Paragon Club Pond	0.556-0.604km	Still water body	Use for household commodities
16.	MDR- Tinseed road	Khurai Lainingthoubung lai Leirak pond	1.473-1.505km	Still water body	Use for household commodities
17.	MDR- Don-Bosco Road	Don-Bosco Church and Hall small pond	0.168-0.181km	Still water body	Use for ceremonial purposes
18.	Don-Bosco Church and Hall small pond	Don-Bosco opposite pond	0.285-0.307km	Still water body	Use for household commodities
19.	Don-Bosco opposite pond	LKYDA Club	0.592-0.612km	Still water body	Use for ceremonial purposes
20.	LKYDA Club	Pond	1.032-1.052km	Still water body	Use for household commodities
21.	Pond	Pond	1.129-1.147km	Still water body	Use for household commodities
22.	ODR- NH - 39 to Singjamei Kongba road via Old Thumb thong bridge	Khongman canal	0.789-1.074km	Still water body	It originates from old Thambuthong bridge and end at Okram chuthek.
23.	ODR- NH - 39 to Singjamei Kongba road via New Thumbuthong bridge	Khongman canal	0.307-1.246km	Still water body	It originates from old Thambuthong bridge and end at Okram chuthek.
24.	ODR- Khuman Palli road i/c internal road of Khuman lampak Complex Lane 1	Khuman lampak lake	1.136-1.312km	Still water body	Use for spots purposes
25.	ODR- Khuman Palli road i/c internal road of Khuman lampak Complex Lane 3	Khuman lampak lake	0.086-0.805km	Still water body	Use for spots purposes
26.	IVR- Sougaijam Leirak	WFC Club Pond	0.306-0.319km	Still water body	Use for household commodities
27.	IVR- Harinath Road	Harinath road pond	0.459-0.489km	Still water body	Use for household commodities
28.	IVR- Harinath Road	Advance research Consortium library	0.496-0.511km	Still water body	Use for household commodities
29.	IVR- Wangkhei	Thangjam Leirak	0.231-	Still water	Use for household

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
	Thangjam Leirak	pond	0.250km	body	commodities
30.	IVR- Hijam leirak	Hijam leirak pond 1	0.430-0.444km	Still water body	Use for household commodities
31.	IVR- Hijam leirak	Hijam leirak pond 2	0.464-0.470km	Still water body	Use for household commodities
32.	IVR- Bamon leikai Thanjam leirak	Small Lake -1	0.270-0.356km	Still water body	Use for household commodities
33.	IVR- Bamon leikai Thanjam leirak	Small Lake -2	0.380-0.447km	Still water body	Use for household commodities
34.	IVR- Wangkheimayum leirak	Wangkheimayum leirak pond-1	0.239-0.252km	Still water body	Use for household commodities
35.	IVR- Wangkheimayum leirak	Wangkheimayum leirak pond 2	0.322-0.329km	Still water body	Use for household commodities
36.	IVR- Wangkheimayum leirak	Wangkheimayum leirak pond 3	0.344-0.365km	Still water body	Use for household commodities
37.	IVR- Wangkheimayum leirak	Khetrimayum Dairy cattle pond	0.396-0.412km	Still water body	Use for household commodities
38.	IVR- Ningthem Pukhri Achouba leirak	Wangkhei Ningthem pukhri (Pond)	0.274-0.467km	Still water body	Use for household commodities
39.	IVR- Yumnam leikai Northern side	Nityainanda Mandap pond	0.133-0.181km	Still water body	Use for ceremonial purposes
40.	IVR- Phuritmayum leirak	Phuritmayum leirak Bamon pond 1	0.129-0.153km	Still water body	Use for ceremonial purposes
41.	IVR- Phuritmayum leirak	Phuritmayum leirak pond 2	0.175-0.195km	Still water body	Use for household commodities
42.	IVR- Phuritmayum leirak	Sijagurumayum mantap pond 1	0.210-0.222km	Still water body	Use for ceremonial purposes
43.	IVR- Phuritmayum leirak	Sijagurumayum mantap pond 2	0.225-0.236km	Still water body	Use for household commodities
44.	IVR- Phuritmayum leirak	Shree Chhatchakra Mandir Pond	0.367-0.386km	Still water body	Use for ceremonial purposes
45.	IVR- Phuritmayum leirak	Phuritmayum leirak Bamon pond 1	0.129-0.153km	Still water body	Use for ceremonial purposes
46.	IVR- Phuritmayum leirak	Phuritmayum leirak pond 2	0.175-0.195km	Still water body	Use for household commodities
47.	IVR- Mahabali Road	Imphal River	0-0.319km	North to South	Various Use
48.	IVR- Mahabali Road	Mahabali pond 1	0.356-0.379km	Still water body	Use for ceremonial purposes
49.	IVR- Mahabali Road	Mahabali Mongbahanba Lai ikol pond	0.437-0.464km	Still water body	Use for ceremonial purposes
50.	IVR- Mahabali Road	Imphal River	0.649-1.264km	North to South	Various Use
51.	IVR- Torban road from old Thambuthong to Singjamei bridge	Imphal River	0-1.152km	North to South	Various Use

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
52.	IVR-Nambul Mapal IVR	Imphal River	0-1.368km	North to South	Various Use
53.	IVR- Yaiskul Jmasthan road	Imphal River (Left)	0-0.528km	North to South	Various Use
54.	IVR- Yaiskul Jmasthan road	Yaiskul Jmasthan road Pond (Right)	0.070-0.117km	Still water body	Use for household commodities
55.	IVR- Tharoijam leirak via Chingjaibi connecting Ipum mapal road	Tharoijam Pukhri (Pond-1)	0.016-0.057km	Still water body	Use for household commodities
56.	IVR- Tharoijam leirak via Chingjaibi connecting Ipum mapal road	Tharoijam Pukhri (Pond-2)	0.305-0.316km	Still water body	Use for household commodities
57.	IVR-Bamon Leirak connecting Imphal Saikul road	Konsam leikai pond 1	0.240-0.248km	Still water body	Use for household commodities
58.	IVR-Bamon Leirak connecting Imphal Saikul road	Konsam leikai pond 2	0.277-0.285km	Still water body	Use for household commodities
59.	IVR-Bamon Leirak connecting Imphal Saikul road	Konsam leikai pond 3	0.293-0.298km	Still water body	Use for household commodities
60.	IVR-Bamon Leirak connecting Imphal Saikul road	Konsam leikai pond 4	0.306-0.344km	Still water body	Use for household commodities
61.	IVR-Bamon Leirak connecting Imphal Saikul road	Pond near Laimayum mandop	0.542-0.544km	Still water body	Use for household commodities
62.	IVR- Road from Porompat road No. 1 to Laihiden Westernside of Kongba river	Kongba River	0-1.391km	North to South	Various Use
63.	IVR- Thingom Leirak Connecting Ayangpalli road	Thingom Leirak pond	0.318-0.330km	Still water body	Use for household commodities
64.	IVR- T.V. Tower Road connecting Porompat road No.1	Thangjam leikai pond	0.022-0.080km	Still water body	Use for household commodities
65.	IVR- T.V. Tower Road connecting Porompat road No.1	Intensive cattle development pond	0.254-0.304km	Still water body	Use by the Intensive cattle development
66.	IVR- T.V. Tower Road connecting Porompat road No.1	AAA community hall pond	0.838-0.865km	Still water body	Use for household commodities
67.	IVR- T.V. Tower Road connecting Porompat road No.1	Ponds	0.932-0.967km	Still water body	Use for household commodities
68.	IVR- Kongpal Laishram leikai, Sajor leikai road	Kongba River	0.108-1.416km	North to South	Various Use

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
69.	IVR- Lai Khulembi Road	Lai khulembi pukhri (Pond)	0.123-0.150km	Still water body	Use for household commodities
70.	IVR- Dingku road to Laipham Khunou	Small pond opposite to Khongsai Veng road	0.198-0.213km	Still water body	Use for household commodities
71.	IVR- Dingku road to Laipham Khunou	SDC Laipham khunou long pond	0.261-0.410km	Still water body	Use for household commodities
72.	IVR- Dingku road to Laipham Khunou	SDC Laipham Khunou pond	0.473-0.495km	Still water body	Use for household commodities
73.	IVR- Dingku road to Laipham Khunou	Laipham Khunou Panchayat ghar opposite pond	0.661-0.682km	Still water body	Use for ceremonial purposes
74.	IVR- Dingku road to Laipham Khunou	Soibam lampak opposite pond	0.718-0.831km	Still water body	Use for household commodities
75.	IVR- Lairikyengbam Mayai Leirak Pukhri Achouba mapan road	Lairikyengbam Mayai leirak pukhri Achouba (Pond)	0.053-0.153km	Still water body	Use for household purposes
76.	IVR- Lairikyengbam Mayai Leirak Pukhri Achouba mapan road	SDC Laipham khunou long pond	0.297-0.435km	Still water body	Use for household purposes
77.	IVR- Kontha Ahallup to Mantripukhri road	Ibudhou Marjing ground Canal	0.208-0.376km	Still water body	Use for irrigation
78.	IVR- Kontha Ahallup to Mantripukhri road	Mantripukhri Mercylane road pond	1.089-1.133km	Still water body	Use for household purposes
79.	IVR- Lamlongei ring road	Pantilong big pond	0.725-0.841km	Still water body	Use for household commodities
80.	IVR- Lairikyengbam makha leikai road upto salanthong	Imphal River	0-0.992km	North to South	Various Use
81.	IVR- Nagaram road	Dingku roadside Thangapat	0-0.276km	Still water body	Its water is not being use of any kind
82.	IVR- Marjing Polo farm road	Marjing power Substation side big pond	0.687-0.792km	Still water body	Use for farming
83.	IVR- Marjing Polo farm road	Pond	1.272-1.325km	Still water body	Use for farming
84.	IVR- Marjing Polo farm road	Pond	1.818-1.842km	Still water body	Use for household commodities
85.	IVR- Marjing Polo farm road	Big pond	1.921-2.014km	Still water body	Use for farming
86.	IVR- Marjing Polo farm road	Konthouba piggery farm pond	2.089-2.232km	Still water body	Use for farming
87.	IVR- Heingang Waikhom Maning to Heingang Panthoibi Leirak	Imphal River	0-1.365km	North to South	Various use
88.	IVR- Heingang Awang Thongkhong to	Imphal River	0-1.251km	North to South	Various Uses

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
	Nungsibi Leirak via Heingang Chonthabi				
89.	IVR- Ipum Mapal road (Muslim side)	Ipum long pond	0-0.805km	Still water body	Use for household commodities
90.	IVR- Heingang Kangjeibung to Heingangkhong	Pond-1	0.265-0.289km	Still water body	Use for household commodities
91.	IVR- Heingang Kangjeibung to Heingangkhong	Small Lake (Right)	0.553-0.665km	Still water body	Use for farming
92.	IVR- Heingang Kangjeibung to Heingangkhong	Canal (Left)	0.553-0.641km	Still water body	Use for farming
93.	IVR- Laiphram Khunou I.V.R. Land 2	Laiphram khunou Mitong lampak opposite leirak pond	0.250-0.307km	Still water body	Use for household commodities
94.	IVR- Laiphram Khunou I.V.R. Land 10	Pond	0.125-0.140km	Still water body	Use for household commodities
95.	IVR- Laiphram Khunou I.V.R. Land 11	Pond	0.006-0.024km	Still water body	Use for household commodities
96.	IVR- Laiphram Khunou I.V.R. Land 12	Pond	0.058-0.073km	Still water body	Use for household commodities
97.	IVR- Laiphram Khunou I.V.R. Land 13	Pond	0.096-0.116km	Still water body	Use for household commodities
98.	IVR- Ahallup Thongkhong to Lairikyengbam Awang Leikai	Imphal River	0-4.384km	North to south	Various Use
99.	IVR- Lairikyengbam Makha Leikai road Lane 1	Pond	0.518-0.555km	Still water body	Use for household commodities
100.	IVR- Lairikyengbam Makha Leikai road Lane 2	Pond	0-0.032km	Still water body	Use for household commodities
101.	IVR- Salan Leirak to Laishram Leirak.	Small pond 1	0.039-0.046km	Still water body	Use for household commodities
102.	IVR- Salan Leirak to Laishram Leirak.	Pond-2	0.087-0.097km	Still water body	Use for household commodities
103.	IVR- Salan Leirak to Laishram Leirak.	Small pond 3	0.210-0.221km	Still water body	Use for household commodities
104.	IVR- Salan Leirak to Laishram Leirak.	Small pond 4	0.226-0.235km	Still water body	Use for household commodities
105.	IVR- Salan Leirak to Laishram Leirak.	Pond-5	0.270-0.283km	Still water body	Use for household commodities
106.	IVR- Salan Leirak to Laishram Leirak.	Pond	1.083-1.110km	Still water body	Use for farming
107.	IVR- Salan Leirak to Laishram Leirak.	Heingang Lake	1.168-1.806km	Still water body	Various Use
108.	IVR- Heingang	Imphal River	0-	North to	Various Use

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
	Kangjeibung to River bund side Road.		0.300km	South	
109.	Heingang I.V.R.	Imphal River	0-0.357km	North to South	Various Use
110.	Heingang Chingya road I.V.R.	Heingang Lake and Fish Farm	0.691-1.500km	Still water body	Heingangpat also known as Ibudhou Marjing's Pat, was once a serene wetland and people used canoes to navigate in the water and fish but now most major portion of it filled with ponds for pisciculture and for poultry farming.
111.	IVR- Arambam Leirak	Arambam leirak pond	0.171-0.190km	Still water body	Use for household commodities
112.	IVR- Ningombam Leirak	Ningombam leirak pond 1	0.098-0.112km	Still water body	Use for household commodities
113.	IVR- Ningombam Leirak	Ningombam leirak pond 2	0.229-0.253km	Still water body	Use for household commodities
114.	IVR- Kharibam Leirak	Kharibam leirak small pond	0.013-0.022km	Still water body	Use for household commodities
115.	IVR- Nepram Leirak	Nepram leirak pond	0.107-0.196km	Still water body	Use for household commodities
116.	IVR- Chingkhei lambi	Chingkhei lambi SWFC Club Pond	0.373-0.393km	Still water body	Use for household commodities
117.	IVR- Beni Leirak	Ema Imoinu laishang pond	0.181-0.243km	Still water body	Use for ceremonial purposes
118.	IVR- Nongmeikapam Leirak	Nongmeikapam leirak pond	0.046-0.056km	Still water body	Use for household commodities
119.	IVR- Lilando Water Supply Road	kakwa Pat (Lake)	0.268-0.371km	Still water body	Use for fish farm
120.	IVR- Lilando Water Supply Road	Kakwa pat road small pond	0.639-0.659km	Still water body	Use for household commodities
121.	IVR- Lilando Water Supply Road	Small pond near Lilando lampak	0.726-0.739km	Still water body	Use for household commodities
122.	IVR- Lilando Water Supply Road	Pond near Lilando water supply	0.882-0.901km	Still water body	Use for household commodities
123.	IVR- Kojjam Leirak	Pond	0.006-0.053km	Still water body	Use for household commodities
124.	IVR- Laishram Leirak Kongba Nandeibam	Small pond 1	0.184-0.194km	Still water body	Use for household commodities
125.	IVR- Laishram Leirak Kongba Nandeibam	Small pond 2	0.234-0.243km	Still water body	Use for household commodities
126.	IVR- Oinam Leirak	Pond-1	0.050-0.058km	Still water body	Use for household commodities
127.	IVR- Oinam Leirak	Pond-2	0.080-0.109km	Still water body	Use for household commodities
128.	IVR- Oinam Leirak	Pond-3	0.113-	Still water	Use for household

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
			0.143km	body	commodities
129.	IVR- Sapam Leirak	Pond-1	0.050-0.058km	Still water body	Use for household commodities
130.	IVR- Sapam Leirak	Pond-2	0.080-0.109km	Still water body	Use for household commodities
131.	IVR- Sapam Leirak	Pond-3	0.113-0.143km	Still water body	Use for household commodities
132.	IVR- Sapam Leirak	Pond-1	0.049-0.064km	Still water body	Use for household commodities
133.	IVR- Sapam Leirak	Pond-2	0.078-0.091km	Still water body	Use for household commodities
134.	IVR- Nandeibam Leirak Lane 1	Pond	0.019-0.033km	Still water body	Use for household commodities
135.	IVR- Nandeibam Leirak Lane 3	Pond	0.058-0.068km	Still water body	Use for household commodities
136.	IVR- Nandeibam Leirak Lane 5	Small pond 1	0.090-0.102km	Still water body	Use for household commodities
137.	IVR- Nandeibam Leirak Lane 5	Pond-2	0.137-0.174km	Still water body	Use for household commodities
138.	IVR- Nandeibam Leirak Lane 5	Pond-3	0.179-0.192km	Still water body	Use for household commodities
139.	IVR- Nandeibam Leirak Lane 5	Pond-4	0.206-0.240km	Still water body	Use for household commodities
140.	IVR- Moirangthem Leirak	Moirangthem leirak pond	0.185-0.215km	Still water body	Use for household commodities
141.	IVR- Ucheckon bridge to Kajipat	Kongba River	0-0.117km	North to South	Vatrious Use
142.	IVR- Ucheckon bridge to Kajipat	Kongba River	0.269-1.477kkm	North to South	Various Use
143.	IVR- Ucheckon bridge to Kajipat	Pond	1.438-1.538km	Still water body	Use for household commodities
144.	IVR- Kshetri leirak	Khetri leirak pond	0-0.041km	Still water body	Use for household commodities
145.	IVR- Thiyam Leirak	Small pond-1	0.067-0.076km	Still water body	Use for household commodities
146.	IVR- Thiyam Leirak	Small pond-2	0.071-0.080km	Still water body	Use for household commodities
147.	IVR- Chingangbam Leirak (connecting Laiwangma Road)	Chingangbam leirka pond	0.170-0.181km	Still water body	Use for household commodities
148.	IVR- Okram Leirak	Okram leirak pond	0.245-0.255km	Still water body	Use for household commodities
149.	IVR- Moirangthem Leirak	Moirangthem leirak pond 1	0.139-0.156km	Still water body	Use for household commodities
150.	IVR- Moirangthem Leirak	Moirangthem leirak pond 2	0.163-0.194km	Still water body	Use for household commodities
151.	IVR- Moirangthem Leirak	Moirangthem leirak pond 3	0.187-0.202km	Still water body	Use for household commodities
152.	IVR- Moirangthem Leirak	Moirangthem leirak pond 4	0.235-0.269km	Still water body	Use for household commodities

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
153.	IVR- Moirangthem Leirak	Moirangthem leirak pond 5	0.259-0.320km	Still water body	Use for household commodities
154.	IVR- Mongkhang Lambi	Mongkham lambi pond-1 (Right)	0.353-0.374km	Still water body	Use for household commodities
155.	IVR- Mongkhang Lambi	Monkham lambi pond-2 (Left)	0.442-0.474km	Still water body	Use for household commodities
156.	IVR- Mongkhang Lambi	Mokhang lambi pond-3 (Right)	0.474-0.488km	Still water body	Use for household commodities
157.	IVR- Ningom Leirak Lane 1	Nilando water supply pond	0.005-0.035km	Still water body	Use for household commodities
158.	IVR- Ningom Leirak Lane 1	Lamdaibung leirak machin pond	0.057-0.095km	Still water body	Use for household commodities
159.	IVR- Ningom Leirak Lane 2	Ningom leirak pond-1 (Right)	0.062-0.074km	Still water body	Use for household commodities
160.	IVR- Ningom Leirak Lane 2	Ningom leirak pond-2 (Left)	0.0667-0.084km	Still water body	Use for household commodities
161.	IVR- Okramchuthek to Panthoibi Bazar	Okram Chuthek water supply tank	0.030-0.054km	Still water body	Use for household commodities
162.	IVR- Okramchuthek to Panthoibi Bazar	Small pond near Lainingthou Naothingkhong	0.390-0.402km	Still water body	Use for household commodities
163.	IVR- Okramchuthek to Panthoibi Bazar	Khongampat Lake	1.443-1.493km	Still water body	Use for fish farming
164.	IVR NH - 39 to Kajipat Uku via Bashikhong bridge	Kongba River	1.913-2.338km	North to South	Various Uses
165.	IVR-NH - 39 Ningomthongjao via Kakwa Lamdaibung	LSW club pond	0.281-0.309km	Still water body	Use for household commodities
166.	IVR-NH - 39 Ningomthongjao via Kakwa Lamdaibung	Lamdaibung leirak pond	0.357-0.394km	Still water body	Use for household commodities
167.	IVR-NH - 39 Ningomthongjao via Kakwa Lamdaibung	Lamdaibung leirak pond	0.600-0.609km	Still water body	Use for household commodities
168.	IVR-NH - 39 Ningomthongjao via Kakwa Lamdaibung	Lamdaibung leirak pond	0.652-0.663km	Still water body	Use for household commodities
169.	IVR-NH - 39 Ningomthongjao via Kakwa Lamdaibung	Lamdaibung leirak pond	0.738-0.758kkm	Still water body	Use for household commodities
170.	IVR-NH - 39 Ningomthongjao via Kakwa Lamdaibung	Lilando water supply pond	0.774-0.805km	Still water body	Use for household commodities
171.	IVR- Singjamei Bridge to Kongba Irong	Imphal River	0-5.296km	North to South	Various Use
172.	IVR- Singjamei Bridge to Kongba Irong	Kongba River	5.296-5.929km	North to South	Various Use
173.	IVR- Singjamei Kongba road to Khongman road	Car wash small pond	0.033-0.040km	Still water body	Use for household commodities

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
	Akampat				
174.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Left)	0.073-0.106km	Still water body	Use for household commodities
175.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Right)	0.314-0.329km	Still water body	Use for household commodities
176.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Right)	0.345-0.362km	Still water body	Use for household commodities
177.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Left)	0.398-0.424km	Still water body	Use for household commodities
178.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Right)	0.433-0.443km	Still water body	Use for household commodities
179.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Right)	0.667-0.744km	Still water body	Use for household commodities
180.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Left)	0.715-0.745km	Still water body	Use for household commodities
181.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Right)	0.754-0.776km	Still water body	Use for household commodities
182.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Left)	0.754-0.781km	Still water body	Use for household commodities
183.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Right)	0.782-0.790km	Still water body	Use for household commodities
184.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Right)	0.793-0.806km	Still water body	Use for household commodities
185.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Right)	0.816-0.835km	Still water body	Use for household commodities
186.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Right)	0.845-0.875km	Still water body	Use for household commodities
187.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Right)	0.880-0.893km	Still water body	Use for household commodities
188.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Left)	0.896-0.909km	Still water body	Use for household commodities
189.	IVR- Singjamei Kongba road to Khongman road Akampat	Pond (Right)	0.930-0.979km	Still water body	Use for household commodities
190.	IVR- Singjamei Kongba	Akampat water	1.037-	Still water	Use for household

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
	road to Khongman road Akampat	supply tank	1.067km	body	commodities
191.	IVR- Singjamei Kongba road to Khongman road Akampat	Akampat Pond	1.075-1.100km	Still water body	Use for household commodities
192.	IVR- Singjamei Kongba road to Khongman road Akampat	Akampat Pond	1.113-1.140km	Still water body	Use for household commodities
193.	IVR- Singjamei Kongba road to Khongman road Akampat	Akampat lampak big pond	1.293-1.343km	Still water body	Use for household commodities
194.	IVR- Kongba Bazar to Ucheckon Bridge Part B	Kongba River	0-2.542km	North to South	Various Use
195.	IVR- Kongba Bazar to Ucheckon Bridge Part C	Kongba River	0-3.110km	North to South	Various Use
196.	IVR- Road from Kajipat culvert to Loumanbi Khongkhong	Kongba River	0-1.573km	North to South	Various Use
197.	IVR- Road from Kajipat culvert to Loumanbi Khongkhong	Big Pond	1.429-1.535km	Still water body	Use for farming
198.	IVR- Kongba Laishram Leirak Eastern/Western	Panthoibi Shanglen pond	0.038-0.084km	Still water body	Use for household commodities
199.	IVR- Kongba Laishram Leirak Eastern/Western	Laishram pikhri opposite big pond	0.212-0.286km	Still water body	Use for farming
200.	IVR- Kongba Laishram Leirak Eastern/Western	Mapal pikhri (pond)	0.705-0.751km	Still water body	Use for household commodities
201.	IVR- Standard College Road	Small pond (Right)	0-0.049km	Still water body	Use for household commodities
202.	IVR- Standard College Road	Big Pond (Left)	0-0.088km	Still water body	Use for household commodities
203.	IVR- Kongpal Khaidem Leirak.	Kongba River	0-1.322km	North to South	Various Uses
204.	IVR- Tharoiyam leirak to saikul road	Small pond near Pisak water supply	0.288-0.302km	Still water body	Use for household commodities
205.	IVR- Thongbam leirak No.4 khurai konsam leirak maning	Pond	0.279-0.287km	Still water body	Use for household commodities
206.	IVR- Minuthong Hatta Road	Imphal River	0.084-0.396km	North to South	Various Use
207.	IVR- Hatta Road	Wangkhei Khunou Laishang pond	0.218-0.242km	Still water body	Use for household commodities
208.	IVR- Wangkhei Khunou-Part 2	Wangkhei khunou road pond	0.377-0.468km	Still water body	Use for household commodities
209.	IVR- Khuman Lampak Stadium Road	Khuman lampak lake	0.496-1.004km	Still water body	Use for spots purposes
210.	IVR- Khuman Lampak	Pond near Smart	0.950-	Still water	Use for household

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
	Stadium Road	wash service	0.984km	body	commodities
211.	IVR- Khuman Lampak Stadium Road	Imphal River	1.164-1.381km	North to South	Various Use
212.	IVR- Sajou Leirak/Jalil School leirak	Pond	0.441-0.460km	Still water body	Use for household commodities
213.	IVR- Sajou Leirak/Jalil School leirak	Small pond	0.462-0.473km	Still water body	Use for household commodities
214.	IVR- Sajou Leirak/Jalil School leirak	Pond	0.507-0.523km	Still water body	Use for household commodities
215.	IVR- East Garden Road	Pond	0.148-0.210km	Still water body	Use for household commodities
216.	IVR- East Garden Road	Pond	0.684-0.708km	Still water body	Use for household commodities
217.	IVR- Heikru Makhong Khomidok Leirak	Pond	0.344-0.386km	Still water body	Use for household commodities
218.	IVR- Mutum Leikai kongpal Road	Pond (Left)	0.218-0.227km	Still water body	Use for household commodities
219.	IVR- Mutum Leikai kongpal Road	Pond (Right)	0.218-0.253km	Still water body	Use for household commodities
220.	IVR- Mutum Leikai kongpal Road	Pond (Right)	0.322-0.338km	Still water body	Use for household commodities
221.	IVR- Nungthin Chaibi southern side Road	Pond	0.048-0.065km	Still water body	Use for household commodities
222.	IVR- Nungthin Chaibi southern side Road	Pond	0.257-0.310km	Still water body	Use for household commodities
223.	IVR- Porompat DC Eastern side road	Pond	0.134-0.164km	Still water body	Use for household commodities
224.	IVR- Porompat DC Eastern side road	Pond	0.184-0.207km	Still water body	Use for household commodities
225.	IVR- Laikhram Leirak Kongba	Pond	0.173-0.195km	Still water body	Use for household commodities
226.	IVR- Sougrakpam Leirak Bamon Kampu	Pond	0.127-0.153km	Still water body	Use for household commodities
227.	IVR- Sougrakpam Leirak Bamon Kampu	Pond	0.221-0.261km	Still water body	Use for household commodities
228.	IVR- Kairang maning leikai to Kairang muslim water supply road	Pond	0.413-0.433km	Still water body	Use for household commodities
229.	IVR- Matai Makha Leikai road	Ibudhou Aseiningthou laishang Pond	0.435-0.474km	Still water body	Use for household commodities
230.	IVR- Matai Mamang Leikai road to Luwangsangbam Khongnangkhang	Pond	0.531-0.599km	Still water body	Use for household commodities
231.	IVR- Matai Mamang Leikai road to Pandilong road	Big pond	0.720-0.832km	Still water body	Use for household commodities
232.	IVR- Luwangsangbam	Imphal river	0-	Still water	It is a tributary of

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
	Makha leikai Road Part 1	branch	0.648km	body	Imphal river
233.	IVR- Luwangsangbam Makha leikai Road Part 1	Imphal river branch	0.847-0.958km	Still water body	It is a tributary of Imphal river
234.	IVR- Luwangsangbam Makha leikai Road Part 2	Imphal river branch	0-0.328km	Still water body	It is a tributary of Imphal river
235.	IVR- Luwangsangbam Makha leikai Road Part 3	Imphal river branch	0.058-0.103km	Still water body	It is a tributary of Imphal river
236.	IVR- Luwangsangbam Makha leikai Road Part 4	Imphal river branch	0.081-0.215km	Still water body	It is a tributary of Imphal river
237.	IVR- Luwangsangbam Godown road to Luwangsangbam Maning Leikai	Luwangshangbam Youth club pond	0.345-0.411km	Still water body	Use household commodities
238.	IVR- Luwangsangbam Godown road to Luwangsangbam Maning Leikai	Lwangshangbam mayai leikai pond	0.566-0.580km	Still water body	Use household commodities
239.	IVR- Luwangsangbam Godown road to Luwangsangbam Maning Leikai	Imphal river branch	0.850-1.047km	Still water body	It is a tributary of Imphal river
240.	IVR- Luwangsangbam Godown road to Luwangsangbam Maning Leikai	Pond	1.323-1.364km	Still water body	Use household commodities
241.	IVR- Luwangsangbam Godown road to Luwangsangbam Maning Leikai	Pond (Right)	1.508-1.539km	Still water body	Use household commodities
242.	IVR- Luwangsangbam Godown road to Luwangsangbam Maning Leikai	Pond (Left)	1.508-1.546km	Still water body	Use household commodities
243.	IVR- Luwangsangbam Haotabi road to Luwangsangbam Awang Leikai	Pond near Dr. Ranchandra's residence	0.251-0.261km	Still water body	Use for household commodities
244.	IVR- Khabam Chumbreithong road	Sunset point ponds	0.578-0.626km	Still water body	Use for farming
245.	IVR- Khabam Chumbreithong road to Kontha Khabam	Leishangthem Fish farm pond	0.172-0.212km	Still water body	Use for farming
246.	IVR- Khabam Lamkhai via Achangbingei Mayai Leikai Road to	Achanbigai Mayai leikai ponds (Left)	1.692-1.759km	Still water body	Use for farming

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
	Koirengei Road				
247.	IVR- Khabam Lamkhai via Achangbingei Mayai Leikai Road to Koirengei Road	Achanbigai Mayai leikai pond (Right)	1.695-1.711km	Still water body	Use for household commodities
248.	IVR- Khabam Lamkhai via Achangbingei Mayai Leikai Road to Koirengei Road	Pond	1.827-1.844km	Still water body	Use for household commodities
249.	IVR- Khabam Lamkhai via Achangbingei Mayai Leikai Road to Koirengei Road	Ponds	1.994-2.031km	Still water body	Use for farming
250.	IVR- Luwangsangbam Chingya to Matai Chingya	J&C Garden round pond	3.110-3.154km	Still water body	Use for farming
251.	IVR- Luwangsangbam Chingya to Matai Chingya	J&C Garden small pond	3.377-3.434km	Still water body	Use for farming
252.	IVR- Luwangsangbam Chingya to Matai Chingya	Ponds	3.490-3.552km	Still water body	Use for farming
253.	IVR- Jubraj Pali Road	Jubraj palli big pond	0.510-0.596km	Still water body	Use for household commodities
254.	IVR- Ucheckon Khuman to Imphal Yairipok Road or Lairanpak oil pump	Lairenpat small lake	0.214-0.523km	Still water body	Use for ceremonial purposes
255.	IVR- Kyamgei Labuk Mayai Road	Pond	0.145-0.165km	Still water body	Use for household commodities
256.	IVR- Canchipur Road	Canal	0.011-0.043km	Still water body	Use for fishing
257.	IVR- Canchipur Kyamgei Road	Youth popular club pond	0.065-0.093km	Still water body	Use for household commodities
258.	IVR- Kongpal Irom Leikai Connecting Kongpal Khaidem Leikai	Pond	0-0.029km	Still water body	Use for household commodities
259.	IVR- Kongpal Irom Leikai Connecting Kongpal Khaidem Leikai	Pond	0.160-0.177km	Still water body	Use for household commodities
260.	IVR- Kongpal Irom Leikai Connecting Kongpal Khaidem Leikai	Gunachandra residence pond	0.375-0.397km	Still water body	Use for household commodities
261.	IVR- Kongpal Khaidem Leikai via Pirang Leirak connecting Kongpal Laihiden thong	Pond	0.020-0.037km	Still water body	Use for household commodities

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
262.	IVR- Kongpal Khaidem Leikai via Pirang Leirak connecting Kongpal Laihiden thong	Pond	0.056-0.070km	Still water body	Use for household commodities
263.	IVR- Kongpal Khaidem Leikai via Pirang Leirak connecting Kongpal Laihiden thong	Pond	0.108-0.134km	Still water body	Use for household commodities
264.	IVR- Kongpal Khaidem Leikai via Pirang Leirak connecting Kongpal Laihiden thong	Pond	0.166-0.175km	Still water body	Use for household commodities
265.	IVR- Kongpal Khaidem Leikai via Pirang Leirak connecting Kongpal Laihiden thong	Pond	0.264-0.277km	Still water body	Use for household commodities
266.	IVR- Kongpal Khaidem Leikai via Pirang Leirak connecting Kongpal Laihiden thong	Pond	0.414-0.439km	Still water body	Use for household commodities
267.	IVR- Kongpal Khaidem Leikai via Pirang Leirak connecting Kongpal Laihiden thong	Pond	0.483-0.494km	Still water body	Use for household commodities
268.	IVR- J.N Hospital mamang Pong Lambi Road via SP office connecting to porompat DC Road	AAA playground small pond	0.681-0.698km	Still water body	Use for household commodities
269.	IVR- J.N Hospital mamang Pong Lambi Road via SP office connecting to porompat DC Road	AAA playground big pond	0.748-0.804km	Still water body	Use for household commodities
270.	IVR- J.N Hospital mamang Pong Lambi Road via SP office connecting to porompat DC Road	Porompat water supply filter tank	0.980-1.009km	Filtration process	Use for filtering water
271.	IVR- Khurai Ningthoubung leirak Lai maning	Khurai lainingthoubung Umang lai pond	0.014-0.034km	Still water body	Use for household commodities
272.	IVR- Khurai Ningthoubung leirak Lai maning	Pond	0.048-0.060km	Still water body	Use for household commodities
273.	IVR- Tangkhul Avenue from Dingku Road to Chingmeirong Kabui Khul	Dikhun Lampak pond	0.488-0.560km	Still water body	Use for household commodities
274.	IVR- Purana Rajbari (Nongmeibung)	Purana rajbari pond	0.152-0.210km	Still water body	Use for household commodities

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
275.	IVR- Chassad Avenue Road (Pureiromba Khongnangkhong to New Checkon Traffic)	Pureiromba khongnangkhong thangapat (Lake)	0.008-0.035km	Still water body	Use for ceremonial purposes
276.	IVR- Leishemba leirak (Soibam leikai)	Wangkhei khunou Laishang pond	0.005-0.038km	Still water body	Use for household commodities
277.	IVR- Hatta Golapati Road	Imphal River	0.147-0.807km	North to South	Various Use
278.	IVR- KR lane	Imphal River	0-0.806km	North to South	Various Use
279.	Tandon pukhri IVR	Tondon Pukhri Pond	0.003-0.077km	Still water body	Use for household commodities
280.	IVR-Mercy Lane	Mantripukhri pond L-1	0.006-0.045km	Still water body	Use for household commodities
281.	IVR-Mercy Lane	Mantripukhri pond L-4	0.037-0.090km	Still water body	Use for household commodities
282.	IVR- Lamlongei Internal Roads Lane 2	Lamlongei Canal	0.099-0.160km	Still water body	Use for fishing
283.	IVR- Lamlongei Internal Roads Lane 2	Pond	0.313-0.352km	Still water body	Use for household commodities
284.	IVR- Lamlongei Internal Roads Lane 2	Lamlongei Canal	0.606-0.754km	Still water body	Use for fishing
285.	IVR- Lamlongei Internal Roads Lane 3	Lamlongei Canal	0.246-0.595km	Still water body	Use for fishing
286.	IVR- Kongpal Chanam Leikai Road (Eastern side of Kongba River)	Kongba River	0-2.221	North to South	Various Uses
287.	IVR- Kongpal Chanam Leikai Road (Western side of Kongba River)	Kongba River	0-2.218km	North to South	Various Uses
288.	IVR- Nungthilchaibi Road	Pond	0.291-0.305km	Still water body	Use for household commodities
289.	IVR- Nungthilchaibi Road	Pond	0.379-0.394km	Still water body	Use for household commodities
290.	IVR- Nungthilchaibi Road	Pond	0.484-0.501km	Still water body	Use for household commodities
291.	IVR- Nungthilchaibi Road	Pond	0.513-0.526km	Still water body	Use for household commodities
292.	IVR- Pong Lambi	Pond	0.134-0.148km	Still water body	Use for household commodities
293.	IVR- Pong Lambi	Ponds	0.457-0.562km	Still water body	Use for farming
294.	IVR- Top Khongnangkhong to Naharup Road	Iril river	0-1.850km	North to south	Variosu Uses
295.	IVR- Kongba Bazar to Naharup Pangong Makhong	Pond	0.052-0.085km	Still water body	Use for household commodities
296.	IVR- Kongba Bazar to Naharup Pangong	Panthoibi Shanglen pond	0.525-0.567km	Still water body	Use for household commodities

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S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
	Makhong				
297.	IVR- Kongba Bazar to Naharup Pangong Makhong	Canal	0.763-0.859km	Still water body	Use for farming
298.	IVR- Kongba Bazar to Naharup Pangong Makhong	Pond	1.303-1.360km	Still water body	Use for household commodities
299.	IVR- Kongba Bazar to Naharup Pangong Makhong	Pond	1.350-1.379km	Still water body	Use for farming
300.	IVR- Kongba Bazar to Naharup Pangong Makhong	Pond	1.390-1.418km	Still water body	Use for farming
301.	IVR- Naharup Pangong Makhong Eco Garden	Iril river	0-0.462km	North to south	Various Use
302.	IVR- Porompat DC junction to Yaral Golf Road	Pond	0.014-0.099km	Still water body	Use for household commodities
303.	IVR- Porompat DC junction to Yaral Golf Road	Pond	0.298-0.314km	Still water body	Use for household commodities
304.	IVR- Porompat DC junction to Yaral Golf Road	Pond	0.411-0.447km	Still water body	Use for household commodities
305.	IVR- Porompat DC junction to Yaral Golf Road	Iril river	0.742-0.921km	North to south	Various Uses
306.	IVR- Road in Front of 7th MR Gate till Imphal-Ukhrul Road.	Kongba River	0-0.101km	North to South	Various Use
307.	IVR- Road in Front of 7th MR Gate till Imphal-Ukhrul Road.	Small Canal	0.280-0.593km	Still water body	Use for farming
308.	IVR- Laishram Leirak Thambalkhong	Pond	0.256-0.311km	Still water body	Use for household commodities
309.	IVR- Thangapat Mapal Northern Side Road	Thangapat (Lake)	0.076-0.840km	Still water body	Use for ceremonial purposes
310.	IVR- Bal Bidya Mandir Leirak	Shri shri Govindaji temple pond	0.007-0.019km	Still water body	Use for household commodities
311.	IVR- Bal Bidya Mandir Leirak	Shri shri Govindaji temple pond	0.096-0.109km	Still water body	Use for household commodities
312.	IVR- Bal Bidya Mandir Leirak	Pond	0.139-0.157km	Still water body	Use for household commodities
313.	IVR- Bal Bidya Mandir Leirak	Shri shri Govindaji temple pond	0.007-0.019km	Still water body	Use for household commodities
314.	IVR- Kongpal Sajor leikai Riverbank Road	Kongba River	0-0.805km	North to South	Various Uses
315.	IVR- Elangbam Kunjeshwor Opposite Road	Pond	0.228-0.241km	Still water body	Use for household commodities

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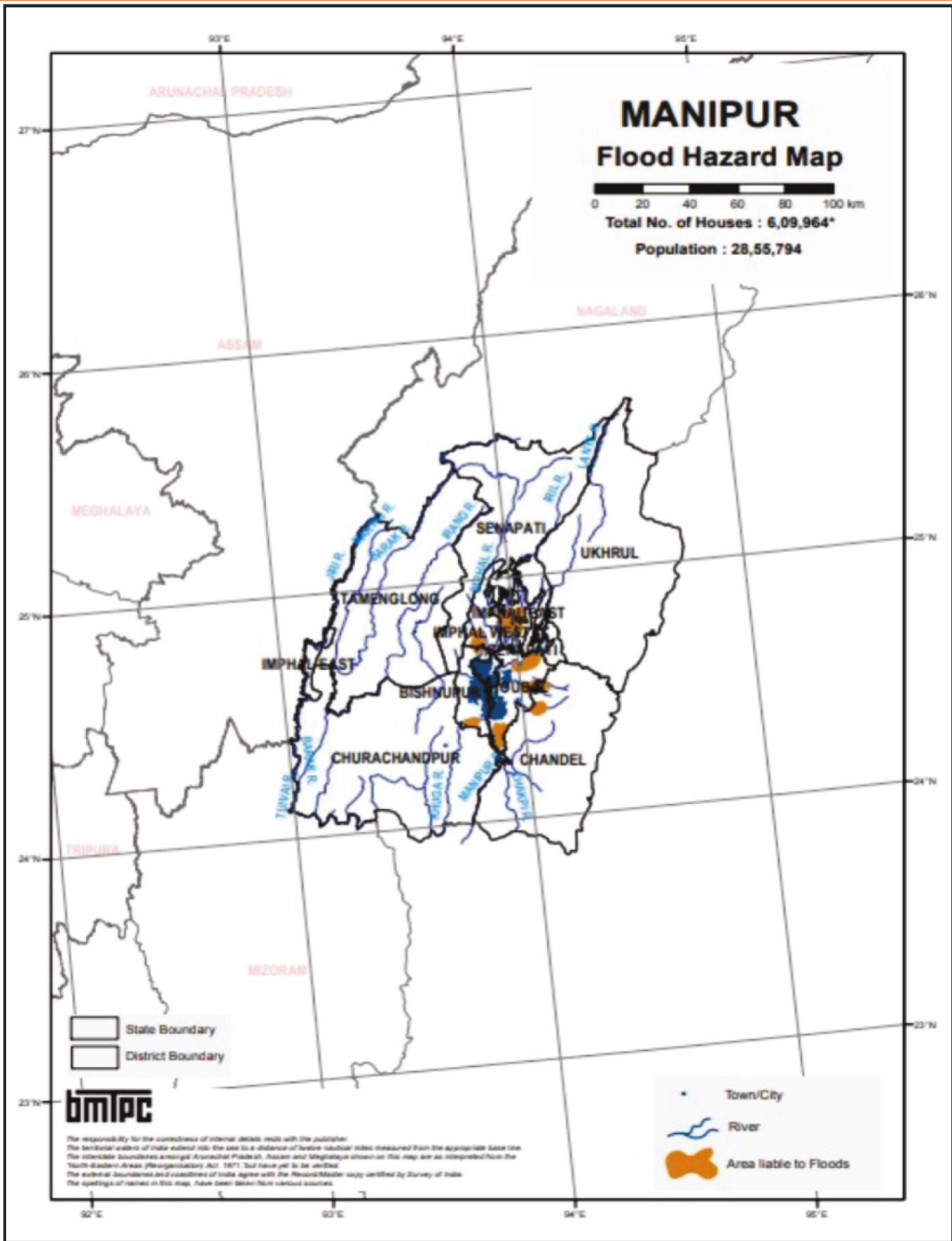
S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
316.	IVR- Bokulmakhong to new thumbuthong bridge	Imphal River	0-0.264km	North to South	Various Use
317.	IVR- Kongba Bazar to Uchekon Bridge	Ponds	0.044-0.218km	Still water body	Use for farming
318.	IVR- Kongba Bazar to Uchekon Bridge	Canal	0.230-0.524km	Still water body	Use for farming
319.	IVR- Kongba Bazar to Uchekon Bridge	Shiripukhri pond	0.682-0.732km	Still water body	Use for household commodities
320.	IVR- Kongba Bazar to Uchekon Bridge	Pond	0.858-0.900km	Still water body	Use for household commodities
321.	IVR- Kongba Bazar to Uchekon Bridge	Thokchom Mani Mana katchaba pukhri (pond)	0.0980-1.003km	Still water body	Use for household commodities
322.	IVR- Ningthem Pukhri Mapal Ring Road	Ningthem pukhri (pond)	0-0.678km	Still water body	Use for household commodities
323.	IVR- Ahallup Thongkhong to Mongjam Bridge	Imphal River	0-5.167km	North to South	Various Use
324.	IVR- Lai Hiden Thong Western Side of Kongba River to Kongpal Sajor leikai Thong	Kongba River	0-0.826km	North to South	Various Uses
325.	IVR- Lai Hiden Thong Eastern Side of Kongba River to Kongpal Sajor leikai Thong	Kongba River	0-0.849km	North to South	Various Uses
326.	IVR- Khurai Thongam Leirak to Khurai Popular High School Kongba River Western Side	Kongba River	0-0.500km	North to South	Various Use
327.	IVR- Thambalkhong School Thong to Ola Lampak Western Side of River	Kongba River	0-1.250km	North to South	Various Use
328.	IVR-Thambalkhong School Thong to Ola Lampak Eastern Side of River	Kongba River	0-01.280km	North to South	Various Use
329.	IVR-Khurai Heikrumakhong to Kairang Eastern Side of Imphal River	Pond	0.007-0.022km	Still water body	Use for household commodities
330.	IVR-Khurai Heikrumakhong to Kairang Eastern Side of Imphal River	Imphal River	0.259-0.452km	North to South	Various Use
331.	IVR-Khurai Heikrumakhong to	Imphal River	0.747-2.214km	North to South	Various Use

S. No.	Roads	Water Body	Chainage	Type/Flow Direction	Usage
	Kairang Eastern Side of Imphal River				
332.	IVR-Heingang Torban Lambi Eastern side of river Connecting Mongjam Road	Imphal River	0-0.592km	North to South	Various Uses
333.	IVR- Top Khongnangmakhong to Top Khewa Bazar Bridge Western Side of Iril River	Iril River	0-2.069km	North to south	Various Use

4.7.8 Flood

All the major river systems in the State are vulnerable to flooding, as captured in the Vulnerability Atlas. The urban areas face flooding primarily due to drainage failures and increased run-off loads on hard surfaces. Flood in Manipur Valley is primarily due to heavy rainfall in the upper catchment areas. Intensity of rainfalls is higher in the hilly region than in the plain region. These good amounts of rainfall feed many streams and rivers, which finally drain, through Manipur Valley. In the hilly region very steep slope nature occupies the major portion. There are many vulnerable points along the riverbanks of the major rivers of Manipur Valley. In these areas, erosion, sliding and slumping of the banks are common, causing breach of riverbanks to these points during rainy season. The four valley districts in Manipur, namely Imphal East, Imphal West, Thoubal and Bishnupur are most vulnerable to floods.

Project lies in Imphal East and West District and both the districts are prone to flooding but major floods are not frequent in these districts. All the rivers in the project area are guided by construction of the embankment bund which protects the land area from flooding during rains. However, instances of urban flooding due to drainage blockage and insufficient capacity cannot be ruled out and is common in the project area during the rainy season (June to September). Flood Hazard Map of Manipur is given in Figure 15. Major floods may strike the state every 6-10 years according to the recorded figures found during the last 50 years and the district will not be spared. The average annual rainfall of Manipur state is 1400mm, so the hazard of flood cannot be taken easily. Major Floods in the project area occurred in 1989, 2002, 2015 and 2016.



Source: BMTPC vulnerability atlas third edition retrieved on 29 November 2019.

Figure 16: Flood Hazard Map of Manipur

4.7.9 Hydrogeology and Water Resources

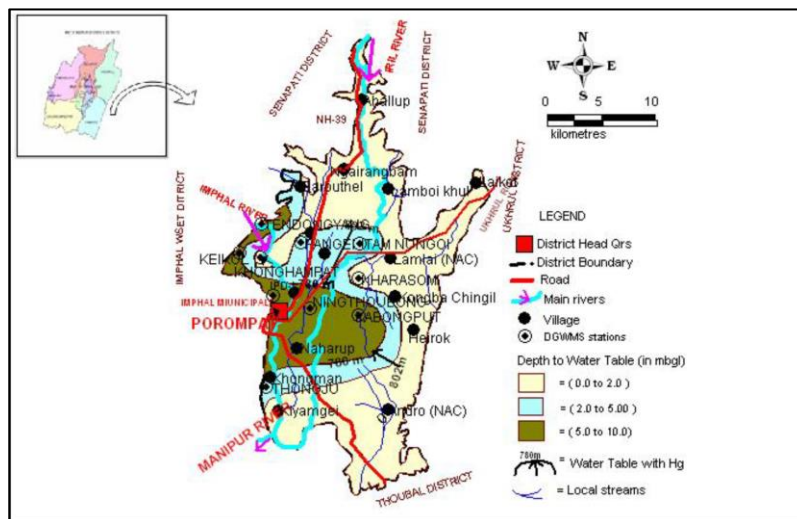
Geologically the Imphal West district is underlain by Quaternary formation comprising Recent alluvium followed by Tertiary group of rocks represented by Disang formation. Quaternary formation comprising younger and older alluvial deposits consisting sand of different grades, pebbles, cobbles, gravel, clay dominate the area. Major parts of the district are underlain by the Recent formation followed by Tertiary formation, while the Tertiary formation alone restricts to the denudation hill ranges comprising hard and compact sandstone, shale and limestone.

Sub-surface geology data infers that the potential aquifer pertaining to Quaternary formation exists down to explored depth of 50 to 100 m followed by Tertiary deposits. The cumulative thickness of aquifer zones has the tendency to increase towards north and in the south-eastern part, the thickness reverses considerably. Hydrogeologically the district is proved to be moderately potential where ground water occurs under water table to confined conditions. Depth to water level in major parts of the district varies from 2 to 5 m bgl. In the extreme southern and south-western parts close to hills, the water level is found to be deeper and generally rests within 5 to 7 m. The movement of ground water is from south to north. The water level shows that there is gradual rising of water level in the district.

The district possesses moderate potential for ground water development. Annual Replenishable Ground Water Resources is 86.55 mcm. Net Annual Ground Water Draft is 1.35 mcm. Projected Demand for Domestic and Industrial Use up to 2025 is 12.75 mcm. Stage of Ground Water Development estimated is 2.0% which is under the 'Safe' category.

Ground water in Imphal East District is present at various depths in a number of sand and gravel aquifers whose cumulative thickness varies from 15 to 45 m. In fact, there is a great variation in both vertical and lateral Lithology even over small distances. Sand and gravel layers have indefinite and largely undefined boundaries. The ground water in the shallow aquifers is unconfined and the static water level is 3 to 5 mbgl. Ground water in deep layers is semi-confined to confine with static water level from 7 mbgl to 1.0 magl. The yield of tube wells varies widely from a few m³ /days to 50m³ /day¹¹

Annual Replenishable Ground Water Resources is 123.25 mcm. Net Annual Ground Water Draft is 0.42 mcm. Projected Demand for Domestic and Industrial Use up to 2025 is 11.63 mcm. Stage of Ground Water Development estimated is 0.36 which is under the 'Safe' category. Hydro-geological maps of the affected districts are given in Figure 16-18¹².



¹¹ Ground Water Brochure Imphal East, CGWB

¹² CGWB

Figure 17: Hydro-geological Hazard Map of Imphal East District

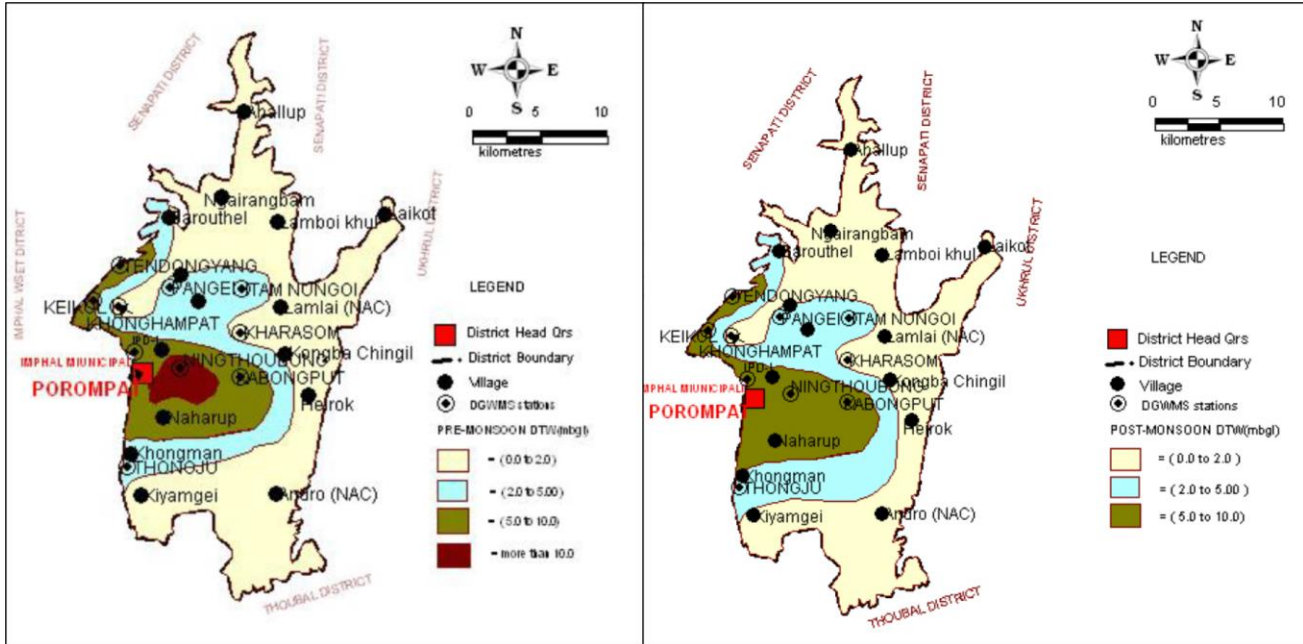


Figure 18: Pre-Monsoon & Post-Monsoon Depth Water Table Map of Imphal East District

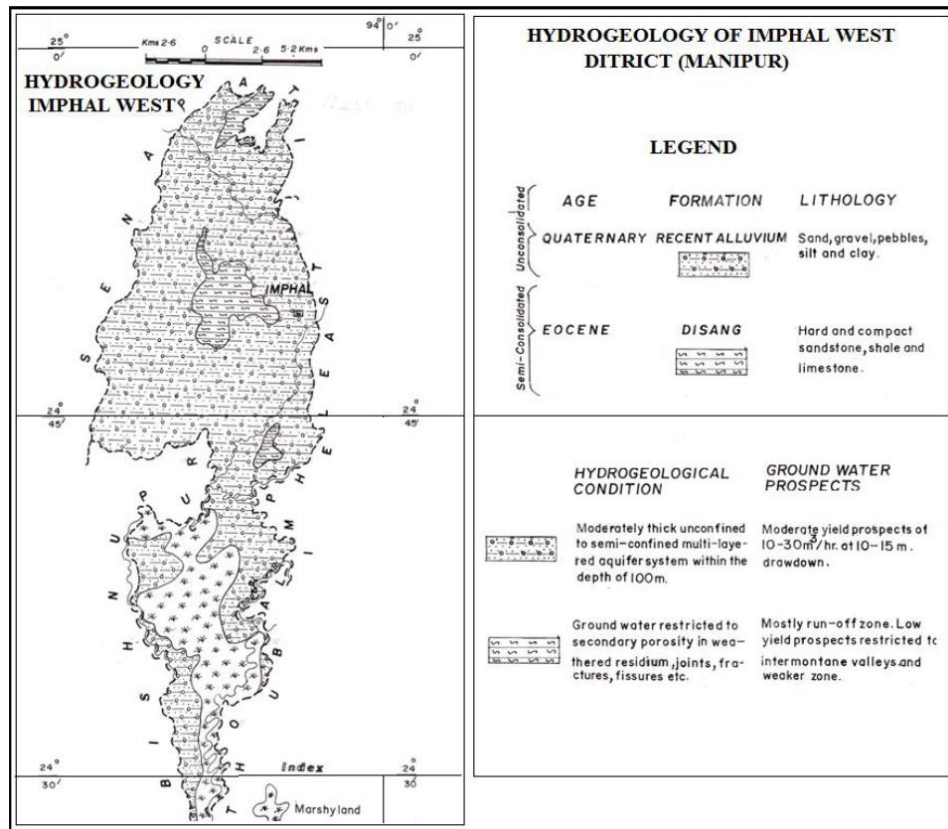


Figure 19: Hydrogeological Maps of Imphal West District

4.7.10 Ground Water Quality

To generate baseline data for ground water quality, study at 16 locations in the project area was conducted during January 2023. Water samples collection, preservation, storage and testing has been conducted as per the defined standard QA/Qc procedures. Source of ground water collection is hand

pump. Details of ground water quality monitoring locations and the results are presented in Table 33, 34 & 35 below. Results are compared with drinking water quality standards IS:10500: 2012 given in Table 36 and is found that concentration of Iron (Fe) at GW 7, 9, 11, 12, 13 & 14 location is higher than defined permissible limit as per IS:10500. This higher quantity of the Fe has been cross verified with the secondary data on water quality collected by CGWB and is found that Imphal East and West District is much higher than the permissible limit as per IS:105000 and need to be treated prior domestic usage. Parameters like Mg, TDS, Total alkalinity etc. at many locations is higher than desirable limit but within permissible limits. Other parameters are well within the permissible limit. Lab reports for ground water quality is attached as Annexure 4

Table 31: Groundwater sampling locations along the project road

Locations	Latitude	Longitude
Imphal Manipur	24.84202°	93.9078916°
Paonam Kollup	24.787605°	93.928613°
Tharon village	24.8312855°	93.93910161°
National Game village Zone 1	24.823775°	93.887461°
Meitram Makha Changangei	24.7383516°	93.8768161°
Malom tuliyaimea	24.7714183°	93.925691°
Kongba Laishram Leikai (Near Kumngaipat Sport Complex)	24.79124593°	93.9638181°
Manipur college	24.783413°	93.934786°
Bamoncampu	24.76839163°	93.9755516°
Keirao menjor inkhol	24.74890°	93.97477506°
Thambalkhong	24.791559°	93.9642849°
Kontha ahallup	24.8481869°	93.9502749°
Imphal, Manipur	24.86203839°	93.9450237°
Potsangbam Khoiruru	24.875933°	93.9170057°
Luwang sangbamkameng	24.864593°	93.90427°
Changangei Awang Leikai Rd. Langjing	24.76476°	93.8881483°

Table 32: Groundwater sampling Results (Location 1-8)

Sample	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Parameter	Mongsanggei awang leiki	Nganapithong	Tharon village	National Game village Zone 1	Langgol zone 4	Malom tuliyaimea	Changangai maning leikai	Manipur college
Color (Hazen)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)
Odor	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
pH	7.87	8.3	8.25	8.34	8.27	8.12	7.72	8.18
Tubidity (NTU)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)
TDS (mg/l)	446	690	254	218	278	102	694	778
Al (mg/l)	BDL(DL-0.01)	0.15	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	0.2	2.9	BDL(DL-0.01)
Ammonia (mg/l)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)
detergent (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
Ba (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	0.2	BDL(DL-0.1)
B (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
Ca (mg/l)	24	36.1	32.1	28	30.1	4	48.1	58.1
chloramines (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
chloride (mg/l)	63.6	118	70.9	56.2	78.4	26.9	137	193.2
cu (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)
F (mg/l)	0.31	0.23	0.18	0.16	0.1	0.09	0.34	0.41

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Sample	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Parameter	Mongsanggei awang leiki	Nganapithong	Tharon village	National Game village Zone 1	Langol zone 4	Malom tuliyaimea	Changangaimaning leikai	Manipur college
RFC (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
Fe (mg/l)	0.35	0.66	BDL(DL-0.05)	0.2	0.16	0.26	11.48	BDL(DL-0.05)
Mg (mg/l)	14.6	29.2	12.1	10.9	15.8	9.7	31.6	30.4
Mn (mg/l)	0.1	BDL(DL-0.05)	BDL(DL-0.05)	0.1	0.16	BDL(DL-0.05)	0.12	0.08
Mineral oil (mg/l)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)
Nitrate (mg/l)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)
Phenolic Compound (mg/l)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)
Se (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Ag (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
SO4 (mg/l)	36	48.2	28.2	21.7	31.4	12.6	65.6	BDL
Sulphide (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)
Total Alkalinity (mg/l)	310	630	156	150	185	35	615	370
Hardness (mg/l)	120	210	130	115	145	50	250	270
Zn (mg/l)	0.05	0.19	BDL(DL-0.05)	BDL(DL-0.05)	0.14	BDL(DL-0.05)	0.7	BDL(DL-0.05)
Cd (mg/l)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)
CN (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)
Pb (mg/l)	BDL(DL-0.005)	BDL(DL-0.005)	BDL(DL-0.005)	BDL(DL-0.005)	BDL(DL-0.005)	BDL(DL-0.005)	BDL(DL-0.005)	BDL(DL-0.005)
Hg (mg/l)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)
Mo (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
Ni (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
As (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Cr (mg/l)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)
Pesticide								
Alachlor	BDL (DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)
Atrazine	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)
Aldrin/Dieldrin	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)
Alpha HCH	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)
Beta HCH	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)
Butachlor	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)
Chlorpyrifos	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)
Delta HCH	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)
2,4 Dichlorophenoxyacetic acid	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)
OP isomers of DDT	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)
P,P isomers of DDT	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)
DDE	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)

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Sample	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
Parameter	Mongsanggei awang leiki	Nganapithong	Tharon village	National Game village Zone 1	Langol zone 4	Malom tuliayaima	Changangai maning leikai	Manipur college
	ug/l)	ug/l)	ug/l)	ug/l)	ug/l)	ug/l)	ug/l)	ug/l)
DDD	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)
Alpha Endosulfan	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)
Beta Endosulfan	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)
Endosulfan sulphate	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)
Ethion	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)
Gamma HCH(Lindane)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)
Isoproturon	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)
Malathion	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)
Methyl Parathion	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)
Monocrotophos	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)
Phorate	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)
PCB's	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)
PAH	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)
Trihalomethane								
Bromoform (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
Dibromochloromethane (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
Bromodichloromethane (mg/l)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)
Chloroform (mg/l)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)

Table 33: Groundwater sampling Results (Locations 9-16)

Sample	GW9	GW10	GW11	GW12	GW13	GW14	GW15	GW16
Parameter	Bamoncam pu	Keirao menjor inkhol	Thambalkhong	Kontha ahallup	Heingang	Potsangbam khoiru	Luwang sangbamkam eng	Kangla fort
Color (Hazen)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)
Odor	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
pH	8.31	8.35	7.92	8.24	7.82	8.06	8.04	8.1
Turbidity (NTU)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)
TDS (mg/l)	273	395	812	697	214	186	282	235
Al (mg/l)	0.15	BDL(DL-0.01)	0.16	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Ammonia (mg/l)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)	BDL(DL-0.5)
detergent (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
Ba (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	0.3	0.13	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
B (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
Ca (mg/l)	28.1	40.5	54.1	42.1	12	16	36.1	30.8
chloramines (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
chloride (mg/l)	66	76.4	161.4	154.1	53.8	49.6	88.1	48.2
cu (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)

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Sample	GW9	GW10	GW11	GW12	GW13	GW14	GW15	GW16
Parameter	Bamoncam pu	Keirao menjor inkhol	Thambalkh ong	Kontha ahallup	Heingang	Potsangbam khoiruru	Luwang sangbamkam eng	Kangla fort
F (mg/l)	0.19	0.39	0.46	0.27	0.72	0.14	0.2	0.15
RFC (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
Fe (mg/l)	1.87	0.15	17	2.48	2.1	4.1	BDL(DL-0.05)	0.2
Mg (mg/l)	13.6	21.6	34	38.9	15.6	11.6	18.2	16.7
Mn (mg/l)	BDL(DL-0.05)	0.23	0.17	BDL(DL-0.05)	BDL(DL-0.05)	0.12	0.25	0.35
Mineral oil (mg/l)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)	BDL(DL-2.0)
Nitrate (mg/l)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)
Phenolic Compound (mg/l)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)
Se (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Ag (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
SO4 (mg/l)	34.5	42.6	49.1	49.2	20.4	19.4	29.1	18.2
Sulphide (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)
Total Alkalinity (mg/l)	205	285	660	650	170	125	160	150
Hardness (mg/l)	125	190	280	265	95	135	165	145
Zn (mg/l)	0.1	BDL(DL-0.05)	3.67	0.79	BDL(DL-0.05)	0.06	0.53	0.56
Cd (mg/l)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)
CN (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)
Pb (mg/l)	BDL(DL-0.005)	BDL(DL-0.005)	0.03	BDL(DL-0.005)	BDL(DL-0.005)	BDL(DL-0.005)	BDL(DL-0.005)	BDL(DL-0.005)
Hg (mg/l)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)
Mo (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
Ni (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
As (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Cr (mg/l)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)	BDL(DL-0.03)
Pesticide								
Alachlor	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)	BDL(DL-7.0 ug/l)
Atrazine	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)
Aldrin/Dieldrin	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)
Alpha HCH	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)	BDL(DL-0.01 ug/l)
Beta HCH	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)
Butachlor	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)
Chloropyrifos	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)
Delta HCH	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)	BDL(DL-0.02 ug/l)
2,4 Dichlorophenoxyacetic acid	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)
OP isomers of DDT	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)
P,P isomers of DDT	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)
DDE	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)

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Sample	GW9	GW10	GW11	GW12	GW13	GW14	GW15	GW16
Parameter	Bamoncam pu	Keirao menjor inkhol	Thambalkh ong	Kontha ahallup	Heingang	Potsangbam khoiruru	Luwang sangbamkam eng	Kangla fort
DDD	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)
Alpha Endosulfan	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)
Beta Endosulfan	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)
Endosulfan sulphate	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)
Ethion	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)
Gamma HCH(Lindane)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)	BDL(DL-1.0 ug/l)
Isoproturon	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)	BDL(DL-3.0 ug/l)
Malathion	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)	BDL(DL-10.0 ug/l)
Methyl Parathion	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)	BDL(DL-0.2 ug/l)
Monocrotophos	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)	BDL(DL-0.5 ug/l)
Phorate	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)	BDL(DL-0.6 ug/l)
PCB's	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)	BDL(DL-5.0 ug/l)
PAH	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)	BDL(DL-2.0 ug/l)
Trihalomethane								
Bromoform (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
Dibromochloromet hane (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
Bromodichloromet hane (mg/l)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)	BDL(DL-0.06)
Chloroform (mg/l)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)	BDL(DL-0.2)

Table 34: Drinking Water Quality Standards

S.No	Parameter	Unit	Limit (IS-10500:2012)	
			Desirable	Permissible
1	Temperature (OC)	(OC)	-	-
2	pH	-	6.5-8.5	No Relaxation
3	Electrical Conductivity	Microm/hos/cm	-	-
4	TDS	mg/l	500	2000
5	TSS	Mg/l	-	-
6	Dissolved Oxygen	mg/l		
7	Alkalinity as (CaCO3)	mg/l	200	600
8	Total Hardness (as CaCO3)	mg/l	200	600
9	BOD (at 27OC 3-Days)	mg/l	-	-
10	COD	mg/l	-	-
11	Nitrate (as NO3)	mg/l	45	No Relaxation
12	Chloride (as Cl)	mg/l	250	1000
13	Phosphates	mg/l	-	-
14	Sulphate (as SO4)	mg/l	200	400
15	Sodium (as Na)	mg/l	-	-
16	Potassium (as K)	mg/l	-	-
17	Calcium (as CaCO3)	mg/l	75	200
18	Magnesium (as CaCO3)	mg/l	30	100
19	Silica	mg/l	-	-

S.No	Parameter	Unit	Limit (IS-10500:2012)	
			Desirable	Permissible
20	Oil & Grease	mg/l	-	-
21	Residual Sodium Carbonate	mg/l	-	-
22	Lead (as Pb)	mg/l	0.01	No Relaxation
23	Arsenic (as As)	mg/l	0.01	0.05
24	Mercury (as Hg)	mg/l	0.001	No Relaxation
25	Cadmium (as Cd)	mg/l	0.003	No Relaxation
26	Chromium (as Cr6+)	mg/l	0.05	No Relaxation
27	Total Chromium (as Cr6+)	mg/l	0.05	No Relaxation
28	Copper (as Cu)	mg/l	0.05	1.5
29	Zinc (as Zn)	mg/l	5	15
30	Iron (as Fe)	mg/l	0.3	1
31	Fluoride	mg/l	1	1.5
32	Nitrite	mg/l	-	-
Bacteriological Parameter				
1	Total Coliform	MPN/100ml	Absent	-
2	<u>E.coli</u>	<u>E.coli</u> /100ml	Absent	-

4.7.11 Surface Water Quality

To generate baseline data for surface water quality, study at 16 locations in the project area was conducted during in January 2023 (winter period). Water samples collection, preservation, storage and testing has conducted as per the defined standard QA/Qc procedures. Source of surface water collection is river/stream/nallah/ponds etc. Details of surface water quality monitoring locations and the results is presented in Table 35, 36 & 37 below. Results are compared with Designated Best Use Criteria for the Inland Surface Water Bodies (IS 2296: 1982) given in Table 38 and is found that the SW 3, 7 and 8 meets the classification criteria for Class C water bodies and rest meet the criteria of Class D & E. Lab reports for surface water quality is attached as Annexure 5

Table 35: Surface Water quality Locations

Locations	Source (pond/river/stream etc.) Mentioned in report	Latitude	Longitude
Ghanpriya Women's College	Pond	24.801348°	93.937934°
Kangla (near Remedy hospital)	Canal	24.802774°	93.541738°
Luwang sangban (NBS)	Canal	24.8738083°	93.922519°
Royal Academy of science	Pond	24.79804°	93.953985°
Imphal Manipur (DC to MI Road)	Canal	24.7832283°	93.9614769°
The new light public school	Pond	24.760163°	93.92769°
New age public school	Pond	24.75542°	93.9228833°
The united Progressive development organization Sagolband tera sayang	River	24.7995183°	93.9187050°
Model higher secondary School	Pond	24.79763°	93.908544°
Uripok, Imphal	River	24.807243°	93.915494°
College of Food technology	Pond	24.823513°	93.902324°
NIIT manipur	Pond	24.8406444°	93.916244°
Malom bazar	Pond	24.757505°	93.881693°
Ghasi (Ghari)	Pond	24.77413°	93.905573°
Salanthong	Pond	24.831793°	93.963463°
Heingang Lake	Pond	24.8730193°	93.9470913°

Table 36: Surface Water quality result of the project road

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Parameters	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
	230109001	230109002	230109003	230109004	230109005	230109006	230109007	230109008
	Ghanpriya Womens college	Kangla(near Remedy hospital)	Luwang sangban(NB S)	Royal Academy of science	Kongba Bazar	The new light public school	New age public school	The united Progressive development organization sagolband tera sayang
Color (Hazen)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)
odor	Unobjection able	Unobjection able	Unobjection able	Unobjection able	Unobjection able	Unobjection able	Unobjection able	Unobjection able
TSS (mg/l)	14	48	10	14	18	11	6	10
Particle Size Distribution	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve
TDS (mg/l)	611	191	161	188	285	265	102	210
pH	7.42	8.12	8.06	7.4	7.94	7.48	7.55	7.65
Temp °C	14 °C	17 °C	16 °C	15 °C	15 °C	16 °C	15 °C	18 °C
O & G (mg/l)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)
Total Residual Chlorine (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
Ammonical Nitrogen (mg/l)	3.4	1.8	2.6	1.8	3.6	4.2	1.1	4.8
Total Kjeldhal Nitrogen (mg/l)	7.6	2.2	3.9	2.6	5.2	7.6	1.7	6.6
Free Ammonia	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
DO (mg/l)	4.8	5.2	5.9	7.4	4.2	3.6	6.8	3.6
BOD (mg/l)	4	2.2	3	2	2.5	5.2	BDL	3.6
COD (mg/l)	36	20	32	36	30	44	16	38
As (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Hg (mg/l)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)
Pb (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Cd (mg/l)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)
Cr+6 (mg/l)	BDL(DL-0.01)	0.067	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Total Cr (mg/l)	BDL(DL-0.05)	0.13	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
Cu (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
Zn (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
Se (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Ni (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)
Mn (mg/l)	0.24	BDL(DL-0.05)	BDL(DL-0.05)	0.053	0.06	0.15	BDL(DL-0.05)	0.066
Fe (mg/l)	0.3	0.66	0.13	0.6	0.2	0.16	BDL(DL-0.05)	0.23
V (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
Cyanide (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)
Fluoride (mg/l)	0.48	BDL(DL-0.01)	0.16	0.25	0.33	0.31	0.09	0.47
Dissolved Phosphate (mg/l)	0.33	0.3	BDL(DL-0.01)	BDL(DL-0.01)	0.08	0.75	BDL(DL-0.01)	0.15
Sulphide (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)
Phenploc compound (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Bioassay	90% survival of fish after 96 hr.in 100%	90% survival of fish after 96 hr.in 100%	90% survival of fish after 96 hr.in 100%	90% survival of fish after 96 hr.in 100%	90% survival of fish after 96 hr.in 100%	90% survival of fish after 96 hr.in 100%	90% survival of fish after 96 hr.in 100%	90% survival of fish after 96 hr.in 100%

INITIAL ENVIRONMENTAL EXAMINATION
Manipur Urban Road and Asset Management Improvement Project (MURAMP)

Parameters	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
	230109001	230109002	230109003	230109004	230109005	230109006	230109007	230109008
	Ghanpriya Womens college	Kangla(near Remedy hospital)	Luwang sangban(NB S)	Royal Academy of science	Kongba Bazar	The new light public school	New age public school	The united Progressive development organization sagolband tera sayang
	sample	sample	sample	sample	sample	sample	sample	sample
Nitrate (mg/l)	2.8	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	1	2.27	BDL(DL-1.0)	2.45

Table 37: Surface Water quality result of the project road

Parameters	SW9	SW10	SW11	SW12	SW13	SW14	SW15	SW16
	230109009	230109010	230109011	230109012	230109013	230109014	230109015	230109016
	Model higher secondary School	Naremthong	College of Food technology	NIIT manipur	Malom bazar	Ghasi	Salanthonng	Marjing
Color (Hazen)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)	BDL(DL-5.0)
odor	Unobjection able	Unobjection able	Unobjection able	Unobjection able	Unobjection able	Unobjection able	Unobjection able	Unobjection able
TSS (mg/l)	12	14	26	8	16	8	20	34
Particle Size Distribution	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve	Pass from 850 Micron Sieve
TDS (mg/l)	131	182	236	179	102	177	114	119
pH	7.54	7.85	7.8	7.62	7.46	7.89	7.92	7.7
Temp °C	16 °C	12 °C	20 °C	18 °C	18 °C	16 °C	14 °C	20°C
O & G (mg/l)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)	BDL (DL-2.0)
Total Residual Chlorine (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
Ammonical Nitrogen (mg/l)	1.6	6.2	1.4	1.1	1.7	2.2	1.6	0.9
Total Kjeldhal Nitrogen (mg/l)	2.6	8.4	2.1	2	2.5	2.9	3.2	1.4
Free Ammonia	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
DO (mg/l)	5.9	2.9	5.6	6.2	6.7	7.4	6.4	6.8
BOD (mg/l)	2.8	4.4	3.1	2.6	BDL	BDL	3.6	BDL
COD (mg/l)	32	48	30	26	18	12	28	16
As (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Hg (mg/l)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)	BDL(DL-0.001)
Pb (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Cd (mg/l)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)	BDL(DL-0.003)
Cr+6 (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	0.12	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	0.2	0.18
Total Cr (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	0.18	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	0.26	0.22
Cu (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
Zn (mg/l)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)	BDL(DL-0.05)
Se (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Ni (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)
Mn (mg/l)	0.09	0.08	0.075	BDL(DL-0.05)	BDL(DL-0.05)	0.13	BDL(DL-0.05)	0.09
Fe (mg/l)	0.58	0.35	1.68	0.058	0.38	BDL(DL-0.05)	3.1	6.06
V (mg/l)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)	BDL(DL-0.1)
Cyanide (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)
Fluoride (mg/l)	0.35	0.15	0.46	0.2	0.24	0.33	BDL(DL-0.05)	BDL(DL-0.05)

Parameters	SW9	SW10	SW11	Sw12	SW13	SW14	SW15	SW16
	230109009	230109010	230109011	230109012	230109013	230109014	230109015	230109016
	Model higher secondary School	Nareonthong	College of Food technology	NIIT manipur	Malom bazar	Ghasi	Salanthong	Marjing
							0.01)	0.01)
Dissolved Phosphate (mg/l)	0.63	0.93	0.3	0.05	0.09	0.05	0.49	0.45
Sulphide (mg/l)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)	BDL(DL-0.02)
Phenploc compound (mg/l)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)	BDL(DL-0.01)
Bioassay	90% survival of fish after 96 hr.in 100% sample	90% survival of fish after 96 hr.in 100% sample	90% survival of fish after 96 hr.in 100% sample	90% survival of fish after 96 hr.in 100% sample	90% survival of fish after 96 hr.in 100% sample	90% survival of fish after 96 hr.in 100% sample	90% survival of fish after 96 hr.in 100% sample	90% survival of fish after 96 hr.in 100% sample
Nitrate (mg/l)	BDL(DL-1.0)	5.15	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)	BDL(DL-1.0)

Table 38: Designated Best Use Water Quality Criteria (CPCB)

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

4.7.12 Climate

The climate of Greater Imphal proposed project sites is sub-tropical or humid sub-tropical in nature. The winters are very cool and dry while summers are hot and humid. The minimum temperature of the region is 4° C and maximum is 25° C. Greater Imphal faces an average rainfall of 1320 mm. The summers in Greater Imphal are from the month of March to May. The average temperature during the summer is 28° C. Winters here starts from November and continues till February. During winter, the region experiences an average temperature of 8 degree Celsius and sometimes plunges below zero degree celsius. January is the coldest month, as cold winds freeze the atmosphere. The monsoon season generally starts from the month of May and continues till the mid of October. It receives an average annual rainfall of 1467.5 mm. However, the rain distribution varies from 933 mm in Imphal to 2593 mm in Tamenglong. The downpour ranges from light drizzles to heavy showers. The normal

rainfall of Manipur enriches the soil and helps in agricultural processes and irrigation. The South Westerly Monsoon picks up moisture from the Bay of Bengal and heads towards Manipur, hits the eastern Himalaya ranges and produces a massive amount of rain in the state.

Micro-meteorology: Meteorology data was collected for January 2023 by installation of Automatic Weather Station in the project area to obtain the meteorology of the project area. Windrose plotted using the data given in the figure below represents the wind movement pattern of the project area. Most dominant wind direction is N and WNW during January 2023. Climatological data of Imphal as per IMD 30-year data is given in Table 39.

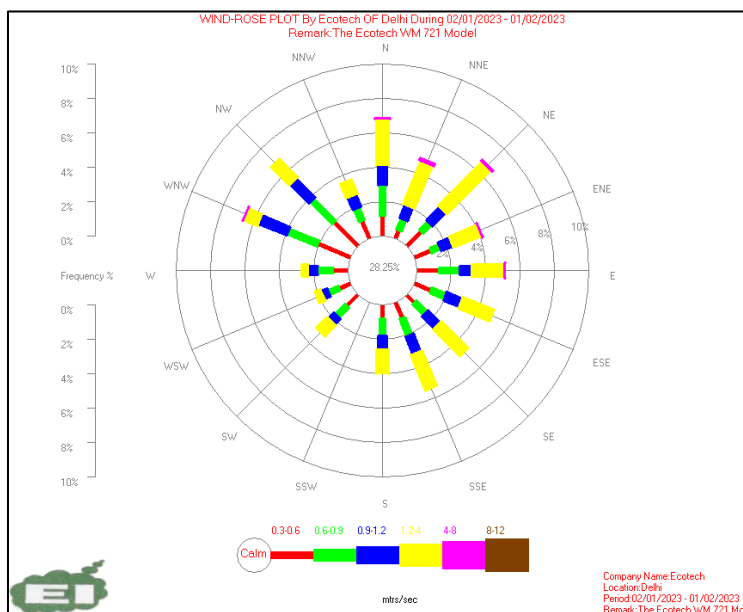


Figure 20: Windrose Diagram of Study Area (Jan 2023)

Table 39: Climate of Imphal (30 Years Data-IMD)

Month	Temperature, deg C		Humidity, %		Pressure, hPa		Dominant Wind Direction	Rainfall - mm
	Max	Min	Morning	Evening	Morning	Evening		
Jan	25.5	0.9	76	60	10.6	11.1	NW	11.5
February	27.7	3.3	69	54	11.7	11.8	W	43.4
March	31.3	7.2	66	53	14.7	14.1	W	81.2
April	32.3	11.8	72	62	18.7	18.5	W	154.6
May	33.2	14.7	76	69	22.6	22.3	NW	174.3
June	32.7	18.7	81	77	26.3	25.9	SE, S	221.6
July	32.2	20.1	83	79	26.8	26.7	SE	231.4
August	32.5	20.0	82	79	26.8	26.9	SE, NW	186.8
September	32.4	18.2	82	80	25.7	25.6	NW, SE	157.2
October	31.7	12.5	82	78	22.5	22.6	SE, W, NW	122.3
November	29.1	6.2	82	74	16.4	16.7	S	34.7
December	25.4	2.4	83	70	12.1	13	W, NW	17.8

Climate Change: Climate change is defined as: “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.” It affects social and

environmental determinants of health like –clean air, safe drinking water, sufficient food, and secure shelter. Climate change may negatively affect human health through several ways, but the commonly experienced are increased frequency and intensity of heat waves leading to rise in heat related illnesses and deaths, increased precipitation, floods, droughts and desertification costing lives directly.

Manipur state is also susceptible to anthropogenic greenhouse gas (GHG) emissions leading to climate change. The dataset of surface temperature variation observed during 1954 – 2011 shows an increasing trend in both the minimum and maximum temperatures.

When the maximum temperature has increased from 26.5°C to 27.3°C, the minimum temperature has increased from 13.8°C to 15.3°C. Even the night temperature has rapidly risen as compared to daytime temperatures because the greenhouse gasses act as a glass house by trapping longwave radiation radiated by earth surface. Seasonal variability of minimum and maximum surface temperatures in Manipur was from 4°C (January) to 21.5°C (July) and 21.5°C (January) to 28.9°C (July) respectively. As per the spatial pattern of minimum temperature, an increasing trend was observed over the region. Southwestern parts of the state i.e., Jiribam, Churachandpur, Bishnupur, Thoubal, Imphal (east & west), Chandel, some parts of Tamenglong and Chandel have experienced an increase in both minimum and maximum temperature of $\geq 1.75^{\circ}\text{C}$ and $\geq 1.5^{\circ}\text{C}$ respectively in the last 100 year. Annual rainfall quantum varies from 956.5 to 2269.9 mm over Manipur. The decadal assessment of monthly rainfall reveals that the period of rainy days in Manipur has extended from monsoon months i.e., June-October to pre-monsoon months like April and May. Few districts of central and southern Manipur experienced a marginal decrease in precipitation over Imphal (east & west), Bishnupur, Thoubal, Tamenglong, Jiribam, Chandel in the last 100 years whereas the northern districts of Manipur i.e., Senapati and Ukhrul has observed a considerable increase in precipitation. Atmospheric CO₂ concentration has also risen by more than 30% since pre-industrial times, from equilibrium level of about 280 ppm in 1880, to the current observed level of 390 ppm.

Construction works and increase in paved surface due to project will lead to increase in heating effect in the project area. However due to construction of the project, it is anticipated traffic congestion will reduce and ultimately will reduce the GHG emission and other pollutant emissions.

4.7.13 Ambient Air Quality

Data on ambient air quality is collected from the project area at 16 locations during Dec 2022-Jan 2023. Map showing Air Quality Monitoring Locations is given in Figure 21 below. Results of air quality monitoring are presented in Table 40 and Figure 22. As per the result, it is found that value of PM₁₀ and PM_{2.5} are much above the prescribed standards (NAAQS 2009) whereas the values are within the prescribed limits of the standards. High level of particulate matter concentration is due to high traffic movement and other construction works being undertaken in project area. Ambient air quality reports are attached as Annexure 6.

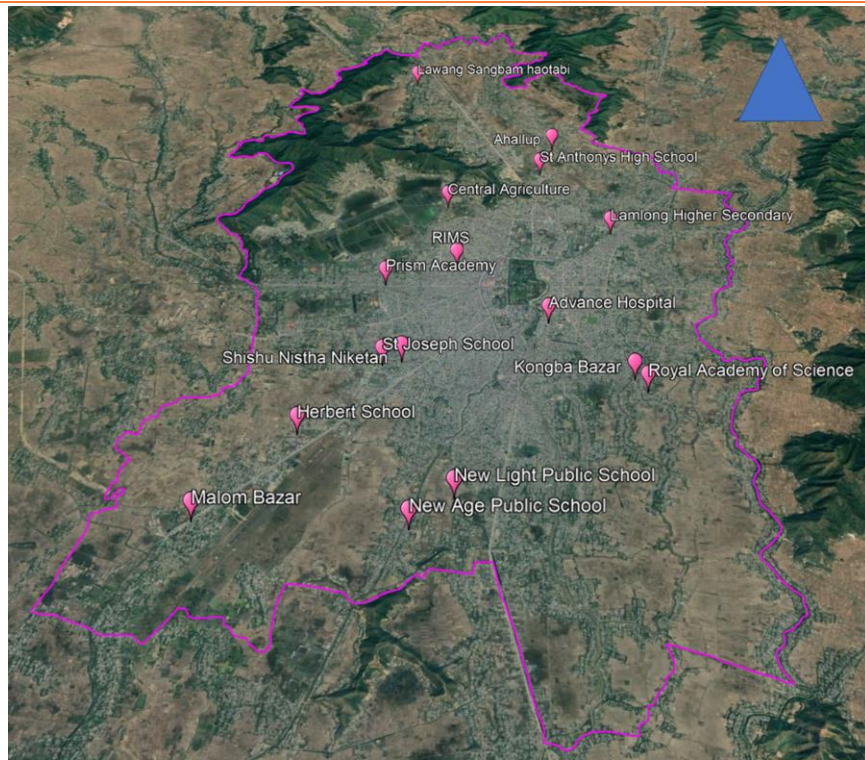


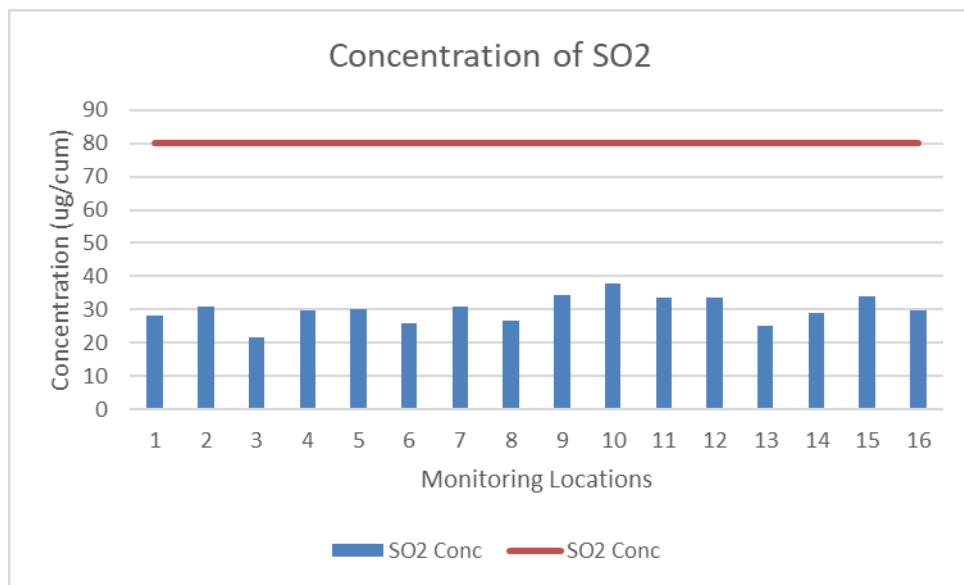
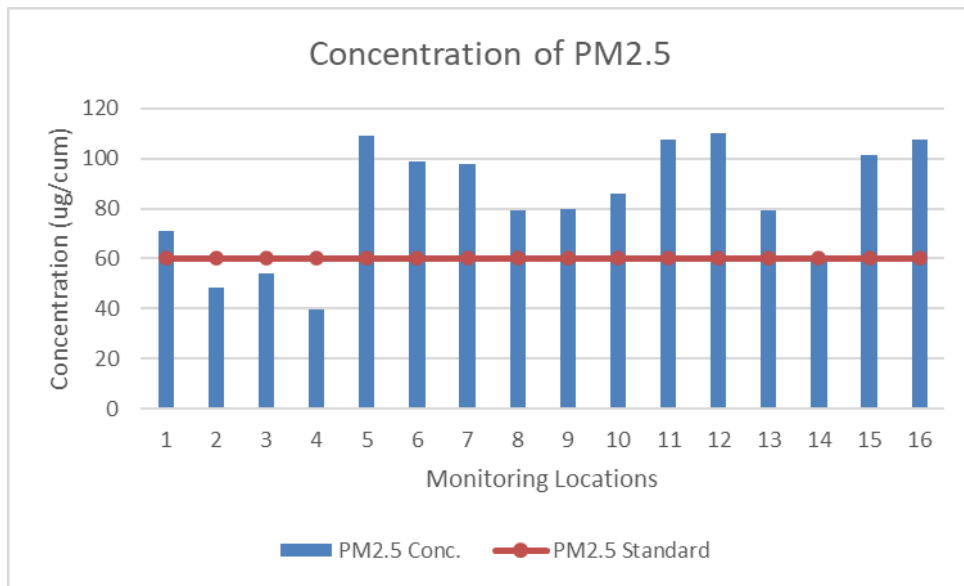
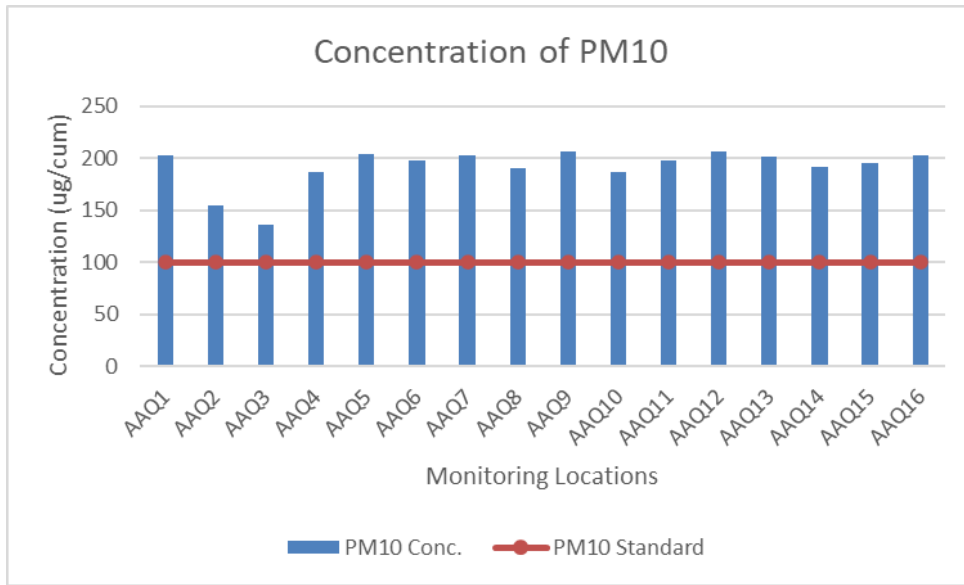
Figure 21: Location Map of AQ Stations

Table 40: AAQM for sensitive 16 location

Parameters	Imphal Road project Location	PM10	PM2.5	CO	NOx	Sox	Ammonia	Ozone	Lead	Nickel	Arsenic	Benzene	BAP
		(ug/m3)	(ug/m3)	(mg/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ug/m3)	(ng/m3)	(ng/m3)	(ng/m3)	(ug/m3)
max	Advance Hospital (4 location Of This site)	203.0	71.0	0.4	10.1	28.4	0.0	14.0	0.0	0.0	0.0	0.0	0.0
min		190.0	57.8	0.4	8.8	22.8	0.0	10.0	0.0	0.0	0.0	0.0	0.0
avg		197.5	65.3	0.4	9.4	24.8	BDL(DL-10)	12.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentile		202.9	70.8	0.4	10.1	28.2	BDL(DL-10)	13.9	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	Ahallup (4 Location of this site)	156.0	48.6	0.7	12.3	31.2	0.0	14.0	0.0	0.0	0.0	0.0	0.0
min		103.0	41.2	0.2	8.1	22.8	0.0	12.0	0.0	0.0	0.0	0.0	0.0
avg		129.8	44.6	0.4	10.2	26.9	BDL(DL-10)	13.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentile		154.8	48.4	0.7	12.2	31.0	BDL(DL-10)	14.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	Central Agriculture University (4 Location of this site)	137.0	54.5	0.3	8.6	21.9	0.0	16.0	0.0	0.0	0.0	0.0	0.0
min		85.0	34.2	0.2	6.9	18.6	0.0	10.0	0.0	0.0	0.0	0.0	0.0
avg		113.5	43.6	0.2	7.7	20.3	BDL(DL-10)	13.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentile		136.5	54.1	0.3	8.5	21.9	BDL(DL-10)	15.9	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	Herbert School (4 Location of This Site)	188.0	39.9	0.3	12.2	29.7	0.0	14.0	0.0	0.0	0.0	0.0	0.0
min		126.0	24.6	0.2	8.5	23.2	0.0	12.0	0.0	0.0	0.0	0.0	0.0
avg		160.0	32.2	0.3	10.6	26.4	BDL(DL-10)	13.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentile		186.9	39.6	0.3	12.1	29.6	BDL(DL-10)	14.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	Kongba Bazar (4 Location Of This Site)	204.0	109.2	0.5	12.9	30.2	0.0	18.0	0.0	0.0	0.0	0.0	0.0
min		129.0	82.4	0.3	10.6	24.9	0.0	12.0	0.0	0.0	0.0	0.0	0.0
avg		178.0	98.5	0.4	12.0	27.4	BDL(DL-10)	15.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentiles		203.6	109.0	0.4	12.9	30.1	BDL(DL-10)	17.9	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	Lamlong Higher Secondary School (4 Location of This Site)	198.0	98.7	0.3	11.6	26.1	0.0	14.0	0.0	0.0	0.0	0.0	0.0
min		157.0	82.6	0.1	8.9	21.7	0.0	12.0	0.0	0.0	0.0	0.0	0.0
avg		184.8	91.6	0.2	10.3	23.5	BDL(DL-10)	13.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentile		197.8	98.6	0.3	11.6	25.9	BDL(DL-10)	14.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	Lawang Sangbam haotabi (4 Location of this site)	204.0	98.2	0.5	12.4	31.2	0.0	16.0	0.0	0.0	0.0	0.0	0.0
min		179.0	66.1	0.3	8.5	24.5	0.0	10.0	0.0	0.0	0.0	0.0	0.0
avg		190.3	82.0	0.4	10.8	28.0	BDL(DL-10)	12.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentile		203.2	97.6	0.5	12.4	31.1	BDL(DL-10)	15.8	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	Malom Bazar (4 Location of This Site)	191.0	79.6	0.5	10.7	26.8	0.0	14.0	0.0	0.0	0.0	0.0	0.0
min		126.0	64.5	0.2	8.4	21.7	0.0	10.0	0.0	0.0	0.0	0.0	0.0
avg		160.8	72.1	0.3	9.4	23.8	BDL(DL-10)	12.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentiles		190.0	79.3	0.5	10.6	26.6	BDL(DL-10)	13.9	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	New Age Public School (4 Location of This Site)	208.0	80.4	0.7	13.6	34.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
min		156.0	41.6	0.5	10.3	27.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
avg		182.0	63.2	0.6	12.1	30.6	BDL(DL-10)	BDL(DL-10)	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentiles		206.7	79.9	0.7	13.6	34.2	BDL(DL-10)	BDL(DL-10)	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	Prism Academy (4 Location Of This Site)	188.0	87.2	1.0	15.1	38.2	0.0	13.3	0.0	0.0	0.0	0.0	0.0
min		122.0	46.8	0.5	10.5	28.9	0.0	10.9	0.0	0.0	0.0	0.0	0.0
avg		154.8	65.1	0.7	12.5	32.9	BDL(DL-10)	12.4	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentiles		186.8	86.0	1.0	15.0	38.0	BDL(DL-10)	13.3	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	RIMS (4 Location of This site)	199.0	108.0	0.6	12.4	33.8	0.0	14.5	0.0	0.0	0.0	0.0	199.0
min		167.0	47.3	0.5	9.2	26.8	0.0	11.6	0.0	0.0	0.0	0.0	167.0
avg		177.0	79.5	0.5	10.5	30.3	BDL(DL-10)	13.1	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	177.0
98 percentiles		197.5	107.3	0.6	12.3	33.6	BDL(DL-10)	14.4	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	197.5
max	Royal Academy Of Science (4 Location	207.0	111.0	0.5	13.1	34.1	0.0	12.6	0.0	0.0	0.0	0.0	0.0
min		161.0	53.1	0.3	8.6	26.1	0.0	10.2	0.0	0.0	0.0	0.0	0.0

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Parameters	Imphal Road project Location of This site)	PM10 (ug/m3)	PM2.5 (ug/m3)	CO (mg/m3)	NOx (ug/m3)	Sox (ug/m3)	Ammonia (ug/m3)	Ozone (ug/m3)	Lead (ng/m3)	Nickel (ng/m3)	Arsenic (ng/m3)	Benzene (ug/m3)	BAP (ug/m3)
avg		184.5	82.7	0.4	10.2	29.1	BDL(DL-10)	11.2	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentile		205.8	110.0	0.5	12.9	33.8	BDL(DL-10)	12.5	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	Shishu Nistha Niketan (4 Location Of This Site)	202.0	79.6	0.4	9.8	25.4	0.0	14.2	0.0	0.0	0.0	0.0	0.0
min		158.0	42.8	0.2	7.7	23.1	0.0	12.8	0.0	0.0	0.0	0.0	0.0
avg		176.8	62.5	0.3	8.4	24.1	BDL(DL-10)	13.4	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentile		201.1	79.1	0.4	9.7	25.3	BDL(DL-10)	14.2	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	St Anthony's High School (4 Location Of This Site)	192.0	59.4	0.4	9.2	29.1	0.0	16.4	0.0	0.0	0.0	0.0	0.0
min		145.0	42.5	0.4	8.1	25.6	0.0	12.5	0.0	0.0	0.0	0.0	0.0
avg		171.5	50.6	0.4	8.8	27.3	BDL(DL-10)	14.2	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentile		191.3	58.9	0.4	9.2	29.0	BDL(DL-10)	16.3	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	St Joseph School (4 Location Of This Site)	196.0	102.0	0.6	13.7	34.1	0.0	12.0	0.0	0.0	0.0	0.0	0.0
min		171.0	58.2	0.5	9.2	30.2	0.0	12.0	0.0	0.0	0.0	0.0	0.0
avg		186.8	84.3	0.5	11.6	32.0	BDL(DL-10)	12.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentile		195.8	101.4	0.6	13.6	34.0	BDL(DL-10)	12.0	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
max	New Light Public School (4 Location Of This Site)	203.0	108.4	0.4	10.4	29.9	0.0	14.0	0.0	0.0	0.0	0.0	0.0
min		134.0	47.9	0.3	8.4	26.2	0.0	10.0	0.0	0.0	0.0	0.0	0.0
avg		168.0	79.5	0.4	9.5	28.1	BDL(DL-10)	11.8	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
98 percentile		202.3	107.3	0.4	10.3	29.8	BDL(DL-10)	13.9	BDL(DL-2.2)	BDL(DL-1.1)	BDL(0.01)	BDL(1.0)	BDL(0.1)
Standards		100	60	4	80	80	100	100	1	20	6	5	1



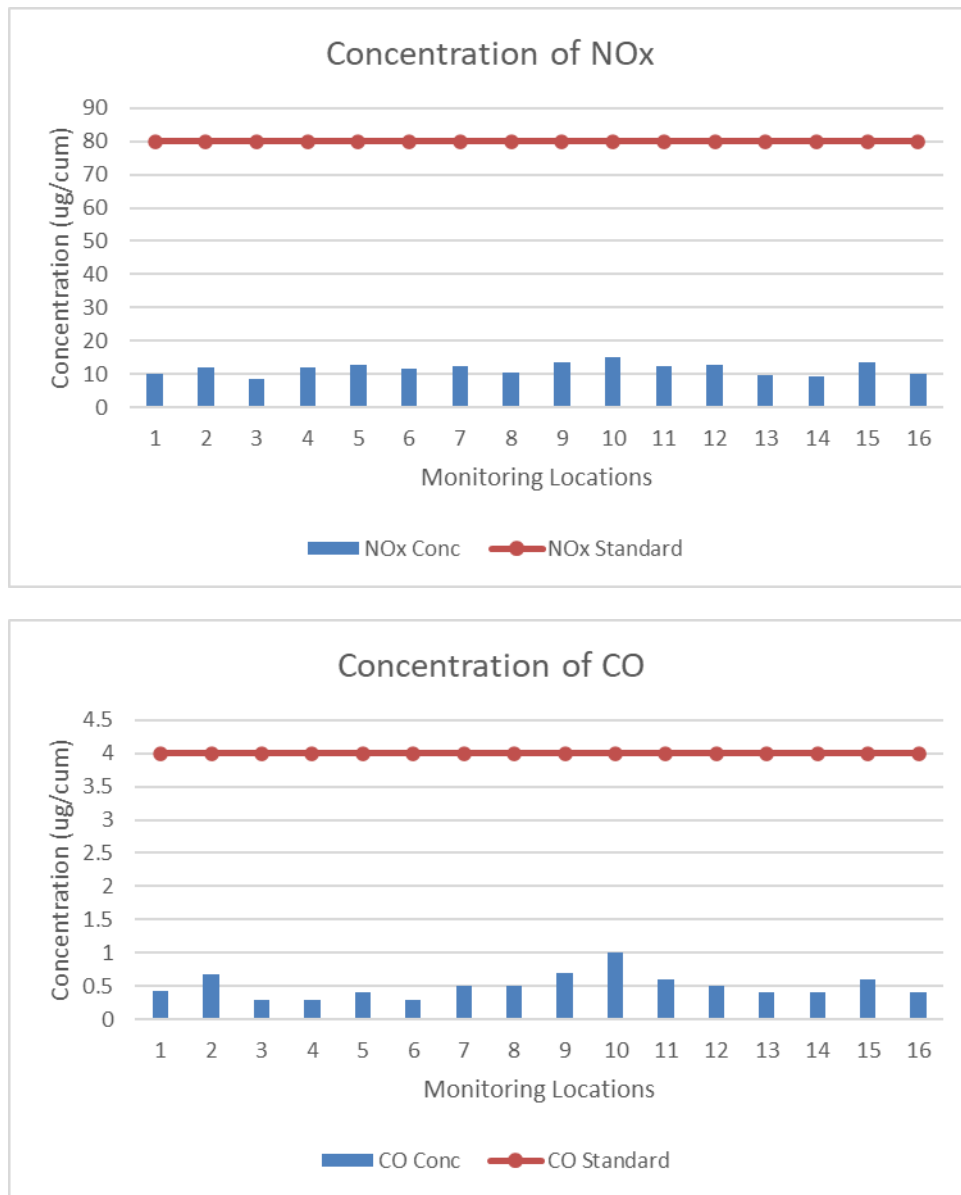


Figure 22: Graphical Representation of the Air Pollutant Concentration in Project Area

4.7.14 Noise Measurements

Noise in general is sound which is composed of many frequency components of various types of loudness distributed over the audible frequency range. Various noise scales have been introduced to describe, in a single number, the response of an average human to complex sound made up of various frequencies at different loudness levels. The noise is measured as dB (A). This is more suitable for audible range of 20 to 20,000 Hz. The scale has been designed to weigh various components of noise according to the response of a human ear. The impact of noise sources on surrounding community depends on:

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

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

Data on noise level quality is collected from the project area at 16 locations during Dec 2022-Jan 2023. As per the result, it is found that Leq level at all the locations is high at all the locations when compared to the Noise standards of Noise Rules 2000 except at location 3 during daytime and location 2 & 3 during nighttime. Noise results are given in Table 41 and 42 and Figure 23 (as Annexure 8)

Table 41: Noise Monitoring Results (Locations 1-8)

	Noise 1	Noise 2	Noise 3	Noise 4	Noise 5	Noise 6	Noise 7	Noise 8
Location	Lamlong H.S. School	Luwang sangban	Kongba Bazar	Royal Academy	RIMS	St. Anthony High School	Malom Mega High School	Herbert School
Land Use	Silence	Residential	Commercial	Silence	Silence	Silence	Silence	Silence
Standard-dB(A)	Day time-50 Night Ti me-40	Day time-55 Night Ti me-45	Day time-65 Night Ti me-55	Day time-50 Night Ti me-40	Day time-50 Night Ti me-40	Day time-50 Night Ti me-40	Day time-50 Night Ti me-40	Day time-50 Night Ti me-40
Sampling Date	21- 22/11/22	17- 18/11/22	21- 22/11/22	21- 22/11/22	17-18/11/22	17- 18/11/22	18- 19/11/22	18- 19/11/22
LEQ dB(A)	55	53.3	55.2	56	62.2	50.8	54.6	53.2
LDay dB(A)	66.9	63.8	64.7	65.4	67.6	59.4	63.8	62
LNight dB(A)	42.8	42.4	45.4	46.2	56.5	41.8	45.1	44
L10 dB(A)	51.5	49.6	52.1	60.5	71.19	67.6	52.3	70.2
L90 dB(A)	35.6	37.3	40.5	40.5	62.27	49.1	37.4	49.1
L50 dB(A)	42.7	42.4	45.3	44.3	68.5	59.5	45.1	62.4

Table 42: Noise Monitoring Results (Locations 9-16)

	Noise 9	Noise 10	Noise 11	Noise 12	Noise 13	Noise 14	Noise 15	Noise 16
Location	St. Joseph's School	Shishu Niketan	New Age Public School	New Light Public School	Prism Academic	Central Agriculture University	Ahallup	Advanced Hospital
Land Use	Silence	Silence	Silence	Silence	Silence	Silence	Silence	Silence
Standard-dB(A)	Day time-50 Night Ti me-40	Day time-50 Night Ti me-40	Day time-50 Night Ti me-40	Day time-50 Night Ti me-40	Day time-50 Night Ti me-40	Day time-50 Night Ti me-40	Day time-50 Night Ti me-40	Day time-50 Night Ti me-40
Sampling Date	18-19/11/22	18-19/11/22	19-20/11/22	19-20/11/22	20-21/11/22	20-21/11/22	07-08/12/22	15-16/12/22
LEQ	54.3	56	51.1	51.2	57.7	54.9	56	56.9
Day	63.4	66.1	60.4	61.6	68.6	64.6	63.2	63
Night	44.8	45.6	41.5	40.4	46.4	44.9	48.4	50.4
L10	68.9	52.3	66.6	70.6	52.3	52.3	72.7	72.1
L90	57.8	37.4	50.4	50.4	37.4	37.4	50.4	50.4
L50	63.5	45.6	60.5	61.7	46.1	44.9	62.3	62.3

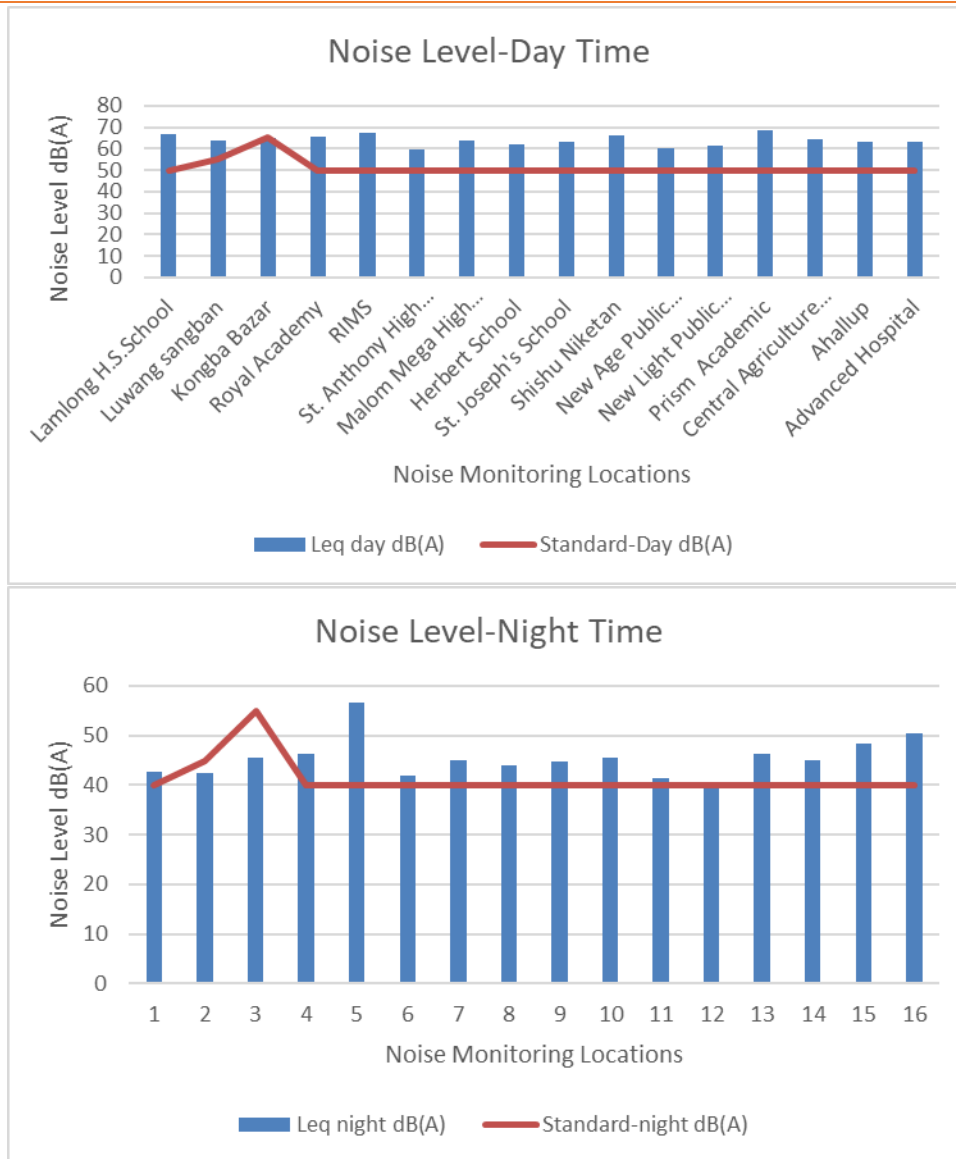


Figure 23: Graphical Representation of the Noise Levels in Project Area

4.8 Biological Environment

4.8.1 Forests & Biodiversity

The state has vast area of forest covering as much as 17,418 sq.km. which forms about 78% of the total geographical area of the state. The actual area under forest is about 15% higher than the recorded forests area of the state. Of the total forests area, reserved forests, and protected forests account for 1,467 sq.km. and 4,171 sq.km, during 2019-20. The remaining 11,780 sqkm. is treated as 'Unclassified Forest'. The important major forests products are timber, firewood, bamboo, cane etc. The production of timber other than teak has shown a decrease from 31.77 thousand cubic meters in 2018-19 to 18.47 thousand cubic meters in 2019-20. Forest map of Manipur is given in the Figure 24 below.

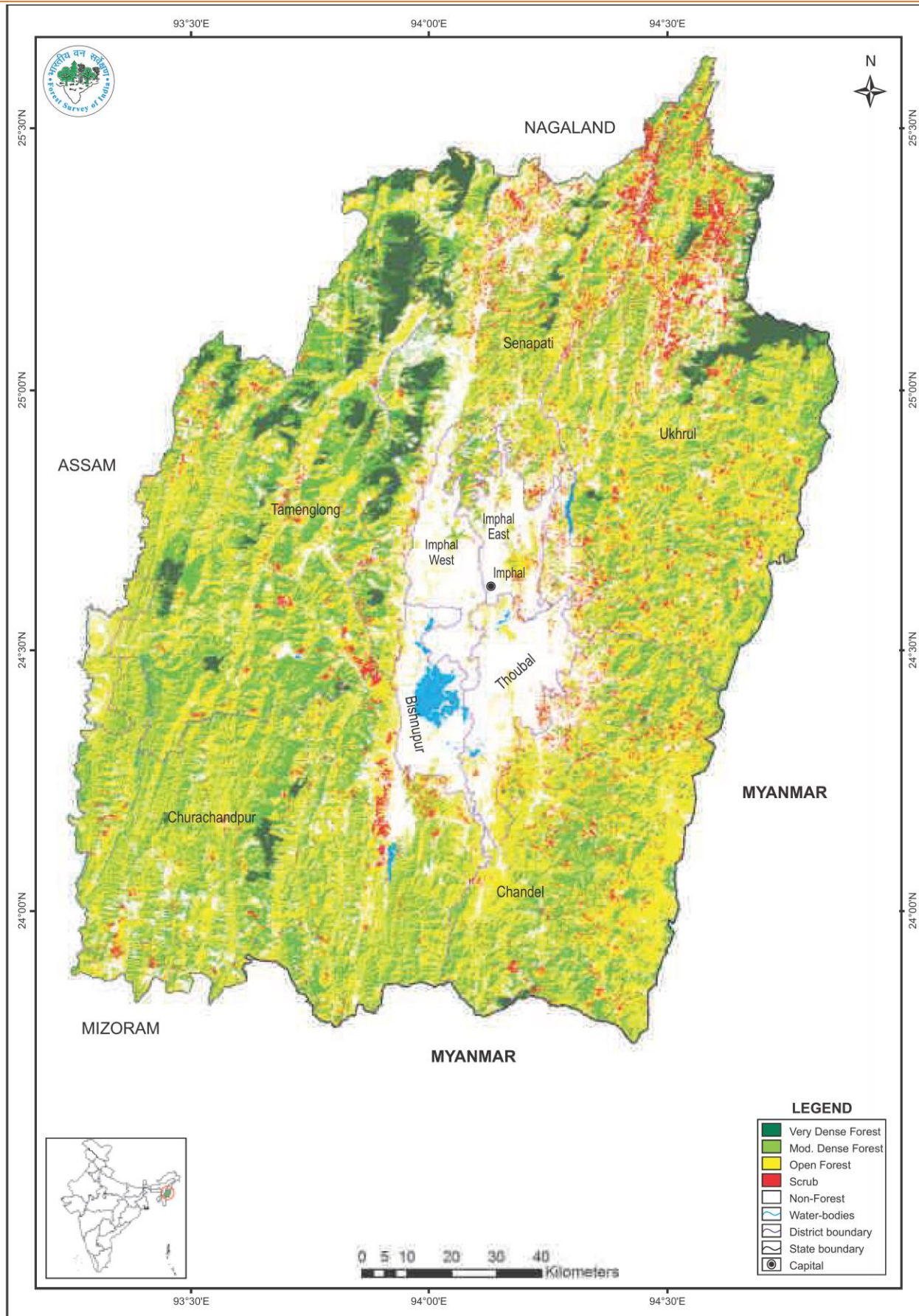


Figure 24: Forest Map in Manipur

Project area falls in Greater Imphal region comprising of Imphal East and West Districts. Details of forest cover in the project affected districts are given in Table 43 below.

Table 43: Forest Cover Detail in Project Affected Districts

District	Geographical Area (GA)	Very Dense Forest	Mod. Dense Forest	Open Forest	Total	% of GA	Change wrt 2017 assessment	Scrub
Imphal East	709	0.00	60.90	213.36	274.26	38.68	-3.74	15.00
Imphal West	519	0.00	15.66	36.09	51.75	9.97	-2.25	9.22

Area given is in sq km.
Source: Indian State of Forest Report 2019

The State has rich wildlife and has long network of protected areas. To protect the rich flora and fauna of Manipur from the poachers, the Government has established parks and sanctuaries. The state's protected area network comprises of five wildlife sanctuaries and two national parks. Recognizing the importance of this region as one of the hot spots, majority of the biodiversity rich areas of the state have been placed inside the protected area network system comprising mainly of the National Park and Sanctuary. Fauna found in the forests of Manipur include Clouded leopard, Hoolock Gibbon, spotted Linshang, slow Loris, Jungle cat, Jackal, Mongoose, Civet cat, Fox etc. Of these the Hoolock (*Hylobates hoolock*) is endangered, Hog badger (*Arctonyx collaris*) and Otter (*Lutra lutra*) are threatened. Clouded leopard (*Neofelis nebulosa*), Slow loris (*Nycticebus coucang*), Serow (*Capricornis sumatraensis*), Sambar (*Cervus unicolor*) is considered vulnerable. Least concerns animals list includes Barking deer (*Muntiacus muntjak*) and Wild pig (*Sus scrofa*). The Sangai or the dancing deer is another distinct fauna of the state. Sangai is recognized as a state animal. Other very rare species of animals that can be found in Manipur are Salamander, hog deer, Sambar and Muntjac.

The Reptilian fauna is represented by Cobra, Krait, Tree-boa, Python, Lizards, Water monitor lizards, Tortoise, Tokkegekko, etc. Avian fauna is represented by Burmese peafowl, Moorhen, Blyth "tragopan, Mrs. Hume's bar-backed pheasant, Red Jungle fowl and 3 species of Hornbills viz. Great Indian Hornbill, Rufous-necked hornbill, Wreathed hornbill, etc. The stamp-tailed Macaques are also found in the state. The critically endangered species are: *Aythya baeri* Baer's Pochard, *Gyps bengalensis* White-rumped Vulture, *Gyps tenuirostris* Slender-billed Vulture, *Houbaropsis bengalensis* Bengal Florican, and *Sarcogyps calvus* Red-headed Vulture. While the endangered species are: *Cairina scutulata* White-winged Duck, *Sterna acuticauda* Black-bellied Tern, *Axis porcinus* Hog Deer, *Hadromys humei* Hume's Rat, Hoolock Gibbon, *Manis pentadactyla* Chinese Pangolin, *Prionailurus viverrinus* Fishing Cat, and *Rucervus eldii* Eld's Deer.

Protected Areas of State:

There is one national park in Manipur. It is the Keibul-Lamjao (Loktak Lake) National Park. Along with this national park Manipur is also home to many wildlife sanctuaries and they are as follows. However, none of these areas are part of project area.

- Yangoupokpi-Lokchao Wildlife Sanctuary
- Bunning Wildlife Sanctuary
- Dzuko Valley
- Jiri-Makru Wildlife Sanctuary
- Kailam Wildlife Sanctuary
- Shiroy Community Forest
- Zeilad Lake Sanctuary

4.8.2 Forest in Project Area

Project lies in Greater Imphal road project which includes part of Imphal East and West Districts. Greater Imphal region has different land cover and diversity. Forest is also a part of the project Influence Area. Some of the forests within the Greater Imphal Region are H Nagan Reserve Forest, Khongham Pat Protected Forest, Langol Reserve Forest, and Nongmaichang Reserve Forest. However, there is no development proposed which requires diversion of the forest area.

4.8.3 Flora of Project Area

Being urban in nature, flora in the project area is restricted in the form of avenue plantation, homestead plantation and plantation along the water bodies. Floral species in project area were identified by observation during the field visits. Project development may affect 5435 trees and the details are presented in Table 44. Important varieties of non-fruit bearing trees and fruit bearing trees, observed during the visits are Bamboos, Pepal, Kaubila, Eucalyptus, Amla, *Parkia roxburghi* (Yongchak), *Arundo donax* (yendhou), *Carica papaya* (papaya), *Citrus grandia* (Pamelo), *Mangifera indica* (Mango), *Prunus domestics* (plum), *Prunus persica* (peach), *Pyrus selerotine* (pear), *Psidium guajava* (guava), *Tamarindus indica* (Tamarind). There are around 500 types of orchids and out of that 472 have been identified. The region is popular for the lily that is known as the “Siroi Lily” that are found in the forest of the hilly region. The varied flora adds to the beauty and charm of the place. Floral species present in the project area is given in Table 45 below. There are no heritage trees found in the project area. Some of the important rare and endangered floral species found in the project districts are *Tectona grandis*, *Dipterocarpus turbinatus*, *Dipterocarpus tuberculatus*, *Melonarrhoeausitata*, *Duabanga Sonnoroes*, *Dilleniapentagyna*, *Terminalliatomentosa*, *Gmelina arborea*, *Bauhinia spp.*, orchids, etc.

Table 44: Summary of Impacted Trees Due to Proposed Project

DIVISION	IMPHAL WEST	IMPHAL EAST	HIGHWAY SOUTH DIVISION
State Highway Roads	219	69	0
Major District Roads	379	175	287
Other District Roads	140	429	0
Inter Village Roads	1636	1629	382
Total Tree Nos.	2374	2302	669
	5345		

Table 45: Important Tree Species Observed in Project Area

Sl. No	Scientific Name	Local Name
1	<i>Acacia farnesiana</i>	Chingonglei
2	<i>Acrocarpus fraxinifolius</i>	Mundani, Mun
3	<i>Adina cordifolia</i>	Terakeena
4	<i>Aegle marmelos</i>	Harikhagok
5	<i>Albizza lucida</i>	Wangkhoi, Missi
6	<i>Albizzia lebbek</i>	Uil
7	<i>Albizzia procera</i>	Khal
8	<i>Albizzia stipulata</i>	Khok, Luang-khoi
9	<i>Alnus nepalensis</i>	Pareng
10	<i>Alseodaphne petiolaris</i>	Jatisundi
11	<i>Amoora rohituka</i>	Heirangoi, Amari
12	<i>Amoora wallichii</i>	Rata
13	<i>Anthocephalus cadamba</i>	Kadam, Keli kodom
14	<i>Aporosa roxburghii</i>	Tinsibi
15	<i>Aquilaria agallocha</i>	Agar
16	<i>Ardisia humilis</i>	Thantup
17	<i>Artocarpus chaplasha</i>	Cham, Dawasem
18	<i>Artocarpus integrifolia</i>	Theibong

Sl. No	Scientific Name	Local Name
19	<i>Artocarpus lakoocha</i>	Heiru-kothong
20	<i>Atalantia monophylla</i>	Bankamla, Ching-kamla
21	<i>Averrhoa carambola</i>	Heinohjom
22	<i>Bauhinia purpurea</i>	Chingthrao
23	<i>Bauhinia variegata</i>	Mai-hou-lei
24	<i>Bischofia javanica</i>	Uthum Naraobi, Urium
25	<i>Bombax ceiba</i>	Tera
26	<i>Bombax insigne</i>	Khuman tera
27	<i>Bombax malabaricum</i>	Tera
28	<i>Bridelia retusa</i>	Khiri, khasi
29	<i>Butea frondosa</i>	Pangong
30	<i>Calliandra umbrosa</i>	Utilou
31	<i>Callicarpa arborea</i>	Saiom
32	<i>Canarium resiniferum</i>	Mekruk, Dhuna
33	<i>Cassia fistula</i>	Chaohei, Chathui, sonnaru
34	<i>Castanopsis hystrix</i>	Thangji
35	<i>Cedrela serrata</i>	Chingtairel
36	<i>Cedrela toona</i>	Tairel
37	<i>Celtis cinnamomea</i>	Heigreng
38	<i>Chukrasia tabularis</i>	Tainirel
39	<i>Cinnamomum cecicodaphne</i>	Gonorei
40	<i>Cinnamomum tamala</i>	Tejpata
41	<i>Citrus aurantium</i>	Kamla
42	<i>Clerodendron nutans</i>	Uthero
43	<i>Clerodendrum tragraus</i>	Kuthab
44	<i>Cordia fragrantissima</i>	Lamuk Laba
45	<i>Crataeva relivosa</i>	Loi-emba lei
46	<i>Croton joufra</i>	Thaunang
47	<i>Cryptocarya amygdalina</i>	Tundur
48	<i>Cynometra polyandra</i>	Naop, Ping
49	<i>Decomonorops jenkinsianus</i>	Humphop
50	<i>Derris robusta</i>	Ileng-kung, kho, boruthching
51	<i>Dillenia indica</i>	Heigri
52	<i>Dillenia pentagyna</i>	Oxi/Larong
53	<i>Dipterocarpus turberculatus</i>	Yangou
54	<i>Dipterocarpus turbinatus</i>	Khangra
55	<i>Dryples assamica</i>	Jam
56	<i>Duabanga sonneratioides</i>	Tal, Tumdala
57	<i>Ehretia acuminata</i>	Lamuk
58	<i>Elaeocarpus florobundus</i>	Chorphon
59	<i>Emblica officinalis</i>	Heikru
60	<i>Entada scandens</i>	Kangkhin
61	<i>Erythrina suberosa</i>	Kurao
62	<i>Eucalyptus spp.</i>	Nasik
63	<i>Eugenia jambolana</i>	Jamun, bogi Black plum
64	<i>Eugenia precox</i>	Silheima
65	<i>Ficus cunii</i>	Heirit, Kangrou
66	<i>Ficus elastica</i>	Indian Rubber tree
67	<i>Ficus hispida</i>	Ashiheibong
68	<i>Ficus religiosa</i>	Sanakhongnang

Sl. No	Scientific Name	Local Name
69	<i>Ficus rumphii</i>	Heibong
70	<i>Ficus elastica</i>	Khongnangbot, khongnang
71	<i>Garcinia anomala</i>	Heibung
72	<i>Gardenia campanulata</i>	Lam-hei-bi
73	<i>Glochidion cowa</i>	Keil, kau
74	<i>Gmelina arborea</i>	Wang
75	<i>Goniothalamus sesquipedalis</i>	Leikhram
76	<i>Grevillea robusta</i>	Koubilia
77	<i>Grewia microcos</i>	Heitup
78	<i>Hardwickia binata</i>	Anjan
79	<i>Hiptage madablota</i>	Mahdabilata
80	<i>Holiodrana longfolia</i>	Kherai
81	<i>Hydnocarpus kurzii</i>	Uthou
82	<i>Hymenodictyon excelsum</i>	
83	<i>Ichnocarpus frutescens</i>	Lamkandol
84	<i>Jatropha curcas</i>	Awakege
85	<i>Junglans regia</i>	Heijuga
86	<i>Kadsura roxburghiana</i>	Kang-mari
87	<i>Kydia calycina</i>	Khabi
88	<i>Lannea grandis</i>	Akaman
89	<i>Lantana camara</i>	Namthibi (Theerei)
90	<i>Legerstroemia flosreginea</i>	Jarul, ajhar
91	<i>Litsaea angustifolia</i>	Haibru
92	<i>Litsaea polyantha</i>	Tumitla
93	<i>Macaranga denticulate</i>	Lajoi
94	<i>Machilus villosa</i>	Uingthou manbi
95	<i>Magnolia griffithii</i>	Utham-ban
96	<i>Mallotus roxburghianus</i>	Khabi-lakoi
97	<i>Mangifera indica</i>	Heinou
98	<i>Mansonia dipikae</i>	Badam
99	<i>Melanorrhoea usitata</i>	Kheu
100	<i>Melia azadirachta</i>	Seichrak
101	<i>Mesua ferrea</i>	Nageshwer, uthou
102	<i>Meyna spinosa</i>	Heibi
103	<i>Michelia champaca</i>	Leihao
104	<i>Mimusops elengi</i>	Bokul
105	<i>Morus alba</i>	Kabrangchak
106	<i>Morus leavigata</i>	Bela
107	<i>Murraya exotica</i>	Kamini kusum
108	<i>Myristica linifolia</i>	Se
109	<i>Nephalium longana</i>	Nonganghei
110	<i>Nerium odorum</i>	Kavirei
111	<i>Nyctanthes arbortristis</i>	Singarei
112	<i>Oroxylum indicum</i>	Samba
113	<i>Parkia roxburghii</i>	Yongchak
114	<i>Phoebe hainesiana</i>	Uningthou
115	<i>Pinus khasya</i>	Uchan
116	<i>Podocarpus neriifolia</i>	Na-u, nam
117	<i>Premna bengalensis</i>	Upongtha
118	<i>Premna mucronata</i>	Cohora, pugta

Sl. No	Scientific Name	Local Name
119	<i>Psidium guajava</i>	Pungdol
120	<i>Pterospermum acerifolium</i>	Kwakla
121	<i>Pyrus communis</i>	Naspati
122	<i>Pyrus laevigata</i>	Bola
123	<i>Quercus serratus</i>	Uyung
124	<i>Rhus semialata</i>	Heimang
125	<i>Salix tetrasperma</i>	Uyum
126	<i>Sapindus mukorossi</i>	Kekru
127	<i>Sapium baccatum</i>	Bella, selling
128	<i>Sarcochlamys pucherrima</i>	Sanamari
129	<i>Saurauja roxburghii</i>	Sing khau
130	<i>Schima wallichii</i>	Usoi
131	<i>Solanum torvum</i>	Khanga
132	<i>Spondias mangifera</i>	Heining
133	<i>Stereospermum chelonoides</i>	Missi
134	<i>Syzgium cuminii</i>	Jam
135	<i>Talauma phellocarpa</i>	Khariasopa, talasuma
136	<i>Tamarindus indica</i>	Mange
137	<i>Tectona grandis</i>	Chingshu, chingsu
138	<i>Terminalia chebula</i>	Manahi
139	<i>Terminalia citrina</i>	Monalu
140	<i>Terminalia myriocarpa</i>	Tolhao
141	<i>Tetrameles nudiflora</i>	Wang-chok, maina
142	<i>Thevetia neriifolia</i>	utonglei
143	<i>Tournefortia viridiflora</i>	Goddhai
144	<i>Trewia nudiflora</i>	Bhura, gutel, bhoidon
145	<i>Urena lobata</i>	Sampakpi
146	<i>Vangueria spinosa</i> (Syn. <i>Meyna spinose</i>)	Heibi
147	<i>Vatica lanceaefolia</i>	Mekruk
148	<i>Vitis pedata</i>	Uri-ising-thokpi
150	<i>Zanthoxylum budrunga</i>	Ngang, sairong
151	<i>Zizphus numularis</i>	Boroi

Agriculture Practice of the Project Influence Area: Other than habitation, agriculture is next most dominant land use of study area. The agriculture practices in the Project Influenced Area (PIA) can be broadly categorized into two distinct types, viz., settled farming practiced in the plains, valleys, foothills, terraced slopes, etc. and shifting cultivation (Jhum) practiced on the hill slopes. The shifting cultivation leads to possible forest degradation in the foothills and reduce the total sink potential across the state. There are 18 (eighteen) main crops which are cultivated during the two seasons in the state. Rice cultivation dominates all others crops. Some of the commercial crops grown in PIA are cotton, kabrangchak, oil seeds and sugarcane which is very essential for enhancing the growth of agro-based industries in the state of Manipur. Common horticulture crops grown in the PFA are Kharif vegetables (French bean, Cucurbits, Tomatoes, Brinjal, Bhindi, Colocecia, Alocasia), Rabi vegetables (Cabbage, Cauliflower, Potato, Pea, Broad bean, Radish, Carrot, Broccoli, lettuce, Capsicum), Spices (Onion, Garlic, Chili, Ginger, Turmeric, Hatkora) Fruits and Plantation Crops (Litchi, Cashew nuts, Wall nuts, Orange, Lemon, Banana, Pineapple, Passion fruit, Peach, Pear, Plum). The PIA has the scope and potential to grow various horticultural crops because of varied agro- climatic condition.

Rice Cultivation: Manipur has always been a rice growing state. Some of the special classes of rice in the state include joha or aromatic rice, bora, or waxy rice and chokuwa or soft rice. Many of the rice in the state can also be divided into Autumn Rice, Winter Rice, Summer Rice and Jhum cultivation. Black rice has been the latest addition to the rice cultivation in the state. Black rice is a common name for a

range of rice belonging to *Oryza Sattiva L.* species. These varieties grow well in tropical zones like Japan, Korea, Myanmar, China, and North-east India. These black rice variety are beneficial not only for the health consideration but also due to the fact that these varieties are more resilient to the effect of climate change. These varieties can grow well even at a higher temperature and flood conditions. A detailed study was conducted to identify black rice cultivation in the project region, no such location has been identified along the project road.

Lamphelpat Wetland: There are no notified wetland within the project area. Lamphelpat wetland is not notified wetland but is very important ecosystem of the project area. The wetland stores water drained from the Lamphel Reserve Forest and the Nambul River. It brought down the temperature and controlled or mitigated flood by storing the excess water from Nambul River. Now all these have been affected by uncontrolled anthropogenic activities and negligence. However due to siltation, human encroachment and dumping of waste materials in the wetland, the Lamphelpat has lost its original form and is in bad condition. Siltation and dumping of waste materials have made it shallower and water plants and weeds have covered the wetland. Wetland once was lush green and supported wide variety of flora and fauna including Kombirei which is an endangered flowering plant of Manipur. However due to the encroachment and dumping of waste, flora and fauna of the wetland has been drastically impacted. Other than this many water bodies, streams and nallahs existing in Imphal has been encroached for various development. No expansion or acquisition of land is proposed to be undertaken in the wetland region or any such waterbody for this project.

Heingangpat Wetland: Heingangpat, also known as Ibudhou Marjing's Pat, was once a serene wetland and people used canoes to navigate in the water and fish, he said. Marjing Ching is in the north of the wetland, bounded by Heingang Khong and Hannabi Ching in the south and southeast side respectively. Heingangpat has about 120 Paris in area, but only 40 Paris are remaining as wetland. About 50 percent of the total wetland area has been turned into fish farms.

4.8.4 Fauna in Project Area

Fauna of Project Influence Area: There are no wildlife significant areas like wildlife sanctuaries, national parks etc. in the project area. Some of the faunal species present in the forest areas of Manipur include 16 species of wild animals. Of these the Hoolock (*Hylobates hoolock*) is endangered, Hog badger (*Arctonyx collaris*) and Otter (*Lutra lutra*) are threatened. Clouded leopard (*Neofelis nebulosa*), Slow loris (*Nycticebus coucang*), Serow (*Capricornis sumatraensis*), Sambar (*Cervus unicolor*) is considered vulnerable. Least concerns animals list includes Barking deer (*Muntiacus muntjak*) and Wild pig (*Sus scrofa*). Of these species of wild animals Clouded leopard (*Neofelis nebulosa*), Slow loris (*Nycticebus coucang*), Barking deer (*Muntiacus muntjak*) and Wild pig (*Sus scrofa*) are also found in the forest areas. But no work for the proposed project is being carried out in the forest areas.

However, due to urban settings of project area, presence of fauna is limited to domesticated fauna only like cow (*Bos taurus*), goat (*Capra aegagrushircus*), pig (*Sus*), dogs (*Canis lupus familiaris*) and buffalos (*Bubalus bubalis*) which were sighted during the site visit. None of these above species are scheduled species as per WPA Act 1972 or listed in red data list of IUCN. Details of fauna in the project area are given in Table 46.

Project area is rich also rich in avifauna and inhabitants' various birds. Project area is not part of any notified important bird area but Manipur forms part of the Central Asia Flyway and East Asia Flyway. As per the Birdlife International Red Data Book report, 55 bird species. out of 666 identified species recorded in Manipur are of conservation concern. Out of these 55 species:

- 4 are listed as Critically Endangered,
- 8 are listed as Endangered,
- 15 are listed as Vulnerable and the remaining 28 Near Threatened species are close to qualifying as Threatened.

Birds which are observed in the state of Manipur are Horn bill, Blyths Tragopan, Burmese Pea-fowl, Sparrow, swallow, owl, myna, pigeon, nightingale, wood pecker, heron, kite, Black-headed bulbul (*Pycnonotus atriceps*), Black-headed yellow bulbul (*Pycnonotus melanicterus*), Purple wood pigeon (*Columba punicea*), Batek, Blue-eared kingfisher (*Alcedo meninting*), White-breasted kingfisher (*Halcyon smyrnensis*), Forest eagle owl (*Bubo Nepalese's*), Tawny eagle (*Aquila vindhiana*), Indian golden-backed three-toed woodpecker (*Dinopium javanense*) etc. Some of the globally threatened species found in the forest areas are (Great Indian hornbill) and five nationally vulnerable (Mrs. Hume's bar backed pheasant, Burmese ring dove, Indian moorhen, the Bar tailed dove, Pheasant tailed Jacana) birds' species are also found in the forest areas of Manipur, however none of these species were observed in project area during the site visit. The lakes and the marshy lands of the Southern Manipur valley comprising of the Outer and core zone of Loktak Lake under Bishnupur district are the favorite habitat of a variety of rare migratory birds such as duck, geese, snipe etc., arriving particularly in winter months from places as far as Siberia. However the project area is a Built Up Urban Center in the middle of Imphal City and no migratory birds or other vulnerable species are observed.

Site area was also superimposed on data maps for key bio-diversity important areas and protected areas as per IBAT and it shows no such area is falling within the project area (Figure 25). Thus, project is not impacting any critical habitat. Screening on the critical habitat is conducted based on criterion: Critically Endangered and Endangered Species, Endemic and Restricted range Species, Migratory and Congregatory Species, Highly Threatened or Unique Ecosystems, Key Evolutionary Processes, The Legally Protected Areas (particularly IUCN Categories I-IV) and Internationally Recognized Areas (e.g., KBAs and IBAs) and other areas of high biodiversity value, such as areas of high scientific value or areas of old growth forest. Project is not impacting any key bio-diversity area/protected area. However, the project area houses 2 vulnerable species, 1 endangered species and 1 threatened species of avifauna. The project being urban in nature, having low biodiversity and does not house any KBA/IBA thus cannot be listed as critical habitat.

Table 46: Fauna in Project Area

Sl. No	Scientific Name	Common/Local Name	IUCN	WPA, 1972
Mammals				
1.	<i>Bos taurus</i>	Cow	LC	Not Listed
2.	<i>Capra aegagrushircus</i>	Goat	LC	Not Listed
3.	<i>Sus</i>	Pig	LC	Not Listed
4.	<i>Canis lupus familiaris</i>	Dogs	LC	Not Listed
5.	<i>Bubalus bubalis</i>	Buffalo	LC	Not Listed
Amphibians				
6.	<i>Bufo melanostictus, Schneider</i>	Common toad	LC	Sch IV
7.	<i>Rana tigrina, Doudin</i>	Indian Bulfrog	LC	Sch IV
8.	<i>Rana limnocharis, Boie</i>	Indian cricket frog	LC	Sch IV
9.	<i>Rana breviceps, Schneider</i>	Indian burrowing frog	LC	Sch IV
Fishes				
10.	<i>Catla catla</i>	Katla, Bao	LC	Not Listed
11.	<i>Labeo rohita</i>	Rou	LC	Not Listed
12.	<i>Labeio calbase</i>	Ngathi	Threatened	Not Listed

Sl. No	Scientific Name	Common/Local Name	IUCN	WPA, 1972
13.	<i>Cirrihinus mirigale</i>	Mrigal	LC	Not Listed
14.	<i>Clarius batrachus</i>	Ngakra	LC	Not Listed
15.	<i>Rita rita</i>	Rita	LC	Not Listed
16.	<i>Heteropneustus fonilis</i>	Ngachik	LC	Not Listed
17.	<i>Notopterus notopterus</i>	Kandala	LC	Not Listed
18.	<i>Macrobrachum rosenbergii</i>	Kjhajing/ Giant River Prawn	LC	Not Listed
19.	<i>M. malconsoni</i>	Monsoom River Prawn	LC	Not Listed
20.	<i>M. Chapral</i>	--	LC	Not Listed
21.	<i>Channa punetatus</i>	Ngamu	LC	Not Listed
22.	<i>C. gaehua</i>	Dwarf snakehead	LC	Not Listed
23.	<i>C. striatus</i>	Ngamu	LC	Not Listed
Reptiles				
24.	<i>Calotes versicolor</i>	Garden lizard	LC	Not Listed
25.	<i>Hemidactylus bowringi, Gray</i>	House lizard	LC	Not Listed
26.	<i>Varanus bengalensis, Daudin</i>	Monitor lizard	LC	Not Listed
Aves/birds				
27.	<i>Ocyeros griseus</i>	Malabar Grey Hornbill	LC	Not Listed
28.	<i>Blyths Tragopan</i>	grey-bellied tragopan	Vulnerable	Sch-I
29.	<i>Pavo muticus</i>	Burmese Peafowl	Endangered	Not Listed
30.	<i>Passer domesticus bactrianus</i>	Sparrow	LC	Not Listed
31.	<i>Hirundo rustica</i>	Swallow	LC	Not Listed
32.	<i>Acridotheres tristis</i>	Myna	LC	Sch-IV
33.	<i>Columba livia</i>	Pigeon	LC	Sch-IV
34.	<i>Luscinia megarhynchos</i>	Nightingale	LC	Not listed
35.	<i>Chrysocolaptes lucidus</i>	Woodpecker	LC	Sch-IB
36.	<i>Ardea alba</i>	Purple heron	LC	Not listed
37.	<i>Nycticorax nycticorax</i>	Night heron	LC	Not listed
38.	<i>Ardeola grayii</i>	Paddybird or, Pond heron	LC	Not listed
39.	<i>Milvus migrans</i>	Kite	LC	Not listed
40.	<i>Pycnonotus atriceps</i>	Black headed Bulbul	LC	Sch-III
41.	<i>Pycnonotus melanicterus</i>	Black-headed yellow bulbul	LC	Sch-III
42.	<i>Columba punicea</i>	Purple wood pigeon	LC	Sch-IV
43.	<i>Alcedo meninting</i>	Blue-eared kingfisher	LC	Sch-IV
44.	<i>Halcyon smyrnensis</i>	White-breasted kingfisher	LC	Sch-IV
45.	<i>Bubo nipalensis</i>	Forest eagle owl	LC	Sch-IV
46.	<i>Aquila vindhiana</i>	Tawny eagle	Vulnerable	Not listed
47.	<i>Dinopium</i>	Indian golden-backed	LC	Sch-IV

Sl. No	Scientific Name	Common/Local Name	IUCN	WPA, 1972
	<i>javanense</i>	three-toed woodpecker		

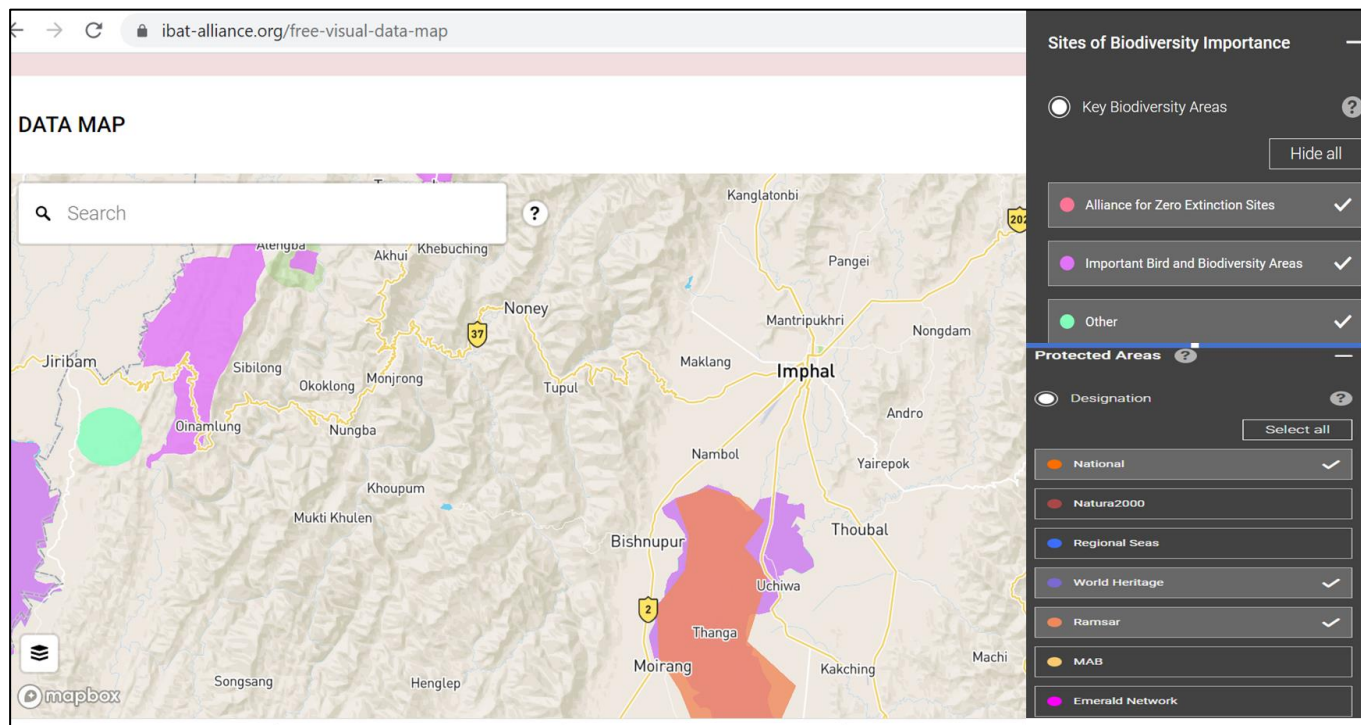


Figure 25: Project area show Biodiversity sites in Manipur.

4.8.5 Aquatic Ecology and Fisheries

The important fishes commonly found in the region's plain and river basins are *Catla catla*, *Labeo rohita*, *Labeo calbase*, *Cirrihinus mirigale*, *Clarius*, *batrachus*, *Rita rita*, *Heteropneustus fonilis*, *Notopterus notopterus*, *N. Chitala*, *Macrobrachum rosenbergii*, *M. malconsoni*, *M. Chapral*, *Channa punetatus*, *C. gaehua*, *C. striatus*. Aquatic plants which are found in the ponds/lakes of project area are: *Zizania latifolia*, *Neptunia oleraceae*, *Ipomea aquatica*, *Jussiaea repens*, *Enhydra fluctuans*, *Eleocharis dulcis*, *Sagittaria sagittifolia*, *Marsilea quadrifolia*, *Trapan natas*, *Nelumbo nucifera*, *Alocasia cuculata*, *Eryngium foetidum*, *Euryale ferox*, *Hedychium coronarium*, *Houttuynia cordata*, *Neptunia oleraceae* and *Oenanthe javanica*. All these plants are used by locals.

4.9 Socio-economic Environment

The primary purpose of the socio-economic analysis is to provide an overview of the States socioeconomic status and the relative status of the Project Influence Area (PIA) within the State.

4.9.1 Project Affected Districts Profile

Project districts came into being with effect from 18th June 1996 by bifurcating the erstwhile Imphal district into two districts namely Imphal East District and Imphal West District occupying the eastern part of Imphal district with its headquarters at Porompat. The total geographical area of Imphal East District (including Jiribam) is 709 Sq. kms. The district is situated at an altitude 790 meters above the M.S. Level. The district lies between latitudes 24°39'49.09"N and 25°4'5.45" N and longitudes 93°55'30" E and 94°8'42" E approximately. The Senapati district bounds on the north and east, Thoubal district on the south and Imphal West district on the west. Some hills like Khundrakpam and other small hillocks such as Angom Leikai (820 m), Chingaren (804 m) and Chingmeirong (802m) dotted the district. Mount Nungsikon located in the Khundrakpam hill as high as 1,168 meters above the mean sea level (MSL) is the highest relief in the district. Generally, the district slopes southwards. The Nongmaijing hill administratively under the Senapati district stretches north – south from the

Kameng village to the end of the district boundary as high as 1,565 meters.

The economy of the district is mainly agriculture based, which is not yet commercialized due to inadequate irrigation facilities and lack of improved farming techniques. There are no major industrial activities except cottage and small-scale industries. Predominant economic activities prevalent in the district include agriculture, handloom, wool-knitting, cane and bamboo works, pottery, black smithy and carpentry, retail trade/ small business. The industrial activities are concentrated in SSI, cottage, and house-hold sectors.

The Imphal West District falls in the Category of Manipur valley region. It is a tiny plain at the centre of Manipur surrounded by Plains of other districts. Imphal City, the State Capital, is the nodal functional centre of this District. It is surrounded by Kangpokpi District on the north, on the east by Imphal East and Thoubal districts, on the south by Thoubal and Bishnupur Districts, and on the west by Senapati and Bishnupur Districts. The district enjoys comfortable temperatures throughout the year, not very hot in summer and not very cold in winter. Overall, the climatic condition of the district is salubrious and monsoon tropical. The whole district is under the influence of the monsoons characterized by hot and humid rainy seasons during the summer, and cool and dry seasons during the winter. Temperature ranges from minimum 0^o C to maximum of 36^o C. The average annual rainfall based on the meteorological data published for the years 1991-99 is 1259.5 mm. The district gets rainfall from the South-West monsoon. It has no rail network and hence communication is entirely dependent on roads.

The valley area of Imphal West district is fertile land and is mainly made up of alluvial soil of recent origin. The valley was once full of swamps and marshy lands, the important ones being Lamphelpat, Takyelpat, Sangaipat, Kakwapat, Poiroupat (pat means lake). The soil is mainly made up of shallow black, brown and alluvial soils which have been technically classified as Udalfs-Ochrepts and Ochrepts-Aquepts-Fluvents.

Main rivers draining Imphal west plain are Imphal river, Nambul river and their tributaries. The Nambul river is made up of several small streams on its upper course. The course of the river is short, and its outlet falls on Loktak Lake. This river passes through Imphal Municipality area dividing its area into almost two equal halves. This river serves as the main discharging drainage of Imphal Bazar area and its surroundings. During rainy season, swift flowing of water directed to it from its tributaries can't be contained in it. As a result, breaking of its river bunds causing waterlogging in the low-lying area is of regular feature.

4.9.2 Demography and Literacy of Project Affected Districts

As per Census 2011, the density population of Imphal East District is 643 per sq. km constituting 16% of the total population of the state. As per 2011 Census, out of the total Imphal East population for 2011 census, 40.17 percent lives in urban regions of district. In total 183,207 people lives in urban areas of which males are 89,305 and females are 93,902. Sex Ratio in urban region of Imphal East district is 1051 as per 2011 census data. Similarly, child sex ratio in Imphal East district was 953 in 2011 census. Child population (0-6) in urban region was 21,612 of which males and females were 11,067 and 10,545. This child population figure of Imphal East district is 12.39 % of total urban population.

As per 2011 census, 59.83 % of the population of Imphal East districts lives in rural areas of villages. The total Imphal East district population living in rural areas is 272,906 of which males and females are 136,789 and 136,117 respectively. In rural areas of Imphal East district, sex ratio is 995 females per 1000 males. If child sex ratio data of Imphal East district is considered, figure is 937 girls per 1000 boys. Child population in the age 0-6 is 38,324 in rural areas of which males were 19,784 and females were 18,540. The child population comprises 14.46 % of total rural population of Imphal East district.

As per 2011 Census, out of the total Imphal West population for 2011 census, 62.33 percent lives in urban regions of district. In total 322,879 people lives in urban areas of which males are 158,106 and females are 164,773. Sex Ratio in urban region of Imphal West district is 1042 as per 2011 census data.

Similarly, child sex ratio in Imphal West district was 957 in 2011 census. Child population (0-6) in urban region was 36,416 of which males and females were 18,606 and 17,810. This child population figure of Imphal West district is 11.77 % of total urban population.

As per 2011 census, 37.67 % of the population of Imphal West districts lives in rural areas of villages. The total Imphal West district population living in rural areas is 195,113 of which males and females are 96,948 and 98,165 respectively. In rural areas of Imphal West district, sex ratio is 1013 females per 1000 males. If child sex ratio data of Imphal West district is considered, figure is 937 girls per 1000 boys. Child population in the age 0-6 is 25,459 in rural areas of which males were 13,141 and females were 12,318. The child population comprises 13.55 % of total rural population of Imphal West district.

Table 47: Socio- Economic Profile of Imphal East and Imphal West District

Description	Imphal East		Imphal West	
	2011	2001	2011	2001
Population	4.56 Lakhs	3.95 Lakhs	5.18 Lakhs	4.44 Lakhs
Actual Population	4,56,113	3,94,876	5,17,992	4,44,382
Male	2,26,094	1,98,371	2,55,054	2,21,781
Female	2,30,019	1,96,505	2,62,938	2,22,601
Population Growth	15.51%	19.49%	16.56%	16.70%
Area Sq. Km	709	709	519	519
Density/km2	643	557	998	856
Proportion to Manipur Population	15.97%	17.21%	18.14%	19.37%
Sex Ratio (Per 1000)	1017	991	1031	1004
Child Sex Ratio (0-6 Age)	943	963	949	945

Source: <https://www.census2011.co.in>

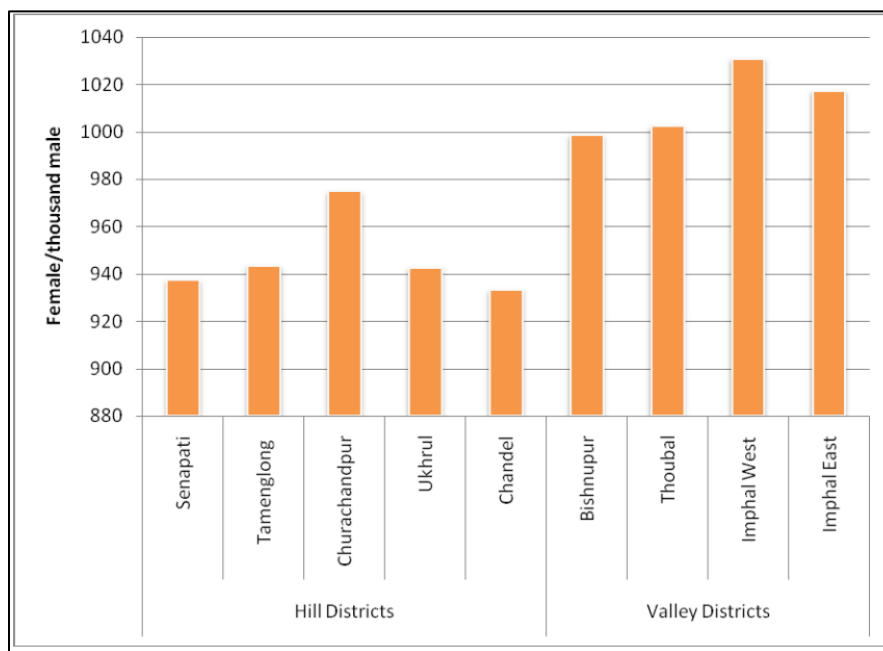


Figure 26: District Wise Sex Ratio in Manipur

Project falls in Greater Imphal Area which comprise of part of both Imphal East & West Districts. Demographic details of the Greater Imphal Planning Area are given below.

Table 48: Socio- Economic Profile of Greater Imphal Planning Area (2011)

	Imphal Municipal Corporation	Non-Municipal Area	Greater Imphal Planning Area

Number of Ward/Census Town/Out-Growth/Villages	27 wards	16 Census Town 05 Out-Growth 56 Villages	27 wards 16 Census Town 05 Out-Growth and 56 Villages
Total Area (sqkm)	34.87	111.68	151.55
Total Population (lakh)	2.68	2.58	5.26
Male Population (lakh)	1.38	1.31	2.69
Female Population (lakh)	1.45	1.12	2.57
Total Households	61,281	46,609	1,07,890
Population Density (pph)	81	20	35
Literacy Rate (%)	81.28	77.26	79.51
Sex Ratio	1052	1033	1044
Population density	81	20	35
Literacy Rate	81.28	77.26	79.51

4.9.3 Literacy rate

Manipur has a literacy rate of 76.9%, (Census 2011), which is more than the national average of 74%. Positive change has been observed during last two-decades in the literacy rate of Manipur, i.e., literacy level has increased from 66.6% in 2001 to 76.9% in 2011, which is a positive sign. Among districts, there is no sharp difference between hill and valley districts in terms of literacy. Imphal West district, which is the most urbanised district in Manipur and contains part of Imphal City, the capital of Manipur, has the highest literacy rate.

Average literacy rate in Imphal West district as per census 2011 is 88.40 % of which males and females are 93.92 % and 83.16 % literates respectively. In actual number 253,235 people are literate in urban region of which males and females are 131,016 and 122,219 respectively.

Literacy rate in rural areas of Imphal West district is 82.16 % as per census data 2011. Gender wise, male, and female literacy stood at 89.45 and 75.04 percent respectively. In total, 139,391 people were literate of which males and females were 74,969 and 64,422 respectively.

Average literacy rate in Imphal East district as per census 2011 is 87.12 % of which males and females are 92.51 % and 82.06 % literates respectively. In actual number 140,783 people are literate in urban region of which males and females are 72,377 and 68,406 respectively.

Literacy rate in rural areas of Imphal East district is 78.39 % as per census data 2011. Gender wise, male, and female literacy stood at 86.27 and 70.54 percent respectively. In total, 183,881 people were literate of which males and females were 100,937 and 82,944 respectively.

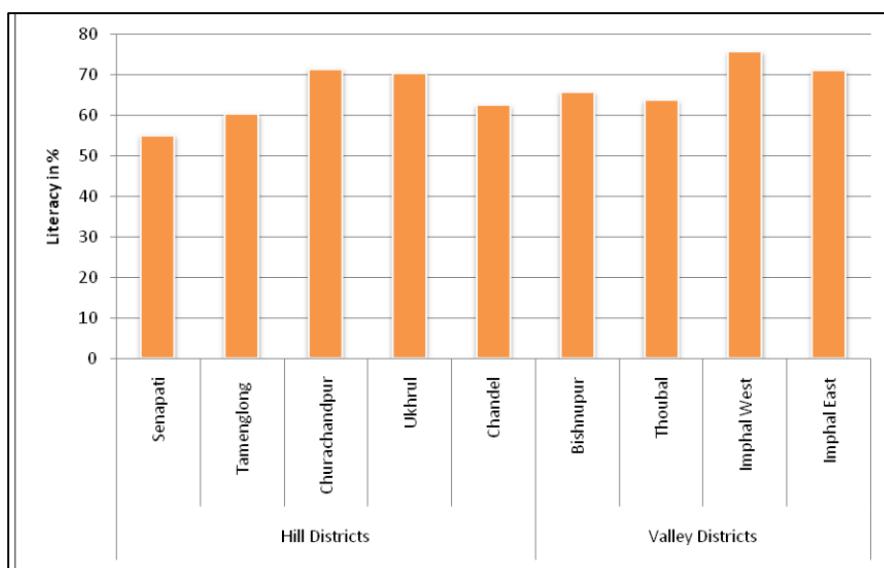


Figure 27: District Wise Literacy Rate in Manipur

4.9.4 Caste Distribution

As per the 2011 Census, the share of SC and ST population of Manipur is 3.40% and 40.8%, as against national average of 16.2% and 8.2% respectively, which reflects a much larger share of ST population in the state than the national average. Regarding the distribution of SC and ST populations, the proportion of the ST population is high in hill districts whereas the proportion of the SC population is high in valley districts. In Manipur, 33 tribal groups are recognized by the Government of India as Scheduled Tribes (STs), seven Scheduled Castes (SCs), and the Meitei's, the Pangans, and 'others' as separate population categories.

Table 49: Caste Composition of Imphal East and Imphal West District

District	SC (%)	ST (%)	Others (%)
Imphal East	3.47	6.06	90.46
Imphal West	3.19	4.66	92.14

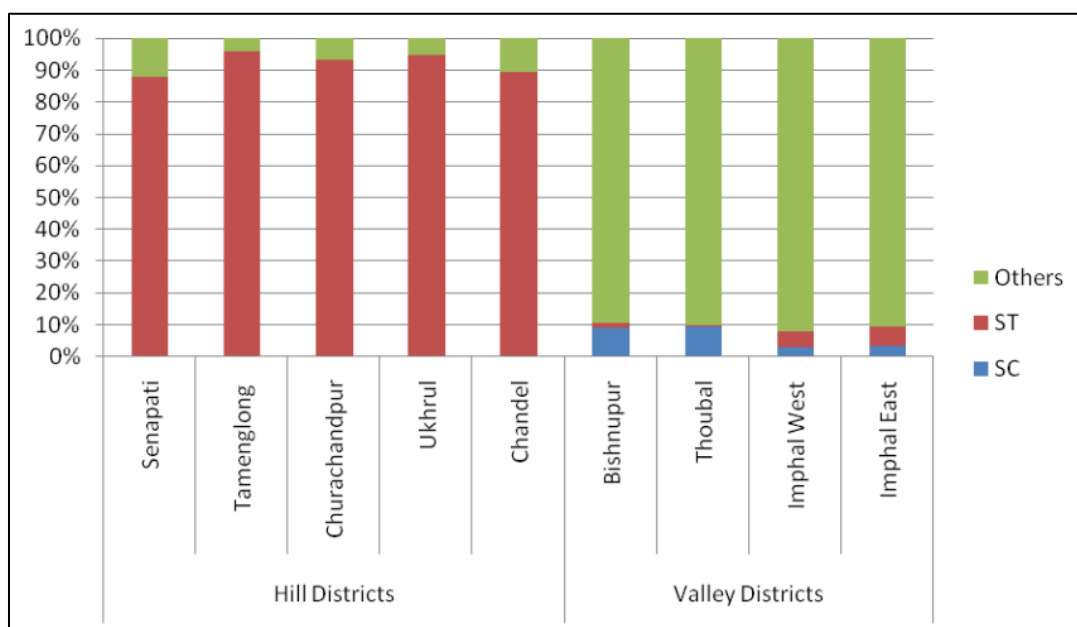


Figure 28: District Wise Caste Composition in Manipur

4.9.5 Workforce Participation

The workforce participation rate in Manipur is 45.09, which is much higher than the national average of 25.51 (Census, 2011). Imphal East and Imphal West district have a low workforce participation rate because of the prevailing urban economy in most part of the two districts. Imphal, the capital city of Manipur and the only Class I city in Manipur located in the northern portion of the valley area, covering the partially area of Imphal East and Imphal West district, contributes highly to increase of the non-farm workforce. Hence these two districts have a major share of the non-farm workforce.

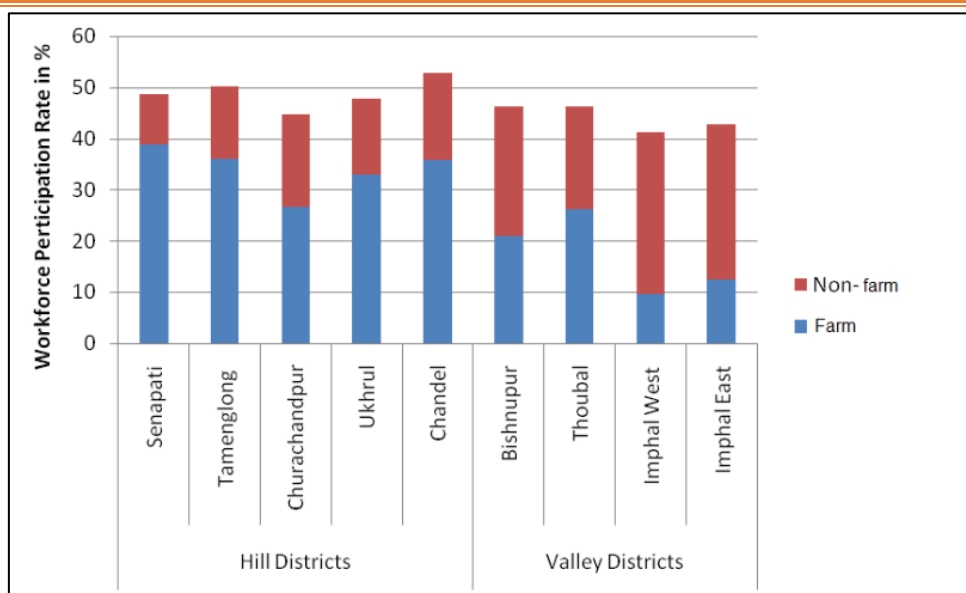


Figure 29: Work Force Participation Ratio in Manipur

4.9.6 Road Network

The selected road network is recommended to be improved as rigid pavement with concrete lined drains. There is no new green field alignment/ road proposed under the project. The roads have been selected on the recommendation and consultation of PWD, Manipur based upon the existing deterioration, importance of road and connectivity offered by the said road. Detail of roads that are undertaken for the improvement as rigid pavement and some roads are selected for flexible pavement (river side roads). The details of the project road in Table 50 & 51 below

Table 50: List of Project Road network based upon type of road.

Road Category	Imphal West	Imphal East Package A	Imphal East Package B	Highway South	Sum
State Highway Roads	10.463	4.578	5.348	0	20.389
Major District Roads	22.834	5.028	4.679	39.451	71.992
Other District Roads	7.768	4.196	6.906	0.922	19.792
Inter Village Roads	131.793	127.23	105.276	70.809	435.108
Sum	172.858	141.032	122.209	111.182	547.281

Table 51: List of Project Road network Based upon Land Width

Road Type	Imphal West	Imphal East Package A	Imphal East Package B	Highway South	Total
Single Lane	130.978	81.212	60.08	78.678	350.948
Intermediate Lane	26.601	39.94	16.251	21.786	104.578
2 Lane	5.967	4.307	7.973	0	18.247
4 Lane	4.242	3.416	1.957	0	9.615
Riverbank Side Roads	5.070	12.157	35.948	10.718	63.893
Sum	172.858	141.032	122.209	111.182	547.281



Figure 30: Road Network in Imphal West Division

Table 52: Road Network Details in Imphal West Division

Imphal West					
State Highway					
	SL	IDL	2 Lane	4 Lane	Total
Conventional Pavement	0	0	0	0	0.00
White Topping	0	0	0	4242	4.24
Short Panel with PC	0	0	0	0	0.00
Short Panel with FDR	2913	211	3097	0	6.22
ICBP	0	0	0	0	0.00
Flexible Pavement	0	0	0	0	0.00
TOTAL (Kms)	2.913	0.211	3.097	4.242	10.46
MDR					
	SL	IDL	2 Lane	4 Lane	Total
Conventional Pavement	2287	4080	0	0	6.37
White Topping	0	0	0	0	0.00
Short Panel with PC	7746	3805	263	0	11.81
Short Panel with FDR	3176	1182	295	0	4.65
ICBP	0	0	0	0	0.00
Flexible Pavement	0	0	0	0	0.00
TOTAL (Kms)	13.209	9.067	0.558	0	22.83
ODR					
	SL	IDL	2 Lane	4 Lane	Total
Conventional Pavement	0	717	0	0	0.72
White Topping	0	0	0	0	0.00

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Short Panel with PC	2998	0	0	0	3.00
Short Panel with FDR	2226	0	1827	0	4.05
ICBP	0	0	0	0	0.00
Flexible Pavement	0	0	0	0	0.00
TOTAL (Kms)	5.224	0.717	1.827	0	7.77
IVR					
	SL	IDL	2 Lane	4 Lane	Total
Conventional Pavement	0	0	0	0	0.00
White Topping	0	0	0	0	0.00
Short Panel with PC	15168	8234	485	0	23.89
Short Panel with FDR	35238	8372	0	0	43.61
ICBP	59226	0	0	0	59.23
Flexible Pavement	5070	0	0	0	5.07
TOTAL (Kms)	114.702	16.606	0.485	0	131.79
Imphal West Summary					
	SL	IDL	2 Lane	4 Lane	Total
Conventional Pavement	2287	4797	0	0	7.08
White Topping	0	0	0	4242	4.24
Short Panel with PC	25912	12039	748	0	38.70
Short Panel with FDR	43553	9765	5219	0	58.54
ICBP	59226	0	0	0	59.23
Flexible Pavement	5070	0	0	0	5.07
TOTAL (Kms)	136.048	26.601	5.967	4.242	172.86

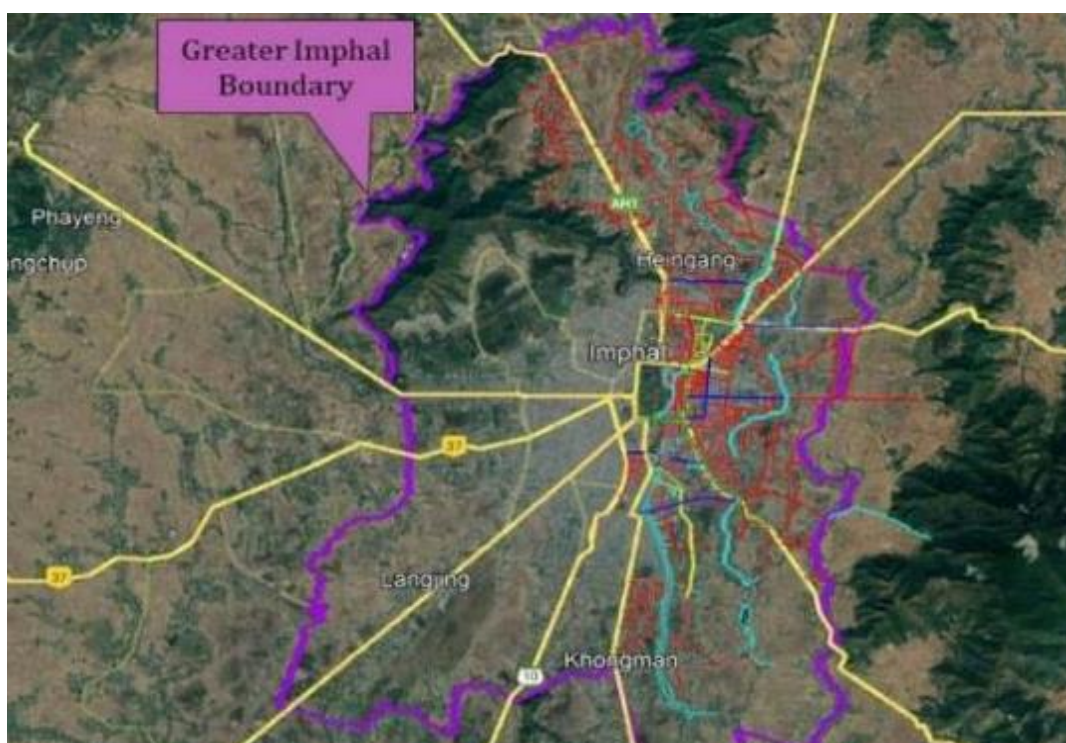


Figure 31: Road Network in Imphal East Division

Imphal East division has been divided into two parts The Northern Half of Imphal East and Southern half of Imphal East. The Porompat DC road is taken as a physical feature which bifurcates these two packages.

Table 53: Road Network Details in Imphal East Division Package A

Imphal East Package A					
State Highway					
	SL	IDL	2 Lane	4 Lane	Total
Conventional Pavement	0	0	0	0	0.00
White Topping	0	0	0	2309	2.31
Short Panel with PC	0	0	0	0	0.00
Short Panel with FDR	0	0	0	0	0.00
ICBP	0	0	0	0	0.00
Flexible Pavement	0	2269	0		2.27
TOTAL (Kms)	0	2.269	0	2.309	4.58
MDR					
	SL	IDL	2 Lane	4 Lane	Total
Conventional Pavement	0	0	0	0	0.00
White Topping	0	0	0	0	0.00
Short Panel with PC	0	1016	0	0	1.02
Short Panel with FDR	0	1848	2164	0	4.01
ICBP	0	0	0	0	0.00
Flexible Pavement	0	0	0	0	0.00
TOTAL (Kms)	0	2.864	2.164	0	5.028
ODR					
	SL	IDL	2 Lane	4 Lane	Total
Conventional Pavement	0	0	0	0	0.00
White Topping	0	0	0	1107	1.11
Short Panel with PC	1005	0	621	0	1.63
Short Panel with FDR	909	0	0	0	0.91
ICBP	0	0	0	0	0.00
Flexible Pavement	554	0	0	0	0.55
TOTAL (Kms)	2.468	0	0.621	1.107	4.20
IVR					
	SL	IDL	2 Lane	4 Lane	Total
Conventional Pavement	0	0	0	0	0.00
White Topping	0	0	0	0	0.00
Short Panel with PC	20428	23111	936	0	44.48
Short Panel with FDR	10126	13965	586	0	24.68
ICBP	48744	0	0	0	48.74
Flexible Pavement	9334	0	0	0	9.33
TOTAL (Kms)	88.632	37.076	1.522	0	127.23
Imphal East Package A Summary					
	SL	IDL	2 Lane	4 Lane	Total
Conventional Pavement	0	0	0	0	0.00
White Topping	0	0	0	3416	3.42
Short Panel with PC	21433	24127	1557	0	47.12
Short Panel with FDR	11035	15813	2750	0	29.60
ICBP	48744	0	0	0	48.74
Flexible Pavement	9888	2269	0	0	12.16
TOTAL (Kms)	91.1	42.209	4.307	3.416	141.032

Table 54: Road Network Details in Imphal East Division Package B

Imphal East Package B

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State Highway					
	SL	IDL	2 Lane	4 Lane	Total
<i>Conventional Pavement</i>	0	0	0	0	0.00
<i>White Topping</i>	0	0	0	1718	1.72
<i>Short Panel with PC</i>	0	0	3630	0	3.63
<i>Short Panel with FDR</i>	0	0	0	0	0.00
<i>ICBP</i>	0	0	0	0	0.00
<i>Flexible Pavement</i>	0	0	0	0	0.00
TOTAL (Kms)	0	0	3.63	1.718	5.348
MDR					
	SL	IDL	2 Lane	4 Lane	Total
<i>Conventional Pavement</i>	0	0	0	0	0.00
<i>White Topping</i>	0	0	0	0	0.00
<i>Short Panel with PC</i>	0	1607	0	0	1.61
<i>Short Panel with FDR</i>	0	452	2620	0	3.07
<i>ICBP</i>	0	0	0	0	0.00
<i>Flexible Pavement</i>	0	0	0	0	0.00
TOTAL (Kms)	0	2.059	2.62	0	4.68
ODR					
	SL	IDL	2 Lane	4 Lane	Total
<i>Conventional Pavement</i>	0	0	0	0	0.00
<i>White Topping</i>	0	0	0	0	0.00
<i>Short Panel with PC</i>	0	0	0	0	0.00
<i>Short Panel with FDR</i>	1058	1090	0	0	2.15
<i>ICBP</i>	0	0	0	0	0.00
<i>Flexible Pavement</i>	4758	0	0	0	4.76
TOTAL (Kms)	5.816	1.09	0	0	6.91
IVR					
	SL	IDL	2 Lane	4 Lane	Total
<i>Conventional Pavement</i>	0	0	0	0	0.00
<i>White Topping</i>	0	0	0	239	0.24
<i>Short Panel with PC</i>	19130	9365	1723	0	30.22
<i>Short Panel with FDR</i>	3396	3737	0	0	7.13
<i>ICBP</i>	36496	0	0	0	36.50
<i>Flexible Pavement</i>	31190	0	0	0	31.19
TOTAL (Kms)	90.212	13.102	1.723	0.239	105.28
Imphal East Package B Summary					
	SL	IDL	2 Lane	4 Lane	Total
<i>Conventional Pavement</i>	0	0	0	0	0.00
<i>White Topping</i>	0	0	0	1957	1.96
<i>Short Panel with PC</i>	19130	10972	5353	0	35.46
<i>Short Panel with FDR</i>	4454	5279	2620	0	12.35
<i>ICBP</i>	36496	0	0	0	36.50
<i>Flexible Pavement</i>	35948	0	0	0	35.95
TOTAL (Kms)	96.028	16.251	7.973	1.957	122.21

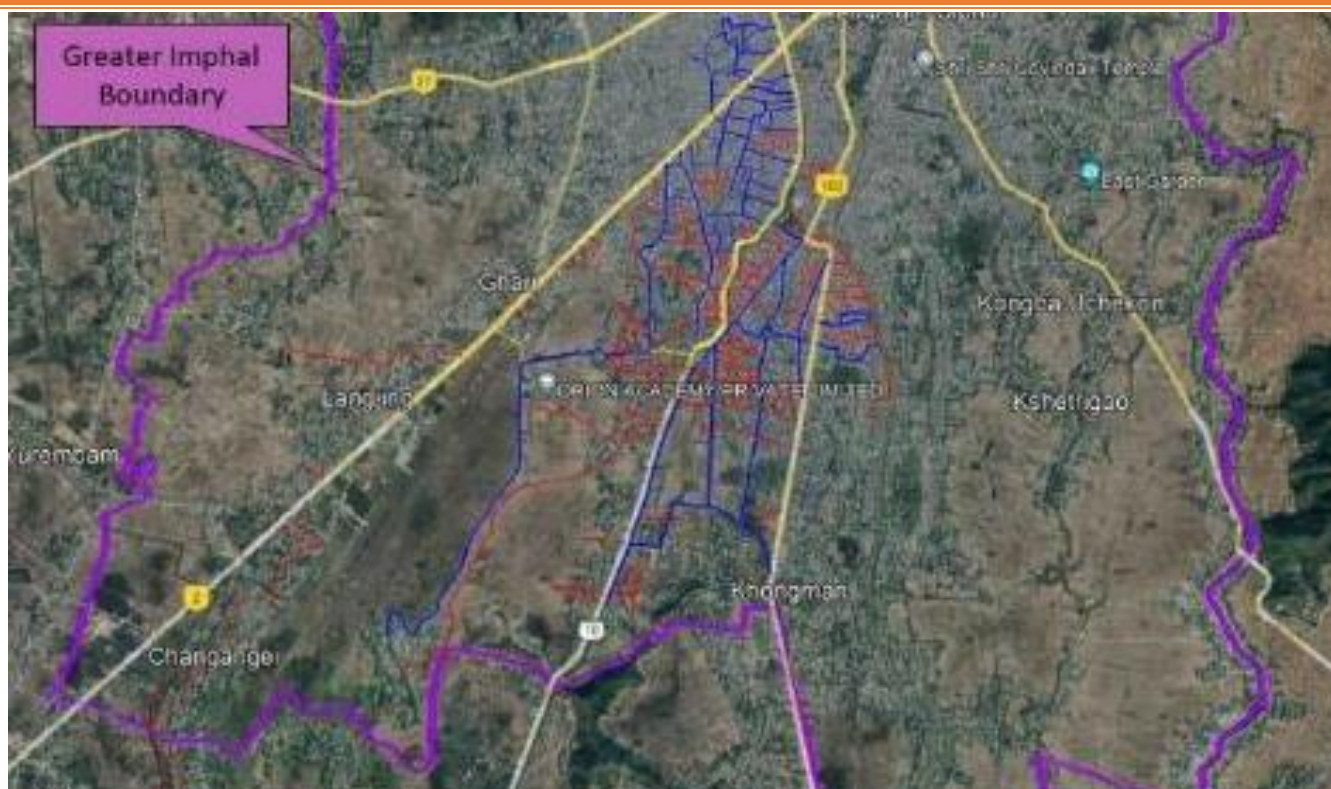


Figure 32: Road Network in Highway South Division

Table 55: Road Network Details in Highway South Division

Highway South Division					
State Highway					
	SL	IDL	2 Lane	4 Lane	Total
<i>Conventional Pavement</i>	0	0	0	0	0.00
<i>White Topping</i>	0	0	0	0	0.00
<i>Short Panel with PC</i>	0	0	0	0	0.00
<i>Short Panel with FDR</i>	0	0	0	0	0.00
<i>ICBP</i>	0	0	0	0	0.00
<i>Flexible Pavement</i>	0	0	0	0	0.00
TOTAL (Kms)	0	0	0	0	0.00
MDR					
	SL	IDL	2 Lane	4 Lane	Total
<i>Conventional Pavement</i>	0	0	0	0	0.00
<i>White Topping</i>	0	0	0	0	0.00
<i>Short Panel with PC</i>	16736	3928	0	0	20.66
<i>Short Panel with FDR</i>	5083	9961	0	0	15.04
<i>ICBP</i>	0	0	0	0	0.00
<i>Flexible Pavement</i>	3743	0	0	0	3.74
TOTAL (Kms)	25.562	13.889	0	0	39.45
ODR					
	SL	IDL	2 Lane	4 Lane	Total
<i>Conventional Pavement</i>	0	0	0	0	0.00
<i>White Topping</i>	0	0	0	0	0.00
<i>Short Panel with PC</i>	0	0	0	0	0.00
<i>Short Panel with FDR</i>	454	468	0	0	0.92
<i>ICBP</i>	0	0	0	0	0.00

Highway South Division					
<i>Flexible Pavement</i>	0	0	0	0	0.00
TOTAL (Kms)	0.454	0.468	0	0	0.92
IVR					
	SL	IDL	2 Lane	4 Lane	Total
<i>Conventional Pavement</i>	0	0	0	0	0.00
<i>White Topping</i>	0	0	0	0	0.00
<i>Short Panel with PC</i>	19589	5359	0	0	24.95
<i>Short Panel with FDR</i>	4639	2070	0	0	6.71
<i>ICBP</i>	32177	0	0	0	32.18
<i>Flexible Pavement</i>	6975	0	0	0	6.98
TOTAL (Kms)	63.38	7.429	0	0	70.81
Highway South Division Summary					
	SL	IDL	2 Lane	4 Lane	Total
<i>Conventional Pavement</i>	0	0	0	0	0.00
<i>White Topping</i>	0	0	0	0	0.00
<i>Short Panel with PC</i>	36325	9287	0	0	45.61
<i>Short Panel with FDR</i>	10176	12499	0	0	22.68
<i>ICBP</i>	32177	0	0	0	32.18
<i>Flexible Pavement</i>	10718	0	0	0	10.72
TOTAL (Kms)	89.396	21.786	0	0	111.18

4.9.7 Inter-state Bus Terminal

There is one Inter-state Terminal in Imphal city. Inter-state Bus terminal is known as ISBT and situated near Khumanlampak stadium. Being located near core of the city, the buses navigate through the core city network causing more congestion on the already saturated network. The location of ISBT is very well suited for multi-modal integration terminal and is highly accessible by multiple modes of transportation.

4.9.8 Railway

The state of Manipur is connected by Indian Railways upto the city of Jiribam on the western side of Imphal. The 111 km long connection between Jiribam and Imphal through Tupul is under construction and is expected to be functional from 2022. The link is proposed to be extended upto Moreh town in future. The Imphal railway station located 12km from Imphal city centre is under construction. The new railway line connects Jiribram to Imphal. It includes 8 new stations, 62 km of tunnels, 11 major bridges, and 134 minor bridges, 4 roads over bridges and 12 roads under bridges.

4.9.9 Airport

The Tulihal Airport or the Imphal Airport is also called Bir Tikendrajit International. It is the second international airport in north-east India and is also the 3rd busiest. The existing airport, catering to domestic traffic is located towards the south-west direction of the Greater Imphal Planning Area. It is the only commercial airport in Manipur.

4.9.10 Settlements along the project

The list of villages and towns on the sides of the project highway, identified during the Reconnaissance Survey and Road Inventory of project road is presented in Table 56.

Table 56: Important Settlements Abutting Project Highway

Features	Description
Settlements	Notable Settlements in Imphal West Division Uripok, Uripok Bachaspati leikai, Uripok Khoisnam Leikai, Nagamapal, Thangmeiband, Thangmeiband Sinam Leikai, Lalambung, Majorkhul, Thangal Bazar, Rims Doctor Colony, Naoremthong, Iroisemba, Langol, Game

	<p>Village, Takyel, Ghari, Tera, Lamboikhongnangkhang, Sagolband.</p> <p>Notable Settlements in Imphal East Division Heingang, Luwangsangbam, Mantripukhre, Sangakpham, Nagaram Village, Chingmeirong, Dewlaland, Ragailong, Zomi Villa, Kairang, Kontha Ahallup, Khuman Lampak, Khurai Thoudam leikai, Khurai Laishram leikai, Khurai Sala thong leikai, Porompat, Top Khonang Makhong, Kongba, Wangkhei, Naharup, Naharup Pangong, Naharup Thongjao, Thongju, Bashikhong, Akampat, Tellipati, Hatta Minuthong, Checkon, Nongmeibong, Kheikhu, Koirengei.</p> <p>Notable Settlements in Highway South Division Kyamgei, Langthabal, Kakwa, Monsangei, Heirangoithong, Singjamei, Malom, Chanchipur, Kwakheithel, sangaiprou, Keishamthong, Ningombam, Hawairou (a small portion), Meitram, Changangei, Keishampat, Yaiskul.</p>
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4.9.11 Existing Economy & Employment Base

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

4.9.12 Cultural/Religious resources & Sensitive Receptors

The language spoken by most of the people is Manipuri and Bengali. English is widely used for official purpose and Manipuri is used as a regional language. The state has a very opulent cultural heritage, one of the richest in India. List of sensitive features along the project roads is given below. There are 2 nos' of CPRs in the project area as per the survey till date which may affect due to the project.

Table 57: Detail of Sensitive Location Adjacent to PIA

Sensitive Location Adjacent to PIA	Imphal West	Imphal East	Highway South Division
School	50	156	20
College	12	11	4
Library	4	2	2
Health Centre/Clinic	10	7	3
Hospital	18	7	2
Temple	7	5	1
Mosque	1	10	-
Church	5	12	2
Police Station	5	3	-
Cremation Ground/Burial Ground	60	44	30

4.9.13 Culture, Heritage and Archaeological and Historical Monuments

Manipur is a mosaic of ancient traditions and rich cultural patterns. In the field of art and culture, the state is best represented by its classical and folk-dance forms. Manipur has given birth to an indigenous form of classical dance known as Manipuri. The Raas Leela, the epitome of Manipuri classical dance, is inter-woven through the celestial and eternal love of Radha and Krishna as has been described in the Hindu scriptures. This graceful dance reveals the sublime and transcendental love of Krishna and Radha and the Gopi's devotion to Lord Krishna. Unlike other Indian dance forms, hand movements are used decoratively rather than as pantomime, bells are not accentuated, and both men and women perform communally. The dance dramas, interpreted by a narrator, are a part of religious life. As mentioned before, themes are generally taken from the life of Krishna, the pastoral god of Hinduism. Long an isolated art form, Manipuri was introduced to the rest of India by the poet Rabindranath Tagore in 1917. Manipuri dance is one of the eight classical dance forms of India and Manipuri Sankirtana was recognized by UNESCO and inscribed on the Representative List of the UNESCO Intangible Cultural Heritage of Humanity in 2013.

In the form of folklores, art forms like dance, drama, music, etc., and events and festivals such as Lai Haraoba, Heikru Hidongba, MeraHouChongba, etc. the cultural and historical glory of the Manipuri's have been passed down and preserved through generations. Lai Haraoba, a spring festival celebrated during April-May, is symbolized by a traditional and symbolic dance performed for peace and prosperity. The varied and colorful tribal folk dances are an expression of nature, creation, and aestheticism of the tribal way of life. The colorful costumes, dance movements, and the unique rituals in the tribal festivals like the Lui-Ngai-Ni are simply majestic and charming. Polo and field hockey are popular sports of the state.

As per *The Ancient Monuments and Archaeological Sites And Remains Act, 1958* and *The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010*, if any project is falling within the protected area (100 m) and buffer area (200 m) of any notified archaeological monument/site, then prior permission shall be obtained from Archaeological Survey of India/National Monument Authority (ASI/NMA).

There are 34* protected historical sites and monuments as per the Manipur Ancient and Historical Monuments and Archaeological Sites and Remains Act of 1976 in the Imphal East and west districts. 28 sites out of 34 are located within the Greater Imphal Planning Area. However these monuments does not come under the purview of *The Ancient Monuments and Archaeological Sites And Remains Act, 1958* and *The Ancient Monuments and Archaeological Sites and Remains (Amendment and Validation) Act, 2010*.

Table 58: Archaeological Monuments/Sites in Project Districts

S. No.	Monument	District of Manipur	Within 300 m of Project Roads
1.	Sekta-Kei Mound	Imphal East	No
2.	Sacred Fireplace	Imphal East	No
3.	Temple of Shri Krishna	Imphal East	Yes
4.	Temple of Thangal General	Imphal East	Yes
5.	Andro Inscription	Imphal East	No
6.	Temple of Madan Mohanji	Imphal East	Yes
7.	Khurai Ahongpund	Imphal East	Yes
8.	Temple of Radha Damodar	Imphal East	Yes
9.	Dolai Thaba Chingu Khubam	Imphal East	Yes
10.	Kangla Fort (Including Quarter Moat Kekrupat)	Imphal West	Yes
11.	Temple of Leimapokpa Keirungba	Imphal West	Yes
12.	Temple of Sanamahi	Imphal West	Yes
13.	Samadhi of Maharaja Khaba	Imphal West	Yes
14.	Samadhi of Maharaja Gambhir Singh	Imphal West	Yes
15.	A Menhir	Imphal West	Yes
16.	Inscribed Stone Monuments	Imphal West	Yes
17.	Inscribed Stone Monuments	Imphal West	Yes
18.	Rash Mandal Pukhri	Imphal West	Yes
19.	Gateway Brick Wall (in ruins) Apanbi Haomacha Pukhri	Imphal West	Yes
20.	A Hillock	Imphal West	No
21.	Inscribed Stone of Maharaja Marjit	Imphal West	No
22.	Thong Nambonbi (Humped Bridge)	Imphal West	Yes
23.	Hicham Yaichampat (Cremation Ground of Bir Tikendrajit	Imphal West	Yes
24.	Sangaiyumpham Maharaja Gambhir Singh	Imphal West	Yes
25.	Wangthonbi Mound	Imphal West	Yes
26.	Lainingthou Marjing	Imphal West	Yes

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S. No.	Monument	District of Manipur	Within 300 m of Project Roads
27.	Makoinungol Ching	Imphal West	Yes
28.	Lainingthou Sanamahi	Imphal West	No
29.	Khagemba Leikol	Imphal West	Yes

Source: <https://asi.nic.in/protected-monuments-in-manipur/>

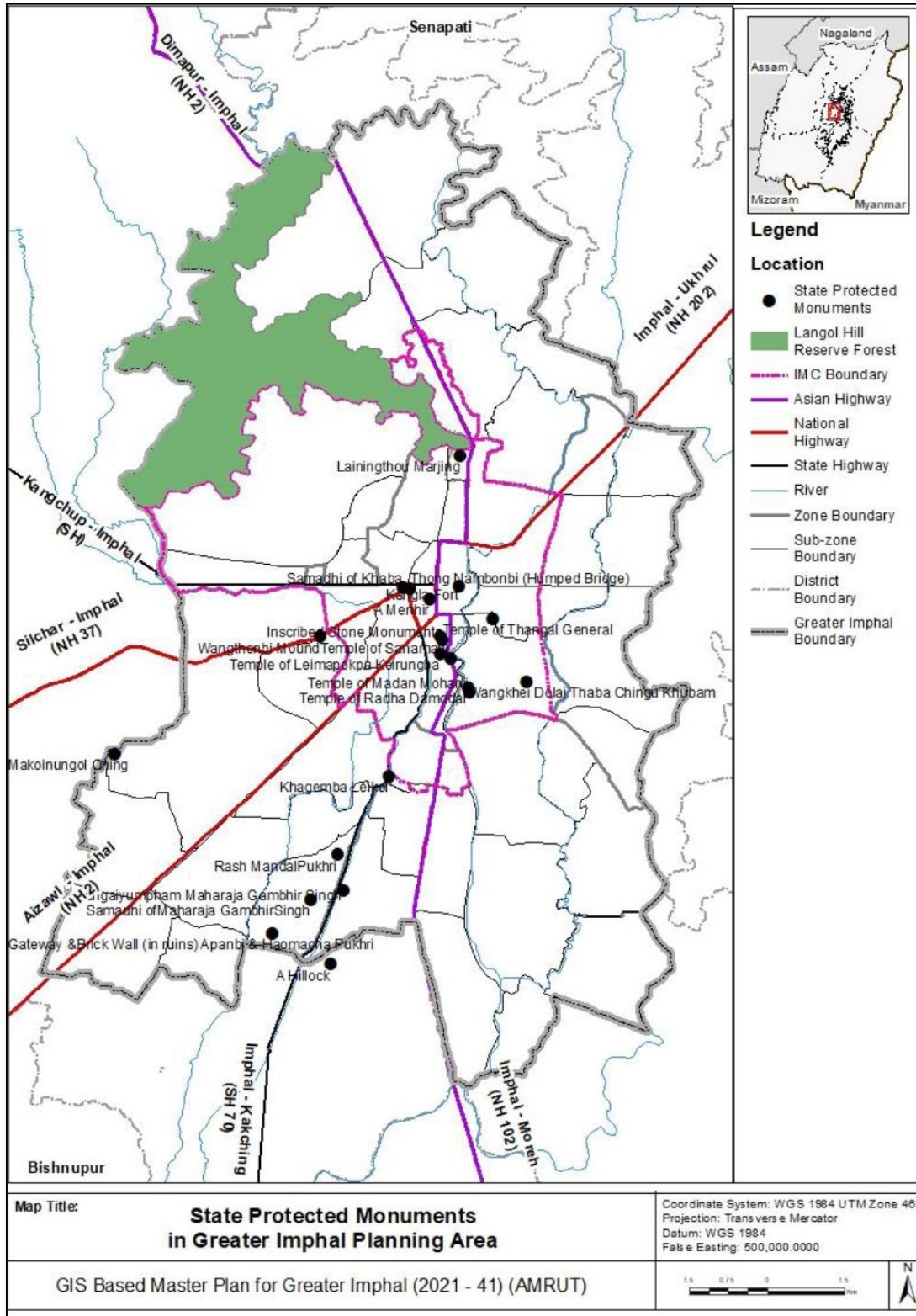


Figure 33: Archaeological Monument in Greater Imphal Planning Area

4.9.14 Tourism

Tourism plays an important role in employment generation as well as in increasing the GDP of the region. Being the centre of all road transportation routes and having the only Airport in Manipur, Imphal has the locational advantage and potential for tourism development. The various tourist spots in and around the Greater Imphal Planning area which have the potential to be developed and attract tourists have been discussed.

4.9.14.1 Eco-tourism spots

- Loktak Lake - Located 48 km from Imphal, is the largest freshwater lake in India's North-East. The lake has small floating islands called 'phumdis' associated with various aspects of the life of the local inhabitants.
- KeibulLamjao National Park - The only floating National Park in the world, the KeibulLamjao National Park located on the Loktak Lake is the last natural habitat of the "Sangai", the dancing deer of Manipur. Other wildlife to be seen include Hog Deer, Otter, a host of waterfowls and migratory birds, the latter usually sighted during November to March. The Forest Department of Manipur maintains watchtowers and two rest houses within the park.
- SaduChiru Waterfalls - About 20 km from Imphal beside the Tiddim Road (NH150) is a picturesque site famous for its perennial waterfall at a scenic foothill. There are three waterfalls altogether. This is a newly opened tourist spot.
- Manipur Zoological Garden - The Manipur Zoological Garden serves as a home to numerous endangered and rare species. Because of this uniqueness, the zoo is often called the Jewel Box of Manipur.

4.9.14.2 Culture tourism spots

- Ima Market - A unique all-women market, with more than 3000 women who run the stalls. It is split into two sections on either side of a road. Vegetables, fruits, fishes, and household groceries are sold in one section and exquisite handlooms and household tools in the other.

4.9.14.3 Heritage tourism spots

- Shaheed Minar - The indomitable spirit of the patriotic Meitei and tribal martyrs, who sacrificed their lives while fighting against the British in 1891, is commemorated by this tall Minar at Bir Tikendrajit Park in the heart of Imphal city.
- Kangla Fort - The seat of Manipur's power till 1891, the historical embodiment of Manipuri Rulers and the people of Manipur, Kangla has a special place in the hearts and minds of the people of Manipur. The old Govindjee temple, outer and inner moat and other relics are perfect reflections of the rich art and architectural heritage of Manipur.
- Manipur State Museum - This Museum near the Polo Ground has a good collection and display of Manipur's tribal heritage and a collection of portraits of Manipur's former rulers. Particularly interesting are the costumes, arms & ammunitions, relics, and historical documents on display.
- War Cemetery - Commemorating the memories of the British and Indian soldiers who died during World War II, the war cemetery is managed by the Commonwealth War Graves Commission. Serene and well maintained, the War Cemetery carries little stone markers and bronze plaques recording the sacrifices of those gallant soldiers.
- INA Memorial - The INA Museum, which has a collection of letters, photographs, badges of ranks and other war memorabilia, reminds the visitors of the noble sacrifices made by the INA soldiers under the charismatic leadership of Netaji Subhas Chandra Bose.
- Mutua Museum - This Museum is a part of Cultural heritage Complex located at Andro village

(about 26 km) from the capital. Here artifacts of the State and from all over the Northeast are housed, such as pottery collection, rare coins, rare manuscripts of the state, paintings, basketries, bell metals, jewellery, wood carving etc. There are exact replicas of the houses from different tribes and groups of the state like Poumai, Kabui, Meitei, Kuki, Tangkhul, etc.

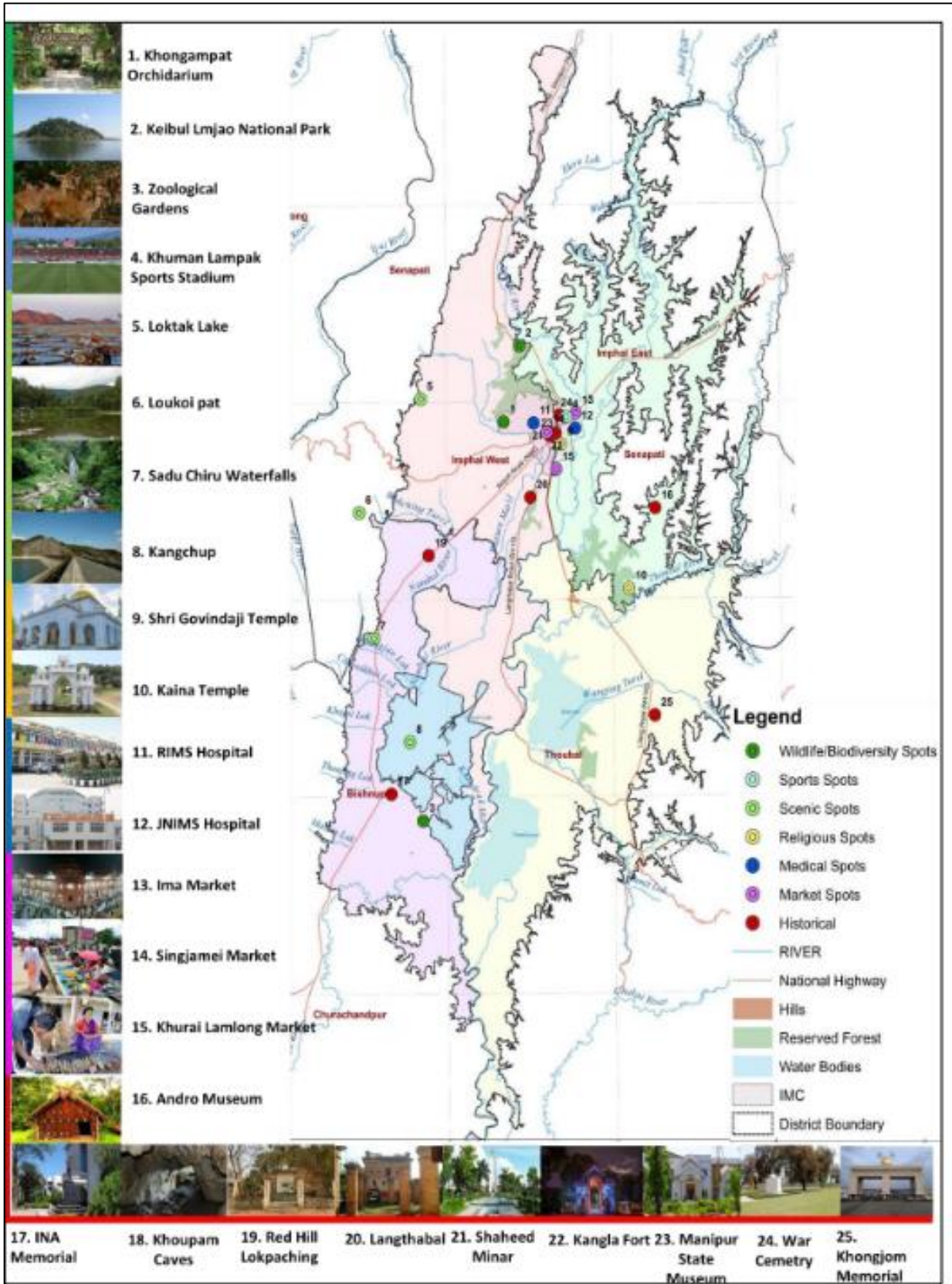
- Nupi Lal Memorial Complex - This memorial complex is dedicated to the memory of several Manipuri women, who fought brilliantly for justice against the British on December 12, 1939. The word Nupi Lal in Manipuri means women's war. The memorial complex houses sculptures portraying Manipuri women fighting against the British officials and is worth as to visit. As the story goes, what began as an agitation against the oppressive policies of the rulers of Manipur and the British government, later turned into a movement for Manipur's constitutional and administrative reform. During Nupi Lal, agitations and protest rallies were held by the women traders in Manipur's Ima Keithel Market. The historical movement paved the way for economic and political reforms in the state during the early 40s.
- R.K.C.S. Art Gallery, Keishamthong - RKCS Art Museum and Gallery is a prestigious art institution in the Indian Northeastern state of Manipur, Exhibiting historical, art and culture of Manipur through paintings. These paintings are original paintings of Manipur's legendary Artist Rajkumar Chandrajit Sana (RKCS). RKCS have also been mentioned in the Limca Book of Records, 1994 and have received several prestigious awards. This Gallery known as RKCS Art Gallery becomes one of the most important tourist destinations in Manipur and asset for future Generation.

4.9.14.4 Religious tourism spots

- Shree Govindajee Temple - A historic Vaishnavite Centre adjoining the royal palace of Manipur's former Maharajas', the Govindajee temple is one of the most popular destinations for tourists. Twin domed shrine, a paved courtyard, and a large, raised congregation hall form a perfect backdrop for priests who descend the steps to accept offerings from devotees in the courtyard. The shrine is adorned with the idols of Lord Krishna and Radha which are flanked by idols of Balaram and Jagannath at right and left sides of the presiding deity. Early hour prayer (Aarti) is a must for devoted followers, exuding spiritual fervor and ecstasy.

4.9.14.5 Medical tourism

- JNIMS Hospital - The Jawaharlal Nehru Institute of Medical Sciences (JNIMS) is a premier state-funded medical college and hospital located in Porompat, Imphal East. It was established in 1989. The hospital is well-equipped with technology and nursing facilities and has a lower cost of treatment to cater to the visiting patient tourists.
- RIMS Hospital – Regional Institute of Medical Sciences was established in 1972. The treatment provided at RIMS attracts patients from other states like Mizoram and Nagaland and neighboring countries with underdeveloped facilities like Myanmar, Laos, and Vietnam. Map 7.3 shows the locations of the major tourist spots in the Imphal Valley region.



Source: Department of Tourism, Government of Manipur

Figure 34: Tourism sites in Greater Imphal Region

4.9.15 Energy and Electric Power Potential

The state has an installed capacity of 117 MW of power including power from central sector. It is just able to meet the current demand. With increase in socio-economic development, more power will be required. It is, therefore, necessary to increase power availability in the state. At present, Greater Imphal gets its power supply from the Grid through T & D networks at different voltage levels. There are total of 28 locations for substations in Greater Imphal Area. Besides these sub-stations, a vast network of transmission and distribution at 11/0.4 KV level is spread over the entire Greater Imphal Area for catering power to all the consumers. The electrical power in Greater Imphal Planning area is supplied from the following 33/11 kV sub stations under Manipur State Power Company Ltd.

4.9.16 Water Source

The existing water supply systems in the Imphal city are mainly dependent on surface water sources, which account for more than 90% of the water sources in Imphal. Currently, four sources of water are being used to meet the demand of the Greater Imphal Planning Area. The sources are Singda Dam, Leimakhong River, Imphal River and Iril River (Map 10.1). Imphal River supplies raw water to 10 existing WTPs, while Iril River supplies raw water to four existing WTPs. Both these rivers flow through the city. Singda Dam, Leimakhong River and Polok River are located to the west of the city and supply raw water to Singda WTP, Kangchup WTP and Kangchup Extension WTP. There are currently 13 water supply zones established in Imphal city. These zones have been assigned areas based on each source and treatment plant and with a view to facilitate operation. The Urban Circle of the PHED operates 11 water supply zones and the Rural Circle (Imphal West Division) is responsible for the rest, namely, Ghari WTP zone and Lamjaotongba WTP zone.

The total length of water supply pipeline in the Imphal Municipal area and the Greater Imphal area are 350 km (approx.) and 600 km (approx.), respectively. Water is not supplied through gravity in the present water supply system, some are gravity fed from either high-level service reservoirs located over hills or elevated overhead tanks fed from the water treatment plants either by gravity or through pumping. In many water supply zones, supply is through direct pumping from zonal/service reservoirs. Since these service reservoirs are in a few areas, therefore the zonal supply system is incorporated. The entire distribution networks are further divided into 25 subzones with 13 zonal reservoirs, 16 clear water reservoirs, and 7 overhead tanks (OHTs).

Table 59: Water Supply Sources in Greater Imphal Region

Source Name	Source Output (MLD)	
	MLD	%
Imphal river	49.5	41
Iril River	23.15	19
Singda Dam	18.16	15
Leimakhong river	14.53	12
Polok river	9.08	7
Potsangbam Groundwater	6.81	6
	121.2	100

4.9.17 Industries

There are no heavy industries within the Greater Imphal area. Only Micro and small-scale industries are there in very few numbers. Industries related to agriculture and food processing like Oil Mill, Rice Mill, spices processing and packaging are in majority in number. The contribution of industry to generating employment is very less at the present time. The share of secondary sector in workforce participation is 11.9% and 13.1% for Imphal West and Imphal East District respectively whereas looking for only Industrial workers, the share of the industrial worker to the total workforce is only 2.5% and 1.9% for Imphal West and Imphal East District respectively.

The Taobungkhok & Changagei Handloom Cluster is reported. But there are many handlooms and handicrafts clusters in Imphal East and Imphal West districts, such as at Khurai, Sagolband, Bamon Kambu, Bamon Likai, Kongba, Bashikhong, Rungbi, Iroisemba in Imphal East and at Keishamthong, Langthabal Kunja, Liong, Keishampat Top Leirerk, Porompat, Konthoujam, and Nigonmthong in Imphal West districts which are not reported.

4.9.18 Education

The status of education facilities in Greater Imphal is validated with the URDPFI guidelines which are guidelines for providing the basic education infrastructure i.e., pre-schools, schools, technical institutes, universities, based on population of the city. The existing infrastructure according to the census data of 2011 for schools, colleges and universities within the planning area are adequate for the existing population in the Greater Imphal area when validated with given standards.

There is one National Institute of Technology, Manipur at Langon covering an area of 138.2 hectares, one Manipur Institute of Technology (MIT) at Takyelpat in an area of 3.98 ha and a Government Polytechnic at Takyelpat covering an area of 3.72 hectares within the Greater Imphal Planning area.

4.9.19 Health facility

Greater Imphal area has adequate medical facilities for existing population. There is total 59 dispensaries, 79 nursing homes/child welfare/maternity centers, 9 speciality hospitals, 18 family welfare centers and 4 veterinary hospitals in Greater Imphal region.

4.9.20 Religious Places

There are various religious places in the Greater Imphal Area such as temples, churches, mosques etc. There are 529 temples, 56 mosque, 1 idgah, 120 church, 1 Monastery and 2 Chhatri.

4.9.21 Crematorium

There are 53 crematoriums and graveyards in Greater Imphal region.

4.9.22 Waste Management Facilities

Complying with the NMCG requirements and the Waste management rules, state has established various facilities for treatment of waste and wastewater. There is one STP of 27 MLD at Lamphel and 2 STPs of 16 & 1 MLD under construction at Maibal Leikai (Imphal West) and Iroisemba (Imphal West). STP of 49 MLD is proposed to be constructed in Imphal. Other than a 400 KLD CETP is also functional at Nilakuthi Industrial Estate, Imphal.

There are MSW treatment and processing facilities in the state with a total capacity of 113 TPD. According to the data received, currently total of 158 tons per day (TPD) of Municipal Solid Waste is generated within the Imphal municipal corporation area. Out of this, 128 TPD is collected and a total of 90 TPD is treated. The solid waste is collected from door to door and 38% of the waste is segregated at source. There is a plant facility at Lamdeng for recycling waste and capacity of converting 60 TPD of waste to energy and generating 1 MW of power. 100 TPD is converted to compost. There are no solid waste management facilities in the village area. So, the villagers are managing by constructing small pits for bio-degradable waste in their locality.

Other than this, a total of 0.7 TPD of bio-medical waste, 1.17 TPD of hazardous waste and 22.7 TPD of plastic waste is generated, while only 0.65 TPD of this bio-medical waste is being treated. A facility of 5 TPD is also proposed to be constructed for treatment of C&D Waste. For bio-medical waste management, there is one common bio-medical waste management facility, 2 captive facilities and 391 nos of deep burial facilities.

5. ANTICIPATED ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATION MEASURES

5.1 Introduction

With rapid strides in economic development, particularly in urban development, the need for rationalizing and upgrading the transport system is imperative. The main aim of the project is to improve the road conditions to improve the traffic conditions in the project area. Very often the process of development has adversely affected the environment leading to ecological imbalances. The importance of conserving and enhancing the environmental assets has assumed urgency. Environmental Impact Assessment (EIA) as a tool to identify the environmental, social, and economic impacts of a project prior to decision-making. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape projects to suit the local environment and present the predictions and options to decision-makers. Identification, evaluation, and prediction of impacts is the most important step of an environmental impact assessment study. Superimposing identified and predicted impacts over collected baseline environmental scenario, provides an understanding of the resultant environmental impact due to the project.

The project road traverses through the urban settlement area of Greater Imphal. Land use of the project area is urban, majorly followed by agriculture and water bodies. Proposed project will not impact the forest area as no expansion or forest land acquisition is proposed for the project. Also approx. 2 nos. CPR will be impacted due to the project. The environmental components in the project area may be affected by the

- Activities for site preparation, construction, and ancillary component during construction phase.
- Operation and maintenance of the project during operation phase.

Various techniques and methods are being used to conduct the environmental impact study. Both qualitative and quantitative methods are used for assessing the environmental impacts of the project. Quantitative techniques used include rating matrices. Qualitative analysis is carried out where quantification of impact assessment in terms of measurable units may not be possible due to lack of information/data, uncertainties involved and complex inter-relationships between various attributes of the environment. In such cases, only qualitative predictions have been made based on rationale, experience elsewhere and reasonable judgment.

The activities wise probable impacts of project on various environmental attributes (such as air, water, noise and vibration, soil, biota, socio-economic, topography, geology, climate change, ecology both flora and fauna, etc.) have been identified and listed in Table 60. After identification, the impacts have been assessed and evaluated and are classified as permanent/temporary, long-term impacts/short-term significant/moderate/low and reversible/irreversible under the various sections. Most of these impacts are envisaged to be short term impacts as they are confined to the construction period. It is found that identified impacts are of low to moderate significance and can be reduced to acceptable limit by adopting appropriate mitigation measures. No major impacts are anticipated during operation phase of the project.

Table 60: Potential Adverse Impacts and Proposed Mitigation Measures during construction phase

S. No.	Environmental Attributes	Potential Impact & Impact Causing Activities	Mitigation Measures Suggested
1.	Air environment	<ul style="list-style-type: none"> • Dust emission due to establishment & operation of batching plant, hot mix plant etc. • Dust emissions due to transportation & Storage of Loose Raw Material & debris/waste 	<ul style="list-style-type: none"> • Obtaining CTEs and CTOs & Compliance to the conditions specified • Polluting plants units shall be placed at a minimum distance of 500 m from residential and sensitive areas in a downwind direction as far as possible. • Sprinkling of water at site and haulage roads

S. No.	Environmental Attributes	Potential Impact & Impact Causing Activities	Mitigation Measures Suggested
		<ul style="list-style-type: none"> • Dust emission from loading & unloading of material. • Loosening of soil & its erosion/dispersion due to vegetation removal & tree cutting 	<ul style="list-style-type: none"> • Dust screens are to be provided wherever required. • Regulation of construction timings near sensitive receptors and settlements • Covering of loose construction material, construction debris, and transportation vehicles • Provision of wheel washing facilities • Provision of mask for workers
2.	Noise environment	<p>The increased Noise level during construction due to</p> <ul style="list-style-type: none"> • Operation of construction machinery & DG sets • Loading & unloading of materials • Transportation of men & material 	<ul style="list-style-type: none"> • Gaseous Pollution due to Operation of construction machinery & DG sets • Vehicular emissions due to transportation & Storage of Loose Raw Material & debris/waste • Vehicles and machinery will be regularly maintained to conform to the emission standards. • All construction and transportation should have valid PUC. • Use of clean fuel like LPG for cooking at labor accommodation • The height of the stack of DG sets shall be as per CPCB norms. • Use of masks by workers engaged in construction
3.	Vibration	<ul style="list-style-type: none"> • Vibration due to heavy construction equipment & DG Sets 	<ul style="list-style-type: none"> • Properly maintained construction equipment, machinery, vehicles to be used. • Noise levels of machinery used should conform to the relevant standard. • Regulation of timing of construction work generating noise pollution near the residential and sensitive areas • Temporary noise barriers shall be provided near the residential and sensitive areas. • Ear plugs and muffs will be provided to workers as per requirement during construction activities
4.	Water environment	<ul style="list-style-type: none"> • Impact on rivers/creek due to construction activities near banks and construction of pier inside the water bodies • Diversion of river during construction purpose • Disposal of Waste/Wastewater in waterbodies 	<ul style="list-style-type: none"> • Properly maintained construction equipment and machinery to be used. • Heavy vibrating machinery & DG sets shall be placed on anti-vibration pads • Minimized no of piers inside the waterbody using the advanced technology. • Bridges, piers, and other structures shall be constructed minimally affecting the original course and flow of water bodies. Width of the waterways is very small due to which, piers are not proposed to be constructed for construction of bridges. Long spans are used to avoid construction of piers. • Stabilization and turfing of slopes along the water bodies will be done. • Waste shall be disposed in accordance with National regulations on waste Management.
		<ul style="list-style-type: none"> • Siltation of water bodies 	<ul style="list-style-type: none"> • Silt fencing around water bodies during

S. No.	Environmental Attributes	Potential Impact & Impact Causing Activities	Mitigation Measures Suggested
			<p>construction will be installed to filter out the silt-laden runoff before entering the water body.</p> <ul style="list-style-type: none"> • Turfing or pitching of embankments of affected water bodies will be done to prevent erosion that also causes siltation in the water bodies. • No solid waste will be dumped in or near the water bodies or rivers. • Excavated earth and other construction materials shall be stored away from water bodies
		<ul style="list-style-type: none"> • Water for construction 	<ul style="list-style-type: none"> • Water sources would be selected so that local availability is not affected. • Labour accommodation has separate water supply facilities so that local water sources are not affected. • Water shall be extracted from surface and ground water resources only after obtaining permission from the concerned authority and all conditions stated in permission letter shall be followed
		<ul style="list-style-type: none"> • Contamination from wastes 	<ul style="list-style-type: none"> • Provision of septic tanks/STP to prevent any untreated sewage discharge from construction workers accommodation and sites to the water bodies. • Sullage from septic tank/STP sludge shall be disposed of periodically through authorized agencies only. • Oil interceptors shall be provided at the drainage outlet of construction site, construction camp, parking area and labour accommodation area. • No waste shall be stored near to the water bodies and shall not be disposed of in any water bodies. • Waste management rules shall be followed for the management and disposal of different types of waste. • Source segregation of waste and disposal through authorized agencies only
		<ul style="list-style-type: none"> • Contamination from fuel and wastes 	<ul style="list-style-type: none"> • Vehicle maintenance shall be carried out in a confined area, away from water sources, and it will be ensured that used oil or lubricants are not disposed to water courses. • Fuel shall be stored in covered containers which should be placed on paved surfaces. Containment shall be provided to contain spillage if any. • Oil spill kits shall be provided for managing

S. No.	Environmental Attributes	Potential Impact & Impact Causing Activities	Mitigation Measures Suggested
			<p>the oil spill and staff shall be trained to use them.</p> <ul style="list-style-type: none"> • Oil brooms shall be kept available during construction on near river to manage accidental oil spills. • A drip tray shall be provided with all the vehicles and the machinery during maintenance
		<ul style="list-style-type: none"> • Sanitation and wastewater from construction sites and labor camps 	<ul style="list-style-type: none"> • Proper sanitation facilities will be provided including toilets with water facilities etc. at labour accommodation and sites. • Wastewater from toilets and kitchen shall be disposed off through septic tanks and soak pits or modular STPs shall be provided. Treated water from STP shall be used for dust suppression and landscaping. • Workers shall be educated not to contaminate the water bodies. • Wastewater from batching plants and transit mixers should be properly treated before disposal. • Regular monitoring shall be conducted for surface, ground water, and drinking water as per EMoP. If STP is installed, then wastewater and treated water quality shall also be monitored on daily basis.
		<ul style="list-style-type: none"> • Disposal of vehicle wash water or concrete slurry 	<ul style="list-style-type: none"> • Vehicle and TM washing shall not be undertaken at any waterbody or in project RoW or at land. Vehicle and TM washing shall be carried out at minimum 100 m distance from any waterbody. • Proper facility comprising of Sedimentation tank shall be provided for TM washing. Concrete slurry shall regularly be removed from the sedimentation tank and shall be re-used or disposed off as per C&D waste Management Rules • Oil/Grease traps shall be provided at outlet of vehicle washing & maintenance facility
5.	Land environment	<ul style="list-style-type: none"> • Loss of topsoil 	<ul style="list-style-type: none"> • Topsoil on stripping shall be removed and stockpiled for plantation and greenbelt development. • Fertile land will be avoided for earth borrowing. If needed, topsoil will be separated and reused for plantation and greenbelt development.
		<ul style="list-style-type: none"> • Soil contamination 	<ul style="list-style-type: none"> • Proper waste management as per the waste management rules. • Proper storage of the fuel, waste oil, and construction material on paved surfaces in

S. No.	Environmental Attributes	Potential Impact & Impact Causing Activities	Mitigation Measures Suggested
			covered conditions <ul style="list-style-type: none"> • Minimizing the spillage of fuel, waste oil, and construction material • Oil and waste/wastewater storage containers/tanks shall be inspected regularly for leakages
		<ul style="list-style-type: none"> • Land-use change 	<ul style="list-style-type: none"> • All project activities including parking & staging of machinery, storage of material & waste shall strictly be carried out within ROW. • Encroachment shall be checked along the project corridor.
6.	Social environment	Land acquisition and loss of livelihood temporarily	<ul style="list-style-type: none"> • The compensation to project affected persons will be paid as per the Right to Fair Compensation & Transparency in Land Acquisition, Rehabilitation & Resettlement Act, 2013 and relevant Acts and guidelines of the Government of India and rules of concerned state governments.
		Loss of Common Property Resources (CPRs)	<ul style="list-style-type: none"> • 2 CPRs as per the survey till date are identified in the project RoW
		Utility shifting	<ul style="list-style-type: none"> • Utilities shall be shifted through the concerned dept. by paying the required fee. • New facilities should be provided before disturbing the existing utilities as much as possible. • In case a new facility cannot be provided before disturbing the existing utility then concerned users shall be pre-informed about the same
7.	Waste generation Generation	Municipal Waste	<ul style="list-style-type: none"> • Municipal waste from site, labour accommodation and other project facilities shall be collected, segregated, treated, and disposed off as per SWM Rules, 2016 • Source segregation of waste shall be adopted. • Recyclable waste shall be sold to authorized vendors only. • Rejection of waste shall be disposed of through the local waste management agencies in the area. • STP/Septic tank sludge shall be disposed off through the authorized vendors only
		C&D waste	<ul style="list-style-type: none"> • C&D waste shall be handled as per the Guidelines of C&D Waste Management Rules 2016. • Permission will be obtained from local bodies for disposal of C&D waste
		Hazardous waste	<ul style="list-style-type: none"> • The authorization shall be obtained from SPCB for storage, handling and disposal of hazardous waste as applicable. • Hazardous waste shall be disposed of only

S. No.	Environmental Attributes	Potential Impact & Impact Causing Activities	Mitigation Measures Suggested
			through an authorized vendor. <ul style="list-style-type: none"> • Hazardous waste shall be stored in covered HDPE containers on paved surfaces. • Storage, transportation, and disposal of hazardous waste shall strictly be as per Hazardous & Other Management Rules 2016
		Bio medical waste	<ul style="list-style-type: none"> • Bio medical waste from first aid centers (if any) shall be collected, stored, and disposed off as per the Bio medical waste management rules, 2016
		Other waste	<ul style="list-style-type: none"> • Other waste like packaging waste, plastic waste, e-waste, battery, etc. may also be generated which shall be disposed off as per the respective regulations in India
8.	Flora	<ul style="list-style-type: none"> • The RoW will be cleared off the vegetation. • Approx. 5345 nos. of trees are falling within the project Row. 	<ul style="list-style-type: none"> • Only required trees shall be cut and other trees shall be saved. • The transplantation approach shall be adopted for trees between the girth 30-75 cm as possible during monsoon season. • Compensatory plantation shall be carried out in consultation with the forest department. • Green area shall be developed comprising of trees, shrubs, and herbs wherever possible along the corridor. • Only native species shall be planted for compensatory afforestation
9.	Fauna (Majorly Aquatic)	<ul style="list-style-type: none"> • Impact Due to Tree Cutting • Impact Due to carrying Out Construction Works in River • Impact Due to Disposal of Waste and Wastewater • Impact Due to Entry of contaminated run-off from construction site • Impact Due to discharge of muck slurry generated from well foundation works 	<ul style="list-style-type: none"> • Construction shall be undertaken during low water levels only. • Precautions will be taken to avoid leakage of chemicals, any hazardous materials due to construction activities in rivers/water bodies. • Construction plants will be located far from waterbody (min 500 m) • On any encounter with wild species, the forest department shall be informed in case handling is required. • Construction sites shall be barricaded to prevent trespassing of any domesticated or wild fauna
10.	Borrowing and Quarrying areas	<ul style="list-style-type: none"> • Land degradation due to establishment of borrow area and quarry. 	<ul style="list-style-type: none"> • Material shall be procured from licensed vendor in place of establishment of new borrow area or quarry. • Environment clearance shall be obtained if new quarry is established. • Borrow areas shall not be developed in fertile land, in forest area, close to waterbody or road and in settlement area. • All borrowing and quarry areas shall be restored after borrowing/quarrying is complete.

S. No.	Environmental Attributes	Potential Impact & Impact Causing Activities	Mitigation Measures Suggested
			<ul style="list-style-type: none"> Borrowed/quarry land must be reclaimed/restored to the acceptable level
11.	Health and Occupational Safety	Occupational risks on workers	<ul style="list-style-type: none"> Child labour shall strictly be prohibited at work sites and shall not be allowed at its supplier sites also. To provide and maintain safe work environment, safe plants and equipment, and safe system of work. To provide information, instruction training and supervision to execute the work in safe and healthy manner. To provide suitable occupational health and safety management arrangements, To provide appropriate personnel protective equipment. Safe and convenient passage for vehicles and pedestrians will be arranged during construction work.

5.2 Rating of Environmental Impacts

Environmental impacts due to the implementation of the project are identified during the various project implementation stages. Broadly impacts are categorized into locational impacts, construction impacts, operation & maintenance impacts and are discussed below. Identified impacts due to the project along with their rating on basis of subjective analysis by experts are tabulated below and rating for these impacts are provided in Table 61. Majority of impacts are envisaged during construction phase only and no significant impact is anticipated during operation phase.

Table 61: Rating of Identified Impacts

Identified Impact	Rating Pre-mitigation	Type of Impact Pre-mitigation	Rating Post-mitigation
Impacts due to project location and design			
Loss of livelihood temporarily of Project Affected People (PAPs)	R1	Permanent, negative, irreversible, can be mitigated, scale to be evaluated	R2
Change of Land use (Government and private land acquired for permanent and temporary purpose)	R2	Permanent, negative, irreversible, can be mitigated, small scale	R2
Loss of trees (5345 no's) and impact on ecology	R1	Permanent, negative, irreversible, can be mitigated, small scale.	R2
Drainage and Utilities: Diversion /shifting	R2	Short term and/or permanent, negative, irreversible can be mitigated; small scale	R3
Impact on State notified Archaeological Monuments and Heritage Assets (Kangla Fort & other Protected archaeological structure in project area)	R4	Short term /temporary/negative, reversible can be mitigated; small scale	R4
Right of Way	R1	Permanent, negative as well as positive, irreversible, can be mitigated, small scale	R1

Identified Impact	Rating Pre-mitigation	Type of Impact Pre-mitigation	Rating Post-mitigation
Impacts due to project construction			
Air pollution: Particulate air pollution due to construction activities, transportation, loading & unloading of material etc.	R1	Temporary, negative, reversible can be mitigated, small scale	R3
High Noise Level: Operation of machinery/construction equipment/DG sets	R1	Temporary, negative, reversible can be mitigated, small scale	R3
Water demand and water quality	R1	Temporary, negative, reversible, can be mitigated, small scale	R2
Soil erosion and land subsidence	R2	Temporary, negative, irreversible, can be mitigated, small scale	R3
Traffic diversions	R2	Temporary, negative, reversible, can be mitigated, small scale	R3
Construction camp and on-site labour safety/ welfare	R1	Temporary, negative, reversible, can be mitigated, small scale	R2
Supply of construction material	R2	Temporary, negative, irreversible, can be mitigated, small scale.	R3
<p>Positive Impacts During Operation Phase</p> <ul style="list-style-type: none"> • Improved connectivity • Improved Traffic Condition • Reduced Traffic Jams • Improvement in Air Quality • Reduction in Noise Level • Reduction in Travel Time • Reduction in fuel consumption (reduction of vehicle idling time in traffic jams) • Reduction in no of accidents due to improve traffic infrastructure and provision of safety features with proposed bridge. • Overall improvement of quality of life 			
<p>Rating: R1: High; R2: Moderate; R3: Low; R4: No impact is expected</p> <p>Rating Criteria/Basis for Impacts</p> <p>R1: High/Moderate severity, irreversible, permanent, long term</p> <p>R2: High severity, reversible, temporary, short term</p> <p>R3: Moderate severity, reversible, temporary, short term</p> <p>R4: Low severity, reversible, temporary, short term</p>			

5.3 Design Considerations in project to Avoid Environmental Impacts

Based on the assessment, the following are the design considerations to avoid or to minimize the environmental impacts

- No pier shall be constructed in the water bodies.
- Selection of RoW to avoid forest, notified protected areas and trees. Road Site Avenue Plantation Tentative approx. 5345 nos. getting impacted for improvement of approx. 547.281 km of road network)
- Undertaking compensatory afforestation for each tree to be affected as per State Forest Policy

- Design of the structures above HFL
- Proposing drains all along the project roads to improve the drainage condition.
- Proposing utility duct for housing utilities to avoid excavation in future for laying down the utilities.
- Implementation of proposed environmental management plan to prevent impact on environmental components.
- Obtaining all the permits, approval, and clearance as applicable on project prior development

5.4 Climate Risks and Adaptation Measures in Project Design

To mitigate the expected impact of project on micro-climate, following measures are adopted.

- Minimizing tree cutting by effective planning. Undertaking compensatory plantation for the trees to be cut as per State Forest Policy. Transplantation shall be preferred.
- Minimizing impact on forest land and environmentally protected areas
- Usage of low embodied material for construction like fly-ash
- Provision of solar streetlights and signage boards
- Provision of rainwater harvesting system to harvest rainwater and recharge ground water resources.
- Design of all structures above HFL of the nearby rivers
- Measures adopted for water resources conservation such as usage of curing compounds, water conservation fixtures etc.
- Opting for long spans to avoid piers construction in the water body.
- Preferring the reflective pavements over the conventional concrete pavement to reduce the heat absorption. This can be achieved by using reflective coating or bright color mixtures in the pavement mixtures.

5.5 Regulatory Requirements on Project

Necessary consents, permits and NoC as indicated in chapter 2, shall be obtained. Failure to obtain necessary consents, permits, NOCs, etc. can result in delays at work. The following shall be done to prevent any delay in work:

- Obtain all necessary consents, permits, clearance, NOCs, etc. to prevent violation of any legal requirement.
- Comply with all the conditions of obtained NOC/Consents/Permits etc as stated above and submit the compliance report as per requirement on regular basis.
- Conditions of the issued consents, permits, clearance, NOCs, etc. shall be incorporated in the project design, construction EMP to assure the conditions are being implemented.
- Utilities: Interruption of services (water supply, CPRs, etc.) will be scheduled and intermittently related to localized construction activities. To mitigate impacts, following measures are required:
 - Identify and include locations and operators of these utilities in the detailed design documents to prevent unnecessary disruption of services during the construction phase.
 - Obtain permission from concerned authorities prior disturbing any utility. Avoid, shifting of utility but if unavoidable, it shall be done by concerned agency at project cost.
 - Require Contractor to prepare a contingency plan to include actions to be done in case of unintentional interruption of services.

- If relocations are necessary, Contractor along with Supervision Consultant will coordinate with the providers to relocate the utility.

5.6 Probable Key Environmental impacts due to the improvement of project road

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

- Cutting roadside trees that fall within formation width may reduce the ecological balance of the area and increase soil erosion problems.
- Blockage of access and restricted mobility during construction phase
- Noise, air and water pollution and disposal of construction waste, during construction, will adversely impact the residents. These latter effects should, however, only be temporary/reversible.
- Several quarries and other sources may be established which may change the landscape. However, material shall be purchased preferably from the existing sources.
- Improvement on the existing road, although limited, may increase soil erosion. Construction may also disturb the habitation of fauna living in this area. These should, however, be only temporary/reversible effects.
- Minor impacts of noise and air quality for those now living and workings along the project roads will deteriorate during the construction period, however, is likely to improve during operation phase.

5.7 Discussion of Impacts During Construction Phase

5.7.1 Natural Hazard

The entire Manipur falls under zone V (very high-risk zone) as per the seismic map of India and therefore the risk of damage to the project road due to an earthquake is critical. Relevant IS codes shall be adopted in the design of civil structures. Further areas are also prone to flooding; thus, infrastructure shall be planned above HFL as per 50 years return flood period. Landslides are not common in the valley area of Manipur, but adequate testing shall be done to assess the risk of subsidence. During excavation, slopes shall be well secured by adequate shoring and benching. In case of unavailability of enough area for shoring, vertical supports such as sheets, meshes shall be provided on the vertical cuts to prevent the collapse of excavated area. Adequate ventilation and lighting shall be provided for workers working in confined areas.

5.7.2 Road Widening, Utilities shifting, and Safety Planning

The entire road network has enough available ROW to accommodate the proposed road improvement works and will be undertaken along the existing alignment with minimal land acquisition required at some locations. Approx. 13.28805 ha of land will be acquired for widening and improvement purposes. Road widening and improvement will result in the shifting of utilities and structures. Poor coordination with local authorities and communities will increase the risk of accidental damage to drainage channels and temporary disruption of water and electricity supplies along active construction fronts. The further contraction of the useable carriageway during construction will exacerbate traffic and will hinder direct access across the road by residents along the road.

Road formation widening will be made based on minimizing tree cutting, utility shifting, and damage to community properties. Road design has incorporated the drainage system to avoid the accumulation of drainage water and surface run-off. Temporary pits will be constructed at side-and cross drains to collect drainage water from demolished or damage drainage channels which will be hauled for off-site treatment.

Adequate safety provisions like crash barriers on accident-prone areas rumble strips in community areas to regulate speed, retro-reflective warning signboards near school, hospital, and religious places are incorporated in the design. All utilities requiring shifting shall be largely made before the start of

construction through concerned agencies.

5.7.3 Change in Land Use

Pre-construction stage will involve land acquisition, vegetation removal and land clearing activities including utility shifting and demolition of structures in proposed RoW for development of the proposed project. Development of the project will change the land use of the strip of the land to be acquired for improvement of roads. However, this impact cannot be reduced as possibly best construction method and technology has been adopted. Further some land may be required temporarily for establishment of construction plants (batching plant, hot mix plants, staging of machinery, labour accommodations etc.). These impacts can be minimized by selecting appropriate sites for establishment of above-mentioned temporary facilities and proper management of muck, C&D debris and removed vegetation. The impact will be significantly reduced by adopting following mitigation measures:

- RoW clearing activities are to be carried out with least disturbance to the surrounding by restricting the project activities within the defined Row.
- Before start of construction activities, sites for C&D waste disposal shall be identified. These sites should be at minimum 500 m distance from residential, sensitive and water body location and shall always be above the HFL of water bodies. These sites should be provided with adequate drainage and silt arresting mechanism.
- Preferably waste land and barren land shall be considered for establishment of the C&D waste disposal site.
- Labour camp, storage yards, casting yards and plant site (batching plant, stone crushers) should be at minimum 500 m distance from residential, sensitive and water body location.
- All the sites being used for the construction purposes temporarily shall be restored back to the original condition.

5.7.4 Land Acquisition and Resettlement Impacts.

Approx. 13.28805 ha of land is required for the project out of which 7.88415 ha falls under Imphal West and 5.40390ha under Imphal East. Mitigation measures for managing the impact are given below.

- Compensation shall be provided as per Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act, 2013
- No other private land shall be acquired or used for project purposes.
- Grievance redress mechanism shall be implemented and adequately monitored.

5.7.5 Terrestrial Ecology

The project road does not pass through any protected area in the state. Approx 5345 trees fall within the project RoW which are required to be cut. Road widening option is made in such a way as to minimize the cutting of trees. Compensatory plantation in a 1:2 ratio for each affected tree shall be carried out in addition to giving preference to transplantation on cutting of affected trees. Plantation of fast-growing local species has been proposed under the project to achieve the lost green cover due to project at the earliest.

5.7.6 Impact Due to Procurement of Construction Material

Large quantity of gravel, sand, aggregates, and cement will be required for the construction of proposed project and for the same borrow area or quarries may be established. Extraction of materials from borrowed areas and quarries can disrupt natural land contours and vegetation resulting in accelerated erosion. However, the material will preferably be purchased from licensed vendors existing in around project area thus no significant impact is anticipated. Following measures shall be taken to minimize the impact.

- Procure materials from licensed suppliers preferably.
- Use existing quarry sites and sources permitted by Government.
- Verify the suitability of all sourced material prior procurement.
- New quarry site/crusher shall be established only after obtaining environmental clearance and consent from BPCB as applicable.
- Documentation detailing the source of materials shall be maintained.
- Borrow pits shall not be selected at the forest land/agricultural land/close to water bodies/existing roads/settlement areas.
- The Indian Road Congress (IRC):10-1961 guideline should be used for the selection of borrow pits and the amount of material that can be borrowed. To the extent possible, borrowed areas shall be sited away from inhabited areas.
- The depths in borrow pits to be regulated so that the sides shall not be steeper than 25%. Minimum distance of 8 m shall be maintained between two borrow pits.
- Aggregates will be sourced from existing licensed quarries. Copies of consent/approval/rehabilitation plan for a new quarry or use of existing sources will be submitted to EO, PIU. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state, and submit a copy of it for the approval to EA if new quarries are opened.
- The depth of borrow pits shall not exceed 45 cm and it may be dug out to a depth of not more than 30 cm after stripping the 15 cm topsoil aside.
- Prior permission shall be obtained from District Collector for establishment of borrow area.
- For the redevelopment of the borrow area, the project proponent shall evolve site-specific redevelopment plan for each borrow area location, which shall be implemented after the completion of borrowing.
- Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. In addition, it may be converted into fishpond in consultation with the fishery department and if desired by the landowner/community.
- The haul roads and borrow areas will be managed and maintained by the Project proponent as established.
- Topsoil shall be preserved in stockpiles and re-used for greening or farming.

5.7.7 Impact Due to Traffic Diversion

Construction work may require blocking completely or temporarily the roads or diversion of existing roads which may impact traffic movement in the area leading to congestion. Movement of construction/transportation vehicles to site may enhance the traffic in the project area especially during peak hours. Measures to be taken to prevent the impact are as follows.

- Plan transportation routes so that heavy vehicles do not use narrow local roads, except nearby delivery sites.
- Schedule transport and hauling activities during non-peak hours.
- Locate entry and exit points in areas where there is low potential for traffic congestion.
- Keep the site free from all unnecessary obstructions.
- Drive vehicles in a considerate manner.
- Provide free access to households and businesses/shops along the ROWs during the construction phase.

- Parking of transportation/construction vehicles/machinery on road shall not be allowed on public roads.
- All activities including stockpiling of materials/debris etc. shall be exclusively undertaken within Row.
- Proper traffic safety measures like provision of adequate barricading and safety signages shall be provided at all the roads to be blocked/diverted to prevent any accident. Site specific traffic diversion/management shall be prepared.
- Public shall be pre-informed about the completely/temporarily blocked roads through appropriate media and shall be suggested to take alternate routes.
- Road blockage/diversion signages shall be provided from at least 1 km of the affected point.
- People shall be pre-informed through appropriate mode about such blockages.

5.7.8 Impact Due to Soil Erosion and Impact on Soil Quality:

Erosion risks are anticipated at approaches of bridges/embankment of water body, borrow area site and quarry site (if any). Also, Soil quality can be impacted due to following:

- Loss of productive topsoil due to land clearing, vegetation removal and excavation activities
- Loss of productive agricultural soil due to development of borrow areas (if any). However, borrow area may not be established for this project and material may be procured from licensed vendors preferably.
- Soil erosion due to wind and water action on the cleared and excavated land parcels
- Due to spillage and improper storage/disposal of construction material, fuel, construction and other waste, contaminated runoff, wastewater from Labour accommodation, waste & wastewater from workshops etc.
- Due to spillage of materials and construction waste during hauling, storage, or transport from site.
- Due to leakage of fuel from tanks of construction vehicles and machinery
- The soil contamination may take place near the construction camp site due to untreated discharge of sewerage, spillage from the material storage area, surface run off in the monsoon months from the construction sites.

Measures to be adopted for prevention of impact on soil quality and prevention of soil erosion are given below.

Soil Quality

- Topsoil from the RoW shall be removed up to the depth of 15 cm and shall be stored for later usage for landscaping and dressing of the temporarily affected areas at the time of restoration.
- Topsoil shall be stored in the form of stockpiles. Slope and height of the stockpile shall be maintained as per the angle of repose of the material. Minimum distance of 250 m shall be maintained b/w the two-stock pile to allow access. These stockpiles shall be sprinkled with water to minimize the erosion.
- Excavated slopes shall be stabilized through appropriate engineering and biological measures like pitching, mulching, turffing etc.
- Loose construction material, construction debris and excavated earth shall be stored and transported in covered conditions.
- Stockpiles of construction materials, construction debris, topsoil and excavated earth shall be located away from rivers, streams, fertile agricultural lands, recorded forest lands or inhabited

area.

- Appropriate measures like silt fence, perimeter dikes, water bars etc. be installed around stockpiles to retain silt from run-off.
- Temporarily drainage shall be provided at the construction sites and excavated areas to divert the runoff. These drains shall be provided with sedimentation tanks to arrest the silt.
- Silt fencing shall be done near all the water bodies prior to the start of work.
- Provision of side drains to guide the water to natural outfalls.
- When soil is spread on slopes for permanent disposal, it shall be buttressed at the toe by retaining walls.
- Side slopes of the embankment shall not be steeper than 2H: 1V. Turfing of embankment slopes shall be done along the stretch.
- Shrubs shall be planted in loose soil areas.
- In rural stretches, longitudinal side drains shall be intercepted by drains serving absolute channels to reduce the erosion.
- IRC: 56 -2011 recommended practice for the treatment of embankment slopes for erosion control shall be taken into consideration.
- Soil erosion shall be visually checked on slopes and high embankment areas. In case soil erosion is found, suitable measures shall be taken to control the soil erosion further including bio-turfing.
- During excavations, the Contractor will take all adequate precautions against soil erosion as per MoRTH Specification for Road and Bridge works (5th Revision) Clause no. 306.
- The earth stockpiles to be located shall be provided with gentle slopes to prevent soil erosion and flow with water.
- Fuel/waste oil shall be stored in covered HDPE containers only on paved surface having provision of containment of spillage. Oil interceptors shall be provided with drains near the fuel/waste oil storage. Oil spill management kits shall be available at the site to manage the spill if any.
- Sewage from Labour accommodation & construction sites and effluent from workshops shall be treated to the acceptable discharge/re-use standards as prescribed CPCB in EP Rules, 1986
- Waste to be generated during pre-construction and construction phase shall be stored, managed, and disposed off as per the relevant waste management rules. Waste management plan is given in the sections below.
- All transportation vehicles and machinery shall be provided with drip trays and collected fuel shall be disposed off through authorized vendors only.
- Explore possibility of usage of fly ash to reduce the soil/sand requirement for construction purposes.

Soil Erosion

- Excavated pits shall be stabilized by shoring to prevent any collapse of excavation and soil erosion.
- Excavation shall not be carried out during monsoon and excavated pits shall be covered with tarpaulin to prevent filling with water. Soil laden water filled in the pit shall be pumped into sedimentation tank and the settled silt shall be re-used within the project.
- Approaches for bridges shall be stabilized and pitched as required to prevent any erosion.
- Excavated earth/stockpiles shall not be piled at construction sites and shall regularly be removed. They shall be stored in covered condition to prevent erosion due to wind and water action. Height

of the stockpiles shall be maintained. High and very close stockpiles shall be avoided. Drainage facility shall be provided in the stockpile area to prevent erosion/washing away of stockpiles.

- Nearby land shall not be used for any purpose like parking of vehicles, storage of materials etc. as any work movement/activity.

5.7.9 Impacts on Water Resources and Quality:

Total water requirement will be 0.77 MLD out of which 0.69 MLD will be used for construction purposes and 0.08 MLD for Domestic purposes. Water for construction purposes will be either procured from the tankers or surface or ground water resources available in the project area which will impact the water resources and downstream users in the project area. Ground water resources can be used for construction purposes as the area falls into the safe category as per CGWB. If ground water is extracted for meeting water requirement during construction phase, permission shall be obtained from CGWB. Water quality of the project area may get impacted due to following activities:

- Undertaking construction activities, storage of construction materials and waste materials, storage of fuel, establishing of workshops and undertaking vehicles washing near the water body.
- Contamination of the runoff due to spillage and improper storage/disposal of construction material, fuel, construction & other waste, wastewater from Labour accommodation, waste & wastewater from workshops, silt from the excavated area etc.
- Due to spillage of materials and construction waste during hauling, storage, or transportation in water body
- Due to discharge of untreated sewerage, effluent, and waste in the water bodies. During construction phase, about 64 KLD of sewage will be generated from construction/labour accommodation during peak time. Improper disposal of sewage and wastewater may impact the water quality of the nearby water bodies.
- Due to storage of sewerage and effluent in the unlined tanks within 100 m area of water body.
- Due to percolation of contaminants (waste oil, sewerage, fuel etc.) into the ground water if the contaminants are stored in the unlined pits or remains spilled on soil for the long time.

Measures to be adopted for prevention of impact on water resources & quality are given below.

- Ground and Surface water may be used only after obtaining necessary permissions from the respective Government authorities.
- STP treated water shall be procured from nearby STPs and shall be used preferably for sprinkling and landscaping.
- Minimizing water requirement by using water conservation measures such as covering the water tanks, providing visual notice for water conservation, low flow taps in toilets etc.
- Regular inspection to detect leakage in water pipelines and water tanks.
- Labour accommodation, plant sites, casting yards, parking area, workshops, material, and fuel storage areas should be located at minimum 500 m distance from the water body.
- Fuel and all hazardous materials/waste on-site should be stored on paved surfaces having the provisions of containments.
- Concrete flooring with slope drains and oil interceptors should be proposed for hot mix plant area and workshop, vehicle washing and fuel handling area so that spilled oil can be collected without contaminating soil or run-off. In case of any oil spills, it should be cleaned properly.
- Oil and grease interceptors shall be provided with drains at construction sites, material storage areas, parking sites and workshops.

- Oil spill kits shall be provided at the site and the staff shall be trained to use these kits during emergencies.
- A floating oil collection boom may be placed on waterbody to collect the oil in case of working inside or near the water body (especially for construction of bridges)
- All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual cleanup. Readily available, simple to understand and preferably written in the local language emergency response procedure, including reporting, will be provided by the contractors Construction camps shall be sited away from water bodies.
- Suitable drainage at construction site/camp/plant site should be provided to avoid formation of stagnant pool of water that leads to water logging and breeding of mosquitoes.
- Excavation activities shall not be undertaken during monsoon season. All excavated pits and borrow area sites shall be covered with tarpaulins during rains. Garland drains shall be provided around the excavated pits and borrow sites to prevent entry of run-off from surroundings into the excavated pits.
- Stockpiled soil and other loose material should be stored in covered areas or should be covered with tarpaulin. Drains with sedimentation tanks shall be provided in this area to facilitate drainage of run-off and arresting the silt from run-off.
- Silt fencing or appropriate silt arresting measures shall be taken while working in and near the water body to prevent entry of sediment in the water bodies.
- Work shall be undertaken during low water season. All temporary structures, filling material, coffer dams etc. shall be removed prior to the onset of monsoon.
- All drainage in project area shall be cleared prior to the onset of monsoon.
- Vehicle and TM washing shall not be undertaken at any waterbody or in project RoW or at land. Vehicle and TM washing shall be carried out at minimum 100 m distance from any waterbody Proper facility comprising of Sedimentation tank shall be provided for TM washing. Concrete slurry shall regularly be removed from the sedimentation tank and shall be re-used or disposed off as per C&D waste Management Rules
- No vehicles or equipment should be parked or refueled near water bodies to avoid contamination from fuel and lubricants.
- All chemicals and oil shall be stored away from water bodies. And concreted platform with catchment pit for spills collection
- Oil/Grease traps shall be provided at outlet of vehicle washing & maintenance facility.
- Proper sanitation facilities (toilet with water facility) at the construction sites and Labour accommodation shall be provided (guidelines as given in BOCWA, 1996 shall be followed)
- Sewage from toilets at labour accommodation and construction sites shall be disposed off complying with the guideline of CPHEEO and SPCB/CPCB. Sewage shall be disposed off through septic tanks and soak pits. Septic tanks shall be evacuated through authorized agencies only at the STP locations or at authorized locations only approved by local bodies. Soak pits shall not be provided anywhere within 100 m of any water body or where ground water table is less than 4 m. If sewage generation at one site is more than 10 KLD, then preferably STP shall be provided. Sewage shall be treated up to tertiary level and shall meet the discharge standards as specified by CPCB. Treated water shall be used at site for water sprinkling and landscaping.
- Water quality monitoring shall be conducted as per environment monitoring plan.

5.7.10 Impact on Hydrology

Various bridges are proposed to be constructed under proposed project, but the waterways width is less than 40 m due to which piers will not be constructed in any water body thereby impact on hydrology is not anticipated to be significant. However, with project, paved areas will increase also concrete so comparatively less pores and will not allow water to percolate leading to generation of high run-off. This high run-off will ultimately enter the waterbodies leading to generation of flash floods. Some of the anticipated impacts are.

- Improper disposal of waste on the land and in the water may choke the local drainage and cause flooding in the nearby area.
- Increase in run-off from the paved surfaces having comparatively lesser water retention/absorption capacity.

Measures to be adopted for prevention of impact on hydrology are given below.

- Existing drainage pattern shall be retained, and no water body shall be closed/blocked/diverted.
- Prefabricated structures shall be used to expedite the construction works within the river.
- All the drains along the RoW and near the camps site shall be cleared off prior to the onset of monsoon.
- C&D waste, excavated muck and other waste shall be stored, transported, and disposed of as per the waste management plan and waste management rules/guidelines.
- No construction material will be stored or disposed near any water body except for reusing it for enhancement measures such as embankment raising.
- No material should be dumped into natural drains that may block, impede, or alter drainage channels.
- Adequate cross drainage structures and longitudinal drains shall be provided in & along roads to ensure the cross drainage of the runoff as required. The cross-drainage structure of service road shall be connected to the nearest existing drainage system. If necessary, the walls of the drains shall be designed to retain the adjoining earth.
- Culverts reconstruction shall be done during lean flow period. In some cases, these minor channels may be diverted for a very short period and shall be brought back to their original course immediately after construction.
- The embankment height shall be designed consistent with the existing topography of the region and shall be higher than the HFL. An elaborate drainage system shall be provided to drain the stormwater from the roadway and embankment and to ensure minimum disturbance to natural drainage of surface and sub-surface water of the area.
- The design of the drainage system such as surface and sub-surface drainage shall be carried out as per IRC: SP: 42 and IRC: SP: 50.
- IRC: 34-2011: Recommendations for road construction in the waterlogged area and IRC: 75 and MORT&H guidelines for the Design of High Embankments shall be referred for construction of roads in such areas.
- Drains along the road proposed shall be provided with pavers blocks and porus concrete to allow percolation of water down the aquifers and minimize run-off entering the waterbodies. This water can be channeled to deeper aquifers also by provision of injection wells. This system if provided shall be cleaned pre and post monsoon every year to maintain the functionality.
- Desalination of water bodies shall also be carried out periodically to maintain the carrying capacity of these water bodies.

5.7.11 Impacts on Air Quality

During construction air quality may be degraded for short periods due to (i) the exhaust emissions from the operation of construction machinery; (ii) fugitive emissions from batching/hot-mix plants/quarry/borrow area; (iii) the dust generated from the haulage of materials, exposed soils, and material stockpiles; (iv) cleaning of the road; (v) material loading; (vi) unloading. The impact is expected to be localised, temporary and confined to construction areas. After removal of the vegetation, suspension of particulate matter is also supposed to be higher in the air by wind and vehicular/machinery movements. Impacts are discussed in detail in table 62.

Table 62: Impact on Air Quality during Construction Stage

Sl. No.	Impact	Source
1.	Generation of Dust	<ul style="list-style-type: none"> • Transportation of raw materials from quarries and borrowing sites. • Stone crushing (if any), handling and storage of aggregates • Site levelling, clearing of trees, construction of bridges. • Concrete batching plants. • Hot mix plant operation • Construction of structures and allied activities
2.	Generation of polluting gases Including SO ₂ , NO _x	<ul style="list-style-type: none"> • Large construction equipment, trucks • The movement of heavy machinery and vehicles • Inadequate vehicle maintenance and the use of adulterated fuel in vehicles. • Hot mix plant operation

As described in table above, there is a potential for increased dust particularly during summer/dry season due to stockpiling of excavated materials. Emissions from vehicles transporting workers, construction materials and debris/materials to be disposed off may cause an increase in air pollutants within the construction zone. These are inherent impacts that are site-specific, low magnitude, short in duration and can be easily mitigated. Special care is required to be undertaken near residential area and sensitive receptors. Emission Estimation during Construction Phase is given below.

Table 63: Detail of Construction Material and Vehicles

Material	Source	Quantity	Lead	Capacity of the Transportation Vehicle-cum	No of Trucks	No of trucks/day	Distance to be travelled /day-km
Sand	Existing Quarries at Dimapur	583,348.42 cum	100	4.8	121531	111	11099
Aggregates	Different quarries & Stone crushers are available near project locations	1,783,117.12 cum	20-45	5	356623	326	11399
Steel	Assam	47,908.65 Tonnes	500	8	5989	5	2735
Bitumen	Haldia	31,003.48 cum	1600	8	3875	4	5663
Cement	Assam & Meghalaya	534,068.18 Tonnes	500	8	66759	61	30483
Concrete	Batching Plants	993,766.39 cum	2-10	6	165628	151	756
						658	62135

Therefore, daily 658 trucks will be required to carry the load of construction material. Pollution load due to movement of these vehicles is quantified below in **Table 64**. **Average** travelling distance is estimated to be 62135 km/day.

Table 64: Quantification of Pollution Load Due to Movement of Trucks

Parameter	Emission Factor (g/Km) *	Pollution Load (g/Km) per day for 658 trucks	Pollution Load-62135km distance (kg/day)
CO	6.0	3947.4	245.3
NO ₂	9.30	6118.5	380.2

Parameter	Emission Factor (g/Km) *	Pollution Load (g/Km) per day for 658 trucks	Pollution Load-62135km distance (kg/day)
PM	1.24	815.8	50.7
SO ₂	0.15	98.7	6.1
HC	0.37	243.4	15.1

Source of emission factors: ARAI, Pune.

Note: Emission factor for Sulphur calculated using emission factors data taken from TERI Report (1998) considering sulfur content in Diesel as 0.05%.

The Project proponent will be required to follow mitigation measures as provided below:

Measures for Dust Control:

- Siting of stone quarry plant, batching plant, hot mix plant, stone crushers plant (if any) should be done in down wind direction.
- Proper and prior planning and appropriate sequencing and scheduling of all major construction activities will be done, and timely availability of infrastructural supports needed for construction will be ensured to shorten the construction period vis a vis reduce pollution.
- Construction materials shall be stored in covered condition to prevent fugitive emissions.
- Construction materials and debris shall be transported in the covered conditions.
- Adequate dust suppression measures such as regular water sprinkling on unpaved haul roads, stone quarry, batching plant and stone crushers sites & fugitive dust during material handling, loading/unloading & other activities at haul road particularly at vulnerable areas near habitation shall be controlled especially in the dry seasons.
- Provision of wheel wash facility
- Dust during loading and unloading will be controlled with careful handling and by following measures:
 - ✓ Increasing moisture content: In some cases, slight moisture may be added to the material to reduce dust during loading.
 - ✓ Reducing falling distance: Shortening the falling distance between the material discharge point and the material pile will slow material velocity and reduce particle impacts, lessening dust generation.
 - ✓ Adding physical barriers at the loading point: Create walls or areas where personnel are removed from the affected area to avoid dust exposure that could occur.

Measures for Emission Control:

- During construction period, all applicable clearances for air quality management and approvals such as 'Consent to Establish' and 'Consent to Operate' for batching plant, stone crushers area (if any), stone quarry (if any) shall be obtained from the State Pollution Control Board and complying all the conditions. All vehicles operating for the Project proponent shall obtain Pollution under Control (PUC) certificate.
- Environmental clearances shall be obtained from authorities for establishing new quarries, borrow areas and crushers as applicable. Project proponent shall strictly comply with all the conditions in the clearances.
- DG sets shall be provided with stack of adequate height as per CPCB norms ($H = h + 0.2\sqrt{KVA}$, where H= total height of the stack, h=height of the building in meters, KVA=total generator capacity of the set in KVA)
- It will be ensured that all the construction equipment & vehicles are in good working condition

and maintained to keep emissions within permissible limits. Idling of vehicles should be minimized and engines should be turned off when not in use to reduce pollution.

- Only clean fuel shall be utilized for all cooking purposes at labor camps.
- Raw materials shall be procured from nearest local sources.
- Provision of wheel wash facility will be installed to contain project site dust within the site.
- Recycled construction materials like fly-ash and sludge from cement plants for construction purposes may be utilized.
- Temporary Electricity connections at the sites will be obtained to minimize usage of DG sets etc.

5.7.12 Impact on Noise Level:

Noise and vibration assessments are key elements of the environmental impact assessment process for Bridge & road projects. Experience has shown that noise and vibration are among the major concerns about the impact of a Bridge & road project on the surrounding community. Source of noise pollution during the design and construction phase are site clearing, operation of excavators/earth moving equipment and leveler, operation of heavy machinery and equipment for construction purpose, loading & unloading of construction material and piling activities (for Bridge piers). Expected noise generation from various construction activities is given in Table 65.

Table 65: Noise Generation from Various Construction Equipment/Machinery

Clearing		Structure Construction		Grand and compacting	
Bulldozer	80	Crane	75-77	Grader	80-93
Front end loader	72 - 84	Welding generator	71-82	Roller	73-75
Dump truck	83-94	Concrete mixer	74-88	Paving	
Jack hammer	81-98	Concrete pump	81-84	Paver	86-88
Crane with ball	75-87	Concrete vibrator	76	Truck	83-94
Excavation & Earth Moving		Air compressor	74-87	Tamper	74-77
Bulldozer	80	Pneumatic tools	81-98	Landscaping and Clean-up	
Backhoe	72-93	Bulldozer	80	Bulldozer	80
Front end loader	72-84	Cement & dump trucks	83-94	Backhoe	72-93
Dump truck	83-94	Front end loader	72-84	Truck	83-94
Jack Hammer	81-98	Dump truck	86-88	Front end Loader	72-84
Front end loader	80-93			Dump Truck	83-94
				Paver	86-88

Maximum noise to be generated due to usage of above equipment ranges between 85 & 90 dB(A). Baseline noise level of study area is already high than the prescribed standard for residential area, but it is evident that operation of the construction equipment will generate high noise levels which it may affect the health of construction labour and nearby residents if the adequate mitigation measures are not taken. As per occupation standards, workers exposure to 90 dB(A) noise level (at 10 m from source) should not be more than 8 hours. OSHA guidelines should be followed for exposure to specific noise levels for workers and are listed in Table 66. Thus, the high noise levels are required to be managed by proper noise level reduction measures and preventive measures to minimize the impact on health due to exposure to high noise level. Conducting regular hearing tests for workers may help in monitoring the impact of the higher noise level on workers' health.

Table 66: OSHA noise exposure limits for the work environment

Noise Levels in dB(A)	Permissible Exposure (hours & minutes)
85	16hrs
90	8hrs
96	3hrs30 minutes

Noise Levels in dB(A)	Permissible Exposure (hours & minutes)
102	1hr30 minutes
108	40min
115	15min
121	6min
127	3min
130	1min

Source: Marsh, 1991, p.322

However, the noise associated with the construction activity will be restricted to construction period only and thus the impact is short term & temporary. Construction machinery & equipment will not be operated throughout the day thus noise generation from this equipment is of intermittent type. Further, by undertaking mitigation measures, impact due to noise pollution can be managed.

Noise attenuates with the distance; thus, the impact of high noise level reduces with the increase in distance from activity area. Thus, it is require maintaining safe distance between the noise source and sensitive receptors (residential areas, man-made sensitive receptors, and eco-sensitive areas). Considering the noise level to be generated during construction phase as 90 dB(A) at 10 m from source, safe distance is calculated for different land uses. Equation for calculating the attenuation in noise and safe distance is given below:

$$L2 = (L1 - 20 \log D2/D1 - Ae - An)$$

L1 and L2 are the noise levels at D1 and D2 from the noise source; Ae and an are attenuation coefficient due to environment correction and background respectively. (Table 67 and 68)

Table 67: Estimated Noise levels Due to Construction Activities at Varying Distance

Distance from noise source location(m)	Highest Noise Level During Construction phase
10	90.00
30	80.46
50	76.02
100	70.00
200	64.00
500	56.00

Table 68: Safe Distance for Different Land Use

Land Use	Day Time Standards dB(A) Leq	Safe Distance (m) Day Time	Nighttime Standards dB(A) Leq	Safe Distance Nighttime
Residential	55	562.3	45	1778.2
Commercial	65	177.8	55	562.3
Industrial	75	56.23	70	100
Silence	50	1000	40	3162.2

Measures for prevention of impact due to high noise level are given below.

- Barricading (Temporary noise barrier) the construction site to minimize the noise level outside the site boundary.
- Management of construction traffic to avoid residential areas.
- Restriction on Honking at the project site.
- Heavy noise generating activities like piling preferably shall not be carried out at residential and sensitive areas during nighttime (10:00 PM to 6:00 AM).
- Periodic monitoring (monthly level) of noise levels to check the level of pollutants and effectiveness of proposed EMP.

- Stationary noise sources like generator sets shall be provided with acoustic enclosures. The plants, equipment and vehicles used for construction should strictly conform to CPCB standards. Vehicles and equipment should be fitted with silencer and maintained accordingly.
- All equipment should be fitted with silencers/noise mufflers and will be properly maintained to minimize its operational noise. Noise level will be one of the considerations in equipment selection, which will favour lower sound power levels.
- Protection devices (earplugs or earmuffs) should be provided to the workers operating near high noise generating machines.
- Hearing test for the workers prior to deployment at site and high noise areas followed by periodic testing every six months.
- Job rotations systems for workers who will be working in high noise level areas.

5.7.13 Impact Due to Vibration:

During construction, some equipment may cause ground-borne vibration, most notably pile driving equipment (for bridge). Construction equipment can produce vibration levels at 25 feet (7.62 m) that range from 58 dB for a small bulldozer to 112 dB for a pile driver. Operation of construction equipment causes ground vibrations which spread through the ground and diminish in strength with distance. Building founded on the soil in the vicinity of the construction site responds to these vibrations, with varying results ranging from no perceptible effects at the lower levels, low rumbling sounds and feeble vibrations at moderate levels and slightly damage at the highest levels. The level of construction vibration is related to the scale of the project and the sensitivity of the surrounding land use. Ground vibrations from construction activities very rarely reach the levels that can damage structures but can achieve the audible and feeble ranges in buildings very close to the site. A possible exception is the case of old, fragile buildings of historical significance where special care must be taken to avoid damage. Pile driving is potentially the greatest source of vibration associated with equipment used during construction of a project. During the construction phase of project, the most severe vibration could be expected from impact pile driver (may be used for bridge). Impact driving is the best method for driving piles into difficult ground or final driving of piles to level in panel form. With a correctly selected and sized hammer it is the most effective way of completing deep penetration into hard soils in most conditions. There are several types of impact hammer available to suit the requirements of a site. The downside of this equipment is an environmental concern, that it can be noisy & maximum vibration generating equipment and could not be suitable for sensitive or restricted sites. Measures proposed to minimize the impact on nearby structures due to vibrations effect are given below:

- Building damage from construction vibration is only anticipated from pile driving at very close distances to buildings (Approx 7 -8 m). If piling is more than 7-8 m from buildings, or if alternative methods such as push piling or augur piling can be used, damage from construction vibration is not expected to occur. Other sources of construction vibration do not generate high enough vibration levels for damage to occur. Prior construction, preconstruction surveys shall be conducted at locations close to piling to document the existing condition of buildings in case damage is reported during or after construction. Damaged buildings would be repaired, or compensation paid to the owners.
- Notify the local people prior to undertaking the construction activities associated with higher vibration level such as activities using vibrating rollers.
- After assessing potential human impacts (or building damage) from construction vibrations, the next step is to identify control measures.

Mitigation of construction vibration requires consideration of equipment location and processes as follows:

Design consideration and project layout

- Route heavily loaded trucks away from residential streets, if possible. Selects street with fewest homes if no alternatives available.
- Operate earthmoving equipment on the construction plot as far away from vibration-sensitive sites.

Sequence of operations

- Phase demolition, earthmoving and ground-impacting operations so as not occur at the same time.
- Avoid night-time activities. People are more aware of vibration in their homes during the night-time hours.

Alternative construction methods

- Avoid impact pile driving where possible in vibration-sensitive areas. Drilled piles or use of a sonic or vibratory pile driver causes lower vibration levels where levels where geological conditions permit their use. However, continuous operation at a fixed frequency may be more noticeable to nearby residents, even at lower vibration levels. Furthermore, the steady-state excitation of the ground may increase resonance response of building components. Resonant response may be unacceptable in cases of fragile buildings or vibration-sensitive manufacturing processes. Impact pile drivers, in contrast, produce a high vibration level for a short time (0.2 s) with sufficient time between impacts to allow any resonant response to decay.
- Select demolition methods not involving impact, where possible.
- Avoid vibratory rollers and packers near sensitive areas.

5.7.14 Impact on Micro-climate:

The project may affect approx. 5345 nos. of trees. Assuming all the trees as mature trees, it is estimated approx. 116.3 tonnes of CO₂ will not be fixed per year (@48 pound/year/adult tree of CO₂ fixation). On an average tree takes 8-10 years to grow fully into a mature tree. Thus, total loss of CO₂ fixation due to the project in 8 years is approx. 930.4 tonnes of CO₂. Other than this there may be loss of Oxygen formation by these trees. It is estimated approx. 630.35 tonnes of O₂ (@ 260 pound/year/adult tree of O₂ formation) will not be formed every year, leading to loss of 5042.8 tonnes of O₂ in eight years. Excess generation of CO₂ may add to heating impact as it is green-house gas. Further impact on micro-climate is anticipated due to

- Temporarily warming effect due to operation of large number of heavy construction machineries.
- Continuous running of DG set at the construction camp.
- Clearing of vegetative cover may also lead to rise in the temperatures in local areas over long term.

Measures proposed to be taken to minimize the impact on micro-climate are given below.

- Compensatory plantation shall be carried out as per the State Forest Policy
- Transplantation shall be preferred over tree cutting. Trees having widths between 30-75 cm shall preferably be planted. Transplantation shall be carried out following the scientific approach in appropriate season and with all the utilities available through an experienced agency only to assure the high survival rate of transplanted tree.
- Survival rate of the plantation shall be maintained, and additional trees shall be planted for every tree lost.
- Proper measures for tree care like provision of guards, watering, manuring etc. shall be provided as required to protect trees from cattle and weather action.
- Plantation shall preferably be carried out with the native species having minimal aftercare

requirements and high survival rate.

- Trees having high CO₂ and other pollutant absorbing capacity shall preferably be planted.
- Exotic and ornamental species shall be avoided.
- Regular monitoring of the plantation shall be done on fortnight basis.
- Proper maintenance of machinery and oiling to minimize heating of the machinery and minimize the emissions.
- Monitoring of DG Sets for performance evaluations
- Good quality coolant shall be used to check the overheating of DG sets and other machinery.

5.7.15 Impacts on Flora

The major land use of the area is urban, comprising of built-up and water bodies followed by agriculture. Thus, no significant wild species of flora and fauna are found in project area. Project does not impact any environmentally protected area or forest. Impact of project on ecology is restricted to cutting 5345 trees only. Cutting down trees will impact the flora and associated benefits of this flora. Further work shall be undertaken on the roads along the forest area. Thus, care shall be undertaken to avoid any impact on those forest areas during construction. Work will also be undertaken on roads along wetland which further require caution to minimize impact. Detailed impacts are discussed below.

- The construction of the proposed project will affect approx. 5345 nos. of trees within the proposed RoW, which are to be cut.
- There will be dust deposit on the leaves of the flora in the surrounding of the construction sites and in the Waterbodies. Deposition of dust on the leaf surface will close the stomata and reduce the photosynthetic activity that will hinder the plant growth. Deposition of dust on waterbody may impact the aquatic life.
- Emission of gaseous pollutants from the engine will impact the health of the floral elements.
- Also, exposure to spilled chemicals or oil, if mixed with runoff, may damage aquatic flora.
- Labour may cut the vegetation/trees for cooking fuel and other purposes. This will disturb the natural community and

Measures to prevent impact on flora are discussed below.

- No labour accommodation, plant site, construction plants etc. shall be established on the forest land.
- Alternate clean fuel shall be provided to the laborers in the labour accommodations to ensure that no firewood will be used for cooking etc.
- Smoking, hunting & fishing shall be prohibited for workers. Regular awareness training related to non-use of firewood, prohibition on smoking in natural areas, bush fires accidents, safe handling of animals (if encountered), prohibition of fishing etc. shall be conducted for labor.
- Noise will be kept under control by regular maintenance of equipment and vehicles. Noisy activity shall be prohibited during night in forest areas.
- Dust control measures will be adequately applied with the dust generating activities.
- Trees located outside the RoW shall not be felled. Minimum number of trees will be felled within the Row with translocation of trees up to maximum possible extent will be performed as much as possible.
- The loss of trees shall be compensated through compensatory plantations in accordance with

requirement of State Forest Department.

- Proper protection and aftercare shall be undertaken for the planted trees for minimum period of 5 years.
- Vehicle washing, TM Washing, establishment of batching plant, hot-mix plant etc. shall not be permitted in the vicinity of any water body to avoid the deterioration of water quality and any human induced impact on aquatic life nor shall workers be permitted to use waterbodies for bathing and washing.
- Proper sanitation facilities at site (toilets, washrooms, bathroom, kitchen) and accommodation area shall be provided for workers and the sewage shall be treated in STP (if sewage is more than 10 KLD) or disposed off in septic tanks. STP sludge/septage shall be disposed off through the authorized agency only. STP treated water shall meet the prescribed standard for re-use and shall be used for horticulture or dust suppression purposes.
- Designated place will be used to store the construction material. Proper care will be taken that no spill of the construction material or the debris shall take place and get mixed into any river body or washed away in heavy rains.
- Moreover, all provisions of Environmental Management Plan made for the air, water, noise pollution control will be implemented, and thus will also be helpful to control the negative impacts on the flora as well.

5.7.16 Impact on Fauna

The alignment traverses through human activity area and no wildlife exists in project area. However arboreal and micro fauna associated with the tree/shrub vegetation may get impacted due to the project. The alignment traverses also through the Waterbodies which supports aquatic fauna. However no piers will be constructed in the waterbodies thus no significant impact on aquatic fauna is anticipated due to project. Impacts on fauna are listed below.

- The removal of trees and other vegetation for the RoW will disrupt the habitat for birds, mammals, etc.
- During the construction phase, vegetation removal from the site will expose the large areas to the erosive forces of wind and rain. This will increase the suspended solids in the water bodies which may impact the aquatic organisms.
- Generation of noise and vibration may disturb the fauna of the vicinity.
- Trespassing of labour into the forests area or in the natural vegetation may disturb the faunal elements. Cutting trees for fuelwood and fire incidents are direct threats to the fauna and their habitats.

Measures proposed for mitigating the impact on fauna are given below:

- Smoking, hunting & fishing shall be prohibited in the natural habitats/forests.
- Awareness will be spread among the workers towards nature's conservation.
- All staff / workers will be instructed not to chase/hunt if any wildlife is seen near the project area. The incidence of sighting wildlife near project site should be reported to Forest Department for safe handling.
- Construction activities will be avoided at nighttime near the natural habitats.
- All kinds of the pollution and noise causing machinery/engines will be properly serviced to keep the disturbance level at minimum or below the prescribed limits.
- Construction in and near waterbodies shall be undertaken during low water level (summertime)

- No waste/sewage disposal shall be carried out in any water body.
- Construction/hazardous material/waste shall not be stored close to any water body.

5.7.17 Impact due to Waste Generation

Construction activities will produce excavated soils, construction materials and solid wastes (such as removed concrete, wood, trees and plants, packaging materials, empty containers, oils, lubricants, and other similar items). Waste anticipated to be generated during construction phase is given in Table 69. These wastes, if not managed properly, have potential to impact the air, water, and soil quality of the project area.

Table 69: Waste Anticipated to be Generated during Construction Phase

S. No.	Type of Waste	Activities Involved	Concerned Regulation in India	NOC required	Treatment	Disposal
1.	Municipal Waste	Domestic Usage by Labour and Staff, Kitchen/food waste, packaging waste (only bio-degradable like paper, cartons), Vegetation Removal, Discarded PPEs like shoes, jackets etc.	Municipal Solid Waste (Management & Handling) Rules, 2016	NOC from local bodies	Composting of wet waste within site as feasible	If not treated to be given off to piggeries or to local bodies for disposal
2.	Plastic Waste	Packaging plastic & foam Waste, disposable plates/glasses, HDPE & PVC pipes & drums, buckets, tarpaulins, water tanks and Waste from the snack's packets & water bottles in canteen majorly, Discarded PPEs like goggles, helmets, harness etc.	Plastic Waste Management Rules, 2016	NOC from local bodies	--	Handed over to recyclers or to be given to local bodies for disposal
3.	Construction and Demolition Waste	broken cement blocks, metal waste, wires, dried concrete, concrete slurry, discarded machinery & tools, plywood/planks, demolition debris etc.	Construction and Demolition Waste Management Rules, 2016	NOC from local bodies	--	Excavated material and demolition debris shall be re-used for road improvement works. Recyclable material shall be sold to the recyclers. Surplus shall be disposed off as per guidance of local bodies
4.	Hazardous Waste	Used engine and hydraulic oil, waste oil,	Hazardous & Other Waste	NOC from SPCB	--	To be given to BPCB

S. No.	Type of Waste	Activities Involved	Concerned Regulation in India	NOC required	Treatment	Disposal
		greased cotton, empty paint tins, dried paint, dried cements, cement slurry, discarded hazardous chemicals, used transformer oil, air filters, bentonite slurry (in case of geo-testing for piles for bridges) etc.	(Management & Transboundary Movement) Rules, 2016 as amended			authorised recyclers or to TSDF site for disposal
5.	Battery Waste	Lead Acid batteries in vehicles	Battery Waste Management Rules, 2022	NOC from SPCB/CPCB	--	To be sold to recyclers
6.	Bio-Medical Waste	Waste from first aid kits in labour accommodation/site area, vehicles & ambulance etc.	Bio-Medical Waste (Management and Handling) Rules, 2016	NOC from SPCB/CPCB	--	To be disposed off through authorized recyclers and disposal site
7.	E-Waste	Used electronic appliances like laptops & its accessories, computers & its accessories, printers, ACs, Xerox machines, Microwaves, Induction, Digital gauges etc. from site office	E-waste (Management) Rules, 2016	Return to be filled and submitted to SPCB/CPCB	--	To be sold to authorized recyclers and disposal sites

Measures proposed to minimize the impacts due to waste generation are given below.

- Contractor shall follow and comply with all the rules pertaining to the management and disposal of waste in India as described in Table.
- Contractor shall obtain NOC for generation, management, and disposal of all kinds of waste generated from SPCBs and local bodies as applicable.
- Contractor shall follow the conditions of all the NOC obtained pertaining to the waste generation.
- Waste generated at the site shall be segregated at source and treated or re-used at site to the extent possible. Recyclable materials shall be segregated and sold to the authorized recyclers. Rejection of waste shall be disposed-off through the authorized local waste management agencies in the area.
- If local agencies/facilities for waste collection and disposal are not available for municipal and C&D waste, in the project area then project proponent shall identify the sites for waste/construction debris disposal. Debris disposal sites shall be selected prior to the start of construction.
- Any hazardous materials to be used will also need to be stored and handled correctly to prevent spills and pollution. Hazardous material shall be stored in covered conditions only in the confined location and shall be provided with the containment for any spillage. Hazardous waste containers shall properly be marked and kept in isolated locations only. Hazardous waste transportation shall be carried out only through the authorized transporters and TREM card shall be maintained for transportation.

- Effort shall be made to re-use C&D waste to the possible extent such as filling material for casting yards or other local construction projects. Surplus shall be sent for recycling to the recyclers or for disposal at approved sites.
- Excavated soil shall be used for backfilling excavations and surplus shall be given to the other construction projects in vicinity or disposed-off to the C&D waste disposal site.
- No dumping should be carried out outside the RoW including private and government land, roadside, low lying areas, wetlands, water bodies, forest area, ecologically sensitive areas etc.
- All the workers engaged in waste management shall be provided with adequate PPEs like jackets, gloves, masks, face shield etc.
- Waste generation shall be minimized by providing adequate material storage and covering facility and providing training to the workers for proper handling of the material and machinery.

5.7.18 Impacts on Occupational Health and Safety

Workers need to be mindful of occupational hazards that can arise from construction works. Exposure to work-related chemical, physical, biological, and social hazard is typically intermittent and of short duration but is likely to reoccur. Anticipated impacts are listed below:

- Accidents due to construction activities, operation of heavy construction machinery & electrical appliances & cables, transportation of construction & waste materials, handling of hazardous chemicals & explosives, exposure to UG/OH utilities, external traffic, biological hazards like venomous snakes & wild animals, exposure to heat/high temperature, drowning due to work on/near water body etc. may affect health and safety of worker at the project site.
- There may be probability of spreading of contagious diseases like Cholera due to creation of unhygienic conditions at the site & labour accommodations etc.
- Chance of spreading of sexually transmitted diseases (STDs) among the construction workers like HIV/AIDS
- Habit of intoxication is also a labour health associated issue, and this may also affect mental peace and health of others too.
- There may be chances of labour suffering with dust associated respiratory diseases, due to dust generation from the construction activities, operation of batching plant, transportation and handling of construction and waste material, operation of quarry and crusher unit etc.
- There may be impact on the workers' health like temporary or permanent loss of hearing abilities by noise and vibration generation due to construction and associated activities.

Potential impacts on occupational health and safety are negative and long-term but reversible by mitigation measures. Overall, the project proponent should comply with BOCWA, 1996. Other measures for mitigating the impacts are given below:

Health Related Measures

- Project proponent shall have safety and health management system for all the construction activities to control and prevent any occupational accidents as per the National and International guidelines whichever is stringent as applicable.
- Project proponent shall implement workers health awareness and surveillance program including health check-ups, regular health monitoring systems for the workers, vaccination drives for prevention of diseases and awareness program.
- Project proponent shall ensure availability of adequate first aid kits, first aiders as per the National guidelines whichever and shall have tie up with nearby hospital to deal accident/emergency cases.

- Workers shall be provided with hydrating drinks like ORS as required to prevent heat stress/exhaustion.
- Provision of covered rest areas at regular intervals with proper facilities like resting desks, drinking water facility, toilets etc.
- Project proponent shall provide all the facilities such as potable drinking water, toilets with water facility, kitchen area, clean cooking fuel, proper bedding, adequate no of toilets and bathing areas, maintenance of cleanliness and sanitation etc. at the labour camp site. Labour camp establishment shall strictly follow the BOCWA, 1996
- Ambulances with all the required facilities as per BOCWA, 1996, should be provided at all work sites to take injured persons to hospitals.
- Emergency contact details (including nearest hospitals and first aiders should be displayed at appropriate locations at construction sites & labour accommodations.
- Full-time medical facilities should be provided at each labour camp with first aid kits & first aiders.
- Sufficient supply of potable water should be ensured for all workers and employees on-site. Conducting regular monitoring of drinking water quality at site and labour accommodations
- Provision of dust and noise shields and maintenance of adequate distance between the workers and noise/dust generation activities as applicable
- Project proponent shall implement administrative controls like practicing job rotation, maintaining work hours of labour, implementing work permit system, implementing LOTO, for the workers to prevent continuous exposure to dust, noise, heat, etc.
- Workers shall be provided with proper training to handle any health-related emergency, if any.
- All workers and staff should be provided with Personal Protective Equipment (PPE) appropriate to their job on site to minimize exposure to the dust and noise like masks, ear plugs etc.
- Safety measures for working on height shall be taken. For working on height, workers shall be tested for Vertigo. Proper working platform with railings shall be provided for working on height. Workers shall be provided with harness, helmet, and Goggles for working on height. Also, proper training shall be imparted to workers for working on height.
- Safety measures for working on water bodies shall be taken. Safe access to railings shall be provided. Safety jackets, floats, and rescue boats shall also be available. Lifeguards for saving people from drowning should be available at work sites.
- EMP for dust and noise control shall strictly be followed as suggested.
- Framing and implementation of drugs/intoxicants prohibition policy by project proponent during the construction phase
- Anti-venoms can be kept in the nearest hospitals/PHCs to treat snake bites if any.
- Drinking water quality, air quality and noise level shall regularly be monitored at all the labour accommodations sites as per CPCB guidelines in regular intervals as suggested in EMoP.

Safety Related Measures

- Safe work method statement including HIRA shall be prepared and implemented for all the construction activities.
- Provision of adequate fire detection and firefighting system at the site like extinguishers, sand buckets, fire blankets, usage of fire-resistant materials/wires etc.
- Emergency preparedness plan shall be prepared to handle any contingency due to construction accidents and natural or man-made disasters like earthquakes, floods, and dust storms.

- Traffic management plan shall be prepared to prevent any traffic-related accidents at or outside the site. Defensive training to the drivers to minimize accidents.
- Provide proper earthing for all electric panels, machinery, DG sets etc. and proper safety & warning signs and conduct security patrols.
- Ensure provision of safe work environment, provision of competent supervision, provision of safe equipment & machinery and provision of proper training to ensure safety at work site.
- Project proponents should appoint an agency to provide awareness about the prevention of STDs among the workers. The agency shall work in close coordination with NACO and SACS for organizing the awareness campaigns. Workers shall be provided with condoms and diaphragms as required for minimizing spread of STDs.
- All workers shall be provided with job specific training, behavioral based safety training and awareness for ensuring safety.
- Smoking shall be prohibited at the site to prevent health and fire hazard.
- All construction sites should be barricaded with proper tamper proof fencing & security lighting and conduct regular security patrols and other security measures. All the construction activity and storage of material shall be strictly within the RoW. All hazardous chemicals & waste shall be stored as per the guidelines in the respective laws.
- Avoiding usage of the chemicals or paints which may impact the health of the workers or community and shall encourage use of the VOC free paints etc. No banned material like asbestos shall be used at the construction site.
- Antifouling paints shall only be used for painting structures which are under water.
- All workers and staff should be provided with Personal Protective Equipment (PPE) like safety jackets, helmets, gloves, goggles, life jackets in case of work on/near water body appropriate to their job on site to minimize exposure to the hazards.
- Coordination with local police to curb the anti-social activities and usage of drugs & narcotics.

5.7.19 Impact on Community Health

Impacts on community health due to proposed project are discussed below.

- Associated risks from accidents will affect health and safety of nearby residents in and around the project site.
- There may be probability of spreading of contagious diseases like Covid-19, Cholera, STDs, etc.
- There may be chances of suffering with dust associated respiratory diseases from the crusher unit, transportation of construction and waste material etc.
- There may be impact on the community like sleep disturbances, reduced hearing abilities by noise and vibration generation due to construction and associated activities.
- Increase of crime like thefts, social unrest, unfair practices etc., in nearby communities due to establishment of labour accommodations

Measures proposed to mitigate the impact are discussed below.

- All construction sites should be surrounded with secure tamper proof fence, with security lighting, regular security patrols and other security measures to prevent trespassing. Only authorized people shall be allowed to enter the construction camps/sites.
- Project proponents shall have health and safety management system to effectively prevent any accidents happening at construction sites.

- All materials and components should be stored and stacked safely in dedicated secure areas.
- Avoid use of any paints containing lead or its compounds as well as high VoCs and any banned material like CFC, asbestos etc.
- Public health system capacity relies on detecting, testing, contact tracing, and isolating those who are or might be sick, or have been exposed to known or suspected communicable diseases. It is important to stop broader community transmission and prevent communities from having to implement or strengthen further community mitigation efforts. This can be done by organizing regular community health check-ups. Awareness program and vaccination camps will be organized in the nearby settlements/villages.
- Ensure that first aid kits are available in all working areas, supplied with adequate material and medicine as per the BOCWA 1996. Facility of ambulance needs to be ensured.
- Records of all nearest hospitals and health centers should be kept at each construction site.
- EMP for dust and noise control shall strictly be followed as suggested.
- Labour accommodation shall preferably be established at minimum distance of 500m from the residential/institutional areas.
- Framing and implementation of drugs/intoxicants prohibition policy by project proponent during the construction phase
- Project design involves provision of road safety infrastructure including crash barrier, rumble strips, lighting etc. which will prevent occurrence of accident and impact on residents and cattle.
- Crash barriers shall also be installed at appropriate locations particularly near the school to provide safety for schoolchildren. The provision of speed breakers or rumble strips shall be made near schools, health centers etc.
- Retro-Reflector zed traffic caution signs shall be used during construction. Regular safety audit or periodic reviews shall be made to assess the effectiveness of safety measures adopted during construction.
- Adequate caution signage near the school, sensitive locations, speed control, caution notes shall be fixed at appropriate locations. These shall be preferable with Retro-reflective paints.
- No manhole or trench shall be left open without cover or appropriate barricading.
- Access to the construction site shall be controlled by placing barricading boards and deputing the security staff especially during night time.
- Adequate lighting should be provided at workplace during nighttime.
- Project proponents will have regular monitoring and audits/inspection system for ensuring effective implementation of safety management system and shall ensure continuous improvement of its safety management system.
- A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do.
- Interested and affected parties need to be made aware of the existence of the complaints book and

the methods of communication available to them. The contractor must address queries and complaints by: (i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environmental and social specialist attention immediately; and (iv) taking remedial action as per environmental and social specialist instruction.

5.7.20 Impacts on Socio-Economic Activities

Manpower is required during the construction phase. This can help generate employment and an increase in local revenue. Thus, potential impact is positive and short-term. However, the project proponent will need to adopt the following mitigation measures:

- Leave space for access between mounds of soil.
- Provide walkways and metal sheets that were required to maintain access to shops/businesses along trenches.
- Consult businesses and institutions regarding operating hours and factoring this into work schedules.
- Provide signboards for pedestrians to inform the nature and duration of construction works and contact numbers for concerns/complaints.
- Employ local persons to the extent possible

5.7.21 Impact due to Labour Camps

There may be involvement of approx. 250 labour/staff during construction phase and labour camp is required to be provided. Preferably rented accommodation shall be provided in place of establishing labour camp. In case labour camp is required to be established, land will be required for establishment which may lead to change in the land use temporarily. Further for establishing the labour camp, there may be requirement to clear the vegetation and cut down trees. Labour camps, if established close to the existing residential areas, may increase the stress on existing resources being used by the nearby community and may increase the social unrest in the area. Due to improper unhygienic and sanitation conditions at the labour camp, there may be spread of infectious and contagious diseases like Cholera, STDs, etc. Dumping of the waste and sewage to be generated from the camp site may impact the soil, water, and air quality of the area also. However, the labour camps will be established only up to the construction period, thus impact anticipated is short-term and temporary. Detailed environmental and social risks due to establishment of labour accommodations is given below.

Environmental Risks and Impacts

- **Inadequate waste disposal and illegal waste disposal sites:** large population of migrant laborers generate increased amounts of waste, for which no sufficient local waste management capacities may exist, which would likely lead to improper disposal practices.
- **Wastewater discharges:** Project-related activities, along with workers' camps and a lack of appropriate wastewater discharges may pollute nearby water resources. Major health risks can occur if latrine pits spill over into local streams that are used for drinking water by the host community.
- **Increased demand on freshwater resources:** The provision of clean drinking water and water for hygiene purposes can result in increased pressure on freshwater resources in the project or camp site area.
- **Increased deforestation, ecosystem degradation, and species loss:** These can result from forest or land conversion for worker housing/ labour shed and migrant laborers' agricultural subsistence activities
- **Increased use of / demand for natural resources:** This can include logging for construction, fuel wood collection, use of water resources, farming and grazing, hunting, and fishing, potential

introduction of invasive or non-native species, and land degradation.

Social Risks and Impacts

- **Risk of social conflict:** Conflicts may arise between the local community and the migrant laborers, which may be related to religious, cultural, or ethnic differences, or based on competition for local resources. Tensions may also arise between different groups within the labor force and pre-existing conflicts in the local community may be exacerbated. Ethnic and regional conflicts may be aggravated if workers from one group are moving into the territory of the other.
- **Increased risk of illicit behavior and crime:** The influx of migrant laborers into communities may increase the rate of crimes and/or a perception of insecurity by the local community. Such illicit behavior or crimes can include theft, physical assaults, substance abuse, prostitution, and human trafficking. Local law enforcement may not be sufficiently equipped to deal with the temporary increase in local population.
- **Influx of additional population (“followers”):** Especially in projects with longer timeframe, people can migrate to the project area in addition to the labor force, thereby exacerbating the problem of labor influx. These can be people who expect to get a job with the project, family members of workers, as well as traders, suppliers, and other service providers, particularly in areas where the local capacity to provide goods and services is limited.
- **Impacts on community dynamics:** Depending on the number of migrant labor and their engagement with the host community, the composition of the local community, and with it the community dynamics, may change significantly. Pre-existing social conflict may intensify because of such changes.
- **Increased burden on and competition for public service provision:** The presence of migrant labor (including their families) can generate additional demand for the provision of public services, such as water, electricity, medical services, transport, education and social services. This is particularly the case when the influx of migrant laborers is not accommodated by additional or separate supply systems.
- **Increased risk of communicable diseases and burden on local health services:** The influx of migrant labor may bring communicable diseases to the project area, including sexually transmitted diseases (STDs), or the incoming migrant labor may be exposed to diseases to which they have low resistance. This can result in an additional burden on local health resources. Workers with health concerns relating to substance abuse, mental issues or STDs may not wish to visit the project’s medical facility and instead go anonymously to local medical providers, thereby placing further stress on local resources. Local health and rescue facilities may also be overwhelmed and/or ill-equipped to address the industrial accidents that can occur in a large construction site.
- **Child labor and school dropout:** Increased opportunities for the host community to sell goods and services to the incoming migrant labor can lead to child labor to produce and deliver these goods and services, which in turn can lead to enhanced school dropout.
- **Local inflation of prices:** A significant increase in demand for goods and services due to labor influx may lead to local price hikes and/or crowding out of community consumers.
- **Increased pressure on accommodations and rents:** Depending on project worker income and form of accommodation provided, there may be increased demand for accommodations, which again may lead to price hikes and crowding out of residents.
- **Increase in traffic and related accidents:** Delivery of supplies for migrant laborers and the transportation of migrant laborers can lead to an increase in traffic, rise in accidents, as well as additional burden on the transportation infrastructure.

Measures proposed to be undertaken to prevent the impact on labour accommodation are listed

below.

- Construction Plant site (batching plant/hot mix etc.) locations should be carefully selected to avoid the land use categories: residential, sensitive and Eco sensitive areas. Distance of minimum 500 m shall be maintained between the said land use and labour camp locations. Camps sites shall preferably be established on waste and barren land so as the vegetation removal and tree cutting can be minimized.
- Labour Camps shall also be established at approx. 500 m distance from the water bodies to prevent any impact on the water body.
- NOC shall be obtained from the landowner and the concerned authority prior to establishment of the labour camp.
- Land shall be restored back to its original condition immediately after the completion of construction works and prior handing over the land back to the landowner. All waste materials, temporary/permanent structures etc. shall be removed from the camp site and the site shall be re-vegetated with the native species of trees.
- Training and awareness shall be provided to the labour to not indulge in unfair practices.
- Labour camp should be enclosed with boundary wall.
- Movement of the workers should be monitored by providing adequate security checks and all the workers should be checked for availability of valid ID cards.
- A cooked food canteen on a moderate scale shall be provided for workers so that they can have their meal at a definite place. All the waste generated from the canteen shall be treated/disposed of as detailed in the other sections of the waste disposal. The labour need not depend on the nearby facilities for food and so interaction with the nearby community will be minimized.
- Firewood and other conventional fuels like dung cakes, paper, waste materials etc. shall not be used for cooking and campfire. Project proponents must provide only clean fuel for cooking like LPG gas.
- Health problems of the workers should be taken care of by providing basic health care facilities at the construction sites, casting yard, labour accommodation, etc. Some arrangements will be made with the nearest hospital to refer patients during health emergencies.
- Facilities at the camp sites shall be provided as per BOCWA, 1996 to establish proper sanitation facility and waste management system at the site to prevent impact on air, water, and soil quality of the area. Details are presented below:
- Construction camps shall be provided with sanitary latrines and urinals with water facilities. Drainage systems and the proper sewage disposal system according to the local conditions should be provided for proper disposal meeting the standards as prescribed by CPCB. If sewage generation is more than 10 KLD then STP shall be provided if less than 10 KLD then sewage can be disposed through septic tank. Soak pits shall not be provided within 100 m of the water body or any water source to prevent impact on water quality.
- Food waste shall be handed over to the piggeries or any pig farm in nearby areas.
- All the municipal waste shall be disposed off through the authorized local waste management agencies only if any in-house treatment facility is not available.
- There must be proper sewage and solid waste handling and management for the labour accommodations. The drainage must be proper in the camp area with no stagnancy of the water. Also, the drainage from the camps must not affect the domestic supply of public water.

5.7.22 Impact on Archaeological, Cultural and Historical Monuments/Places

There is risk that any work involving ground disturbance can uncover and damage archaeological and historical remains. Kangla fort and 28 more archaeological monument falls within 300 m of the project road. However, no activity causing high vibration level is planned to be undertaken within 300 m of these monument, reducing the impact to minimum. Also, there are many places of religious and cultural importance along the project road. Other than this there are also chances of chance finding archaeological remains, artifacts, coins etc. during excavation. Following measures shall be undertaken to prevent this.

- Consult State Department of Archaeology to obtain an expert assessment for construction near the archaeological monuments in project area (as listed in Table 58). Consider alternatives if the site is found to be of medium or high risk.
- Develop a protocol for use by the Contractors in conducting any excavation work close to archaeological monuments and elsewhere in project area, to ensure that any chance finds are recognized, and measures are taken to ensure they are protected and conserved.
- If fossils, coins, articles of value or antiquity, structures, and their remains of geologic or archaeological interest are found, local government shall be immediately informed of such discovery and excavation shall be stopped until identification of cultural relics by the authorized institution and clearance is given for proceeding with work. All the above discovered on site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation.
- The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing.
- He shall, immediately upon discovery thereof and before removal acquaint the Employer and ASI of such discovery and carry out their instructions for dealing with the same.

5.8 Key Impacts During Operation Phase

Being a road improvement and rehabilitation project, project is not expected to have any impact during operation phase. However, it is expected traffic volume will increase with time. Traffic projection rate for the area is given in Table. From the data, it can be viewed area has higher traffic projection rate than standard 5% for 2 Axle, 3 Axle, MAV, Taxis, 2 wheelers and cars. The reason is due to unavailability of well-developed public transportation system due to which dependence for transportation and travelling is majorly on private vehicles. With increase in number of vehicles with time, it is likely to increase in vehicular emission, air modeling study (Annexure 9) is conducted to understand the impact of increased vehicular number on the air quality and is given in section below. Also, with increased no of vehicles, noise level is also likely to increase and the same has been discussed in the section below.

Other than this impact may be due to maintenance works of roads which is also anticipated to be less frequent than present scenario as the roads proposed are rigid pavement which requires comparatively less maintenance and repair. Aesthetics in the area will improve due to improved road condition, proper road infrastructure, adequate drains, landscaping along the road corridors. Provision if utility chamber will reduce the need of excavation of roads which is required on regular basis for routine laying new or maintenance & repair of existing utilities. Project will bring in the adequate road safety measures which will significantly enhance the road safety and reduce the number of accidents. Project overall is expected to bring in positive impact for community by provision of smooth maintained roads, reduction of traffic jams, reduction in vehicular emissions and fuel consumption, overall reducing vehicle operating cost and enhancing the quality of life.

5.8.1 Ambient Air Quality Monitoring Study

Methodology for Air Quality Modelling: CALINE 4 (Caltrans, 1989) is a simple line source Gaussian plume dispersion model that predicts air impacts near roadways. The model is broadly divided into five screens such as Job Parameters, Run Conditions, Link Geometry, Link Activity and Receptor

Positions

Job Parameters

Run Type: determine averaging times and how the hourly average wind angle(s) will be determined. In the present case modelling exercises were made to predict the impact on worst case scenario. Multi-Run / Worst Case Hybrid type was used for PM, NO2, CO impact modelling.

Aerodynamic Roughness Coefficient: determine the amount of local air turbulence that affects plume spreading. CALINE 4 offers the 4 choices for aerodynamic roughness Coefficient namely, Rural, Suburban, Central Business District and Other. For the present modelling rural roughness options have been considered.

Altitude above Sea Level: Define the altitude above mean sea level. This input is used to determine the rate of plume spreading.

Running conditions.

Wind Speed: Expressed in meters per second. USEPA recommends a value of 1 m/s as the worst-case wind speed.

Wind Direction: The direction the wind is blowing from, measured clockwise in degrees from the north. As the model study is on “Worst Case scenario”, CALINE 4 will consider this input.

Link Geometry

Link Type: 5 choices available such as At Grade, Fill, Depressed, Bridge and Parking lot. In this model study At Grade link type is used.

Link Height: For the project link height is considered as zero.

Mixing Zone Width: Mixing zone is defined as the width of the roadway, plus 3m on either side.

Link Activity

Traffic Volume: The hourly traffic volume anticipated to travel on each link, in units of vehicles per hour.

Emission Factor: The weighted average emission rate of the local vehicle fleet, expressed in terms of grams / mile per vehicle.

Receptor Positions

Receptors positions expressed in Cartesian (x, y) coordinate system. Z value can also be provided to assess the proposed impacts at various heights. For the present case incremental GLCs were assessed. Approach and Methodology Emission Factors were arrived using standard values prescribed by The Automotive Research Association of India, Pune under Air Quality Monitoring Project-Indian Clean Air Program (ICAP). Traffic load and emission factors were estimated for traffic sections. Table below presents the Traffic and emission factors considered for the project.

Table 70: Traffic and emission factors for traffic sections at Advance Hospital

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	16	1.47000	1.890000	4.210000
2030	24	2.22000	2.910000	6.370000
2040	38	3.50000	4.580000	9.770000
2050	55	5.15000	6.620000	1.380000
2060	74	6.95000	8.950000	1.830000

Table 71: Traffic and emission factors for traffic sections at Ahallup

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	4	0.033146125	0.510076229	1.253779597
2030	9	0.05138371	0.789088726	1.894721162
2040	19	0.080845956	1.239212218	2.901956446
2050	40	0.116993007	1.790932162	4.106840811
2060	82	0.158076547	2.417625365	5.448028454

Table 72: Traffic and emission factors for traffic sections at Central Agriculture University

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	2	0.015999382	0.239932854	0.492317813
2030	3	0.024630394	0.369537407	0.744427175
2040	8	0.038604451	0.579159473	1.142105397
2050	22	0.055787673	0.836730821	1.61954255
2060	70	0.075355744	1.129915481	2.152634736

Table 73: Traffic and emission factors for traffic sections at Herbert School

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	4	0.027308889	0.453129396	1.056663389
2030	8	0.042477919	0.702952926	1.599813073
2040	21	0.067162705	1.10848374	2.456001146
2050	65	0.097658653	1.608466642	3.483285285
2060	250	0.132521749	2.179200044	4.629770212

Table 74: Traffic and emission factors for traffic sections at Kongba Bazar

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	15	0.158600465	1.960691396	4.196210417
2030	31	0.244973892	3.035346592	6.353846544
2040	71	0.38403166	4.771757991	9.753174
2050	180	0.554100756	6.903087739	13.82932363
2060	539	0.746885631	9.326799041	18.37580749

Table 75: Traffic and emission factors for traffic sections at Lamlong Higher Secondary School

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	23	0.249576118	2.861513625	5.710984014
2030	45	0.384100531	4.422849337	8.646724858
2040	107	0.600125188	6.94543959	13.27451204
2050	282	0.863742738	10.0420445	18.82707774
2060	897	1.162054372	13.56408139	25.02384365

Table 76: Traffic and emission factors for traffic sections at Lawang Sangbam haotabi

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	4	0.033146125	0.510076229	1.253779597
2030	9	0.05138371	0.789088726	1.894721162
2040	19	0.080845956	1.239212218	2.901956446
2050	40	0.116993007	1.790932162	4.106840811
2060	82	0.158076547	2.417625365	5.448028454

Table 77: Traffic and emission factors for traffic sections at Malom Bazar

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	4	0.027308889	0.453129396	1.056663389
2030	8	0.042477919	0.702952926	1.599813073
2040	21	0.067162705	1.10848374	2.456001146

2050	65	0.097658653	1.608466642	3.483285285
2060	250	0.132521749	2.179200044	4.629770212

Table 78: Traffic and emission factors for traffic sections at New Age Public School

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	7	0.033976354	0.65477666	1.941380306
2030	13	0.052944842	1.01355118	2.929077699
2040	32	0.083809199	1.593387263	4.478719445
2050	83	0.121935349	2.30541449	6.329700749
2060	261	0.165518218	3.115553991	8.387574012

Table 79: Traffic and emission factors for traffic sections at Prism Academy

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	29	0.235009833	3.304333424	7.556844396
2030	44	0.363880992	5.123792578	11.43695175
2040	69	0.572226118	8.072134217	17.54938039
2050	100	0.828061478	11.70116616	24.87870891
2060	134	1.119067821	15.83796936	33.05410611

Table 80: Traffic and emission factors for traffic sections at RIMS

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	32	0.364434069	3.653143257	7.680106653
2030	60	0.559007474	5.628627089	11.60392642
2040	134	0.869803696	8.804416763	17.77060487
2050	322	1.247153222	12.68460169	25.14799574
2060	913	1.672331617	17.08059639	33.3606615

Table 81: Traffic and emission factors for traffic sections at Royal Academy of Science

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	17	0.176457042	2.152576688	4.395755285
2030	35	0.272659709	3.33941818	6.663607873
2040	81	0.427686716	5.262460589	10.24231517
2050	204	0.617467256	7.629106413	14.54032019
2060	601	0.832779958	10.3264111	19.3408406

Table 82: Traffic and emission factors for traffic sections at Shishu Nistha Niketan

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	6	0.038034639	0.643413417	1.629202146
2030	9	0.059171845	0.997867187	2.463721516
2040	14	0.093546946	1.57267606	3.777047873
2050	20	0.135989846	2.28073648	5.350365508
2060	27	0.184488139	3.088418944	7.103924043

Table 83: Traffic and emission factors for traffic sections at St Anthony's High School

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	4	0.033146125	0.510076229	1.253779597
2030	9	0.05138371	0.789088726	1.894721162
2040	19	0.080845956	1.239212218	2.901956446
2050	40	0.116993007	1.790932162	4.106840811
2060	82	0.158076547	2.417625365	5.448028454

Table 84: Traffic and emission factors for traffic sections at St Joseph School

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	6	0.038034639	0.643413417	1.629202146
2030	9	0.059171845	0.997867187	2.463721516
2040	14	0.093546946	1.57267606	3.777047873
2050	20	0.135989846	2.28073648	5.350365508
2060	27	0.184488139	3.088418944	7.103924043

Table 85: Traffic and emission factors for traffic sections at New Light Public School

Year	Traffic Volume per day	Emission for PM	Emission for NO2	Emission for CO
2022	7	0.033976354	0.65477666	1.941380306
2030	10	0.052944842	1.01355118	2.929077699
2040	16	0.083809199	1.593387263	4.478719445
2050	23	0.121935349	2.30541449	6.329700749
2060	30	0.165518218	3.115553991	8.387574012

Results

Dispersion model software was run by using data as discussed above. The output results at various distances along the project highway for projected year 2059-60 are presented in Table and Figure below.

1. Advanced Hospital

a. PM

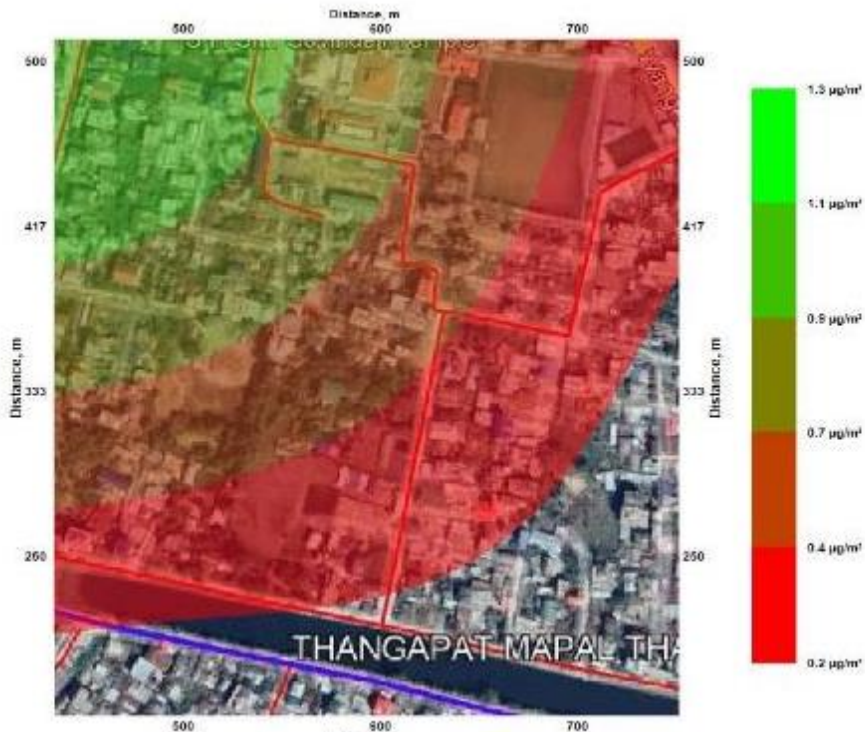


Figure 35: Isopleth for PM for the projected year 2059-60



Figure 36: Isopleth for NO2 for the projected year 2059-60



Figure 37: Isopleth for CO for the projected year 2059-60

Table 86: Baseline Incremental Value in 2059-60 near Advanced Hospital

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO2 ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	1.100	13.800	28.4

2. Ahallup

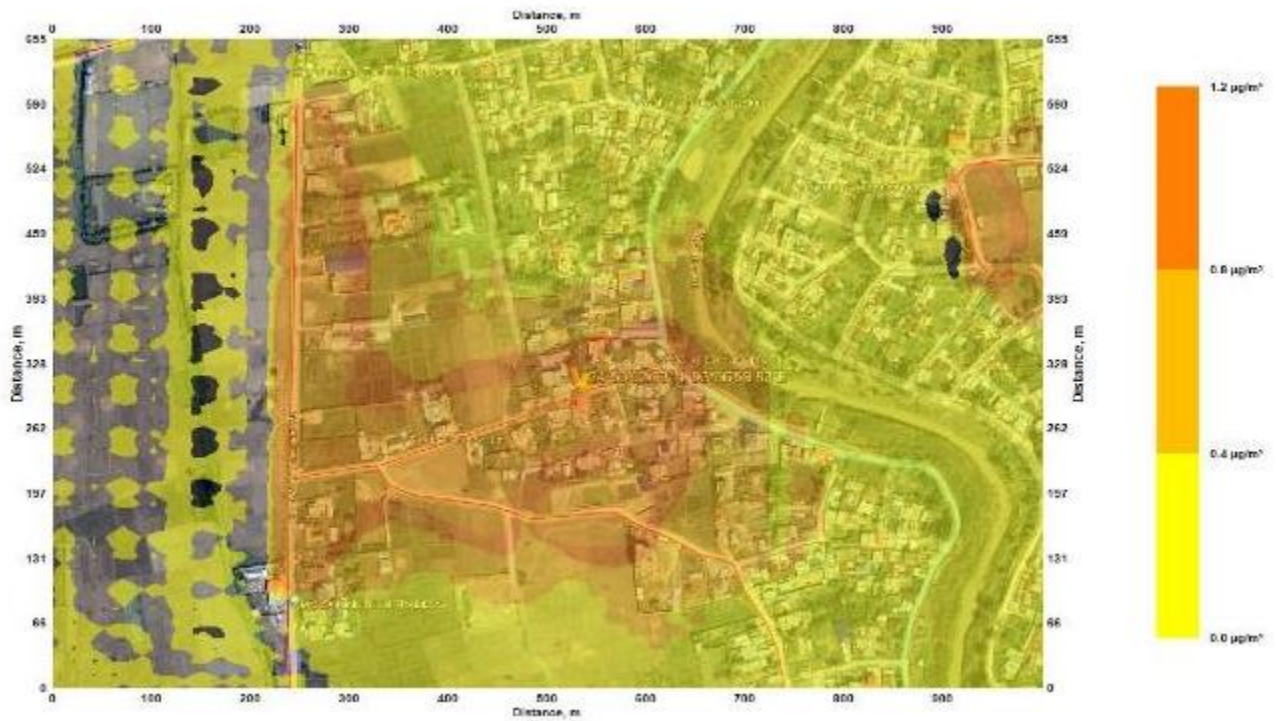


Figure 38: Isopleth for PM for the projected year 2059-60

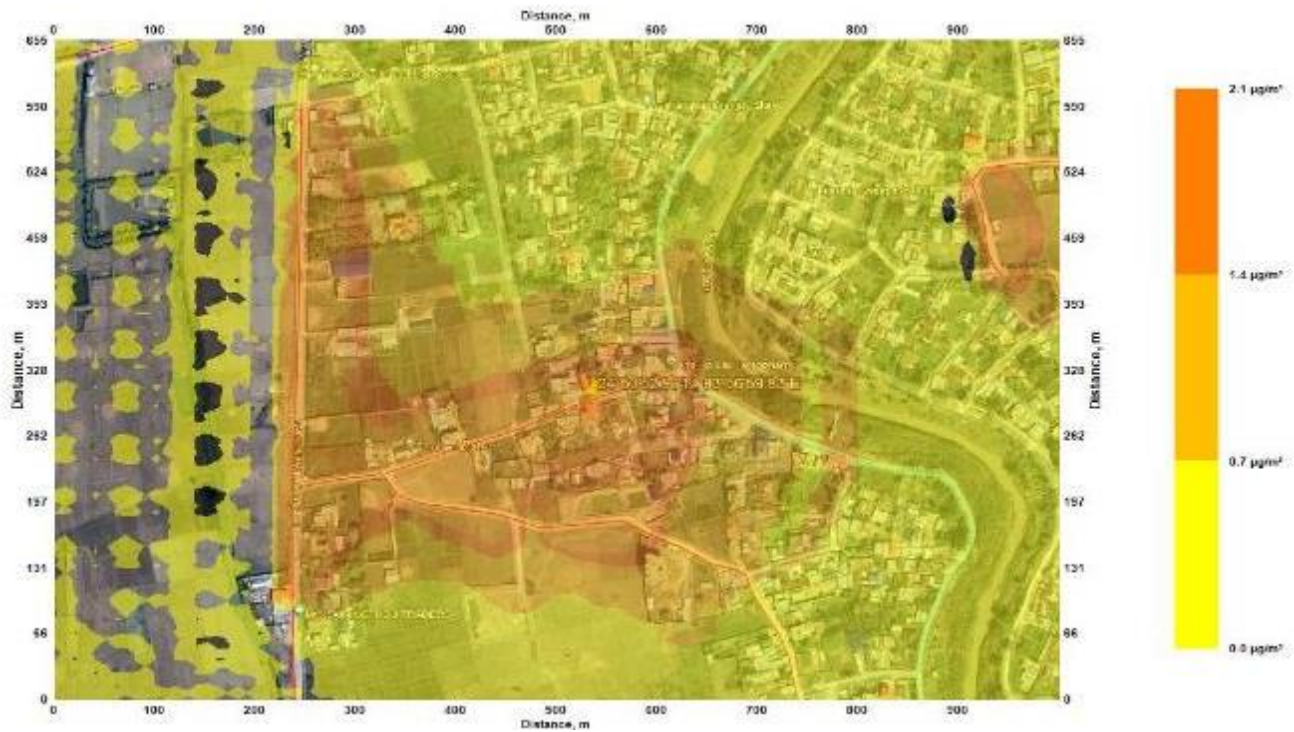


Figure 39: Isopleth for NO₂ for the projected year 2059-60

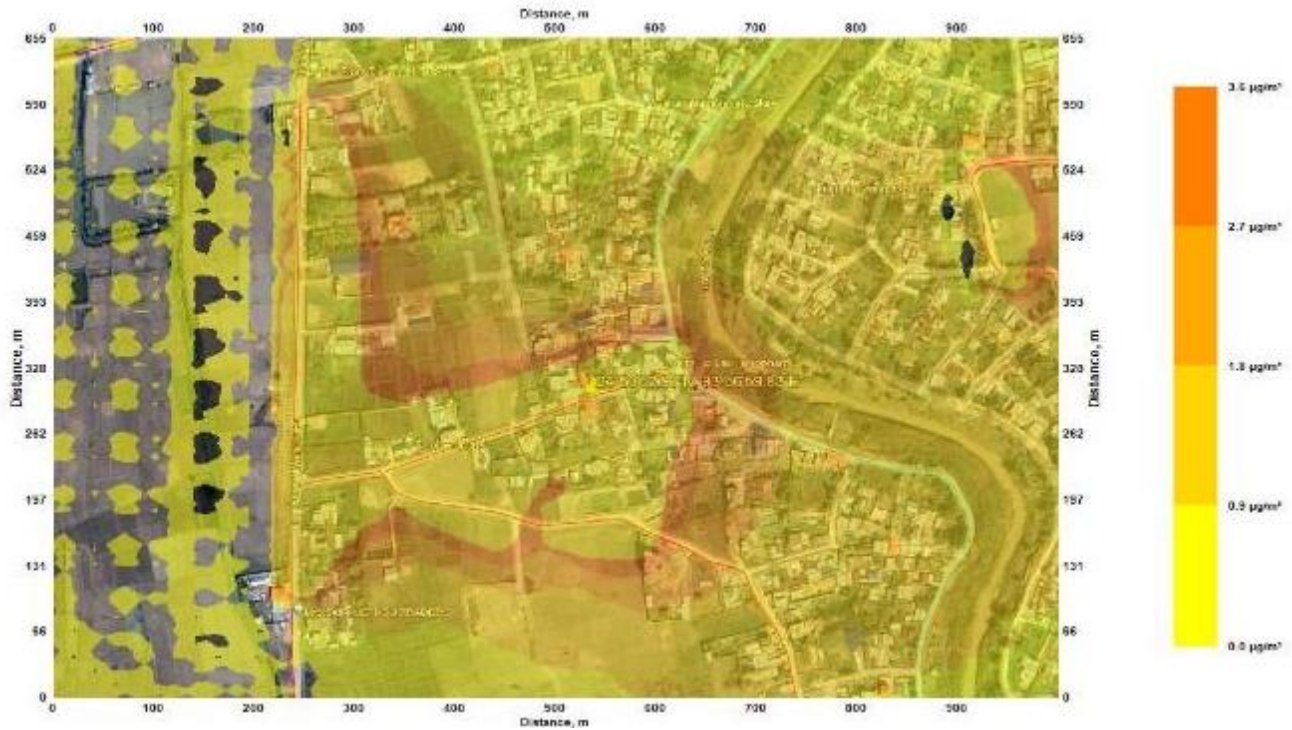


Figure 40: Isopleth for CO for the projected year 2059-60

Table 87: Baseline Incremental Value in 2059-60 near Ahallup

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO ₂ ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	0.800	1.100	2.700

3. Central Agriculture University

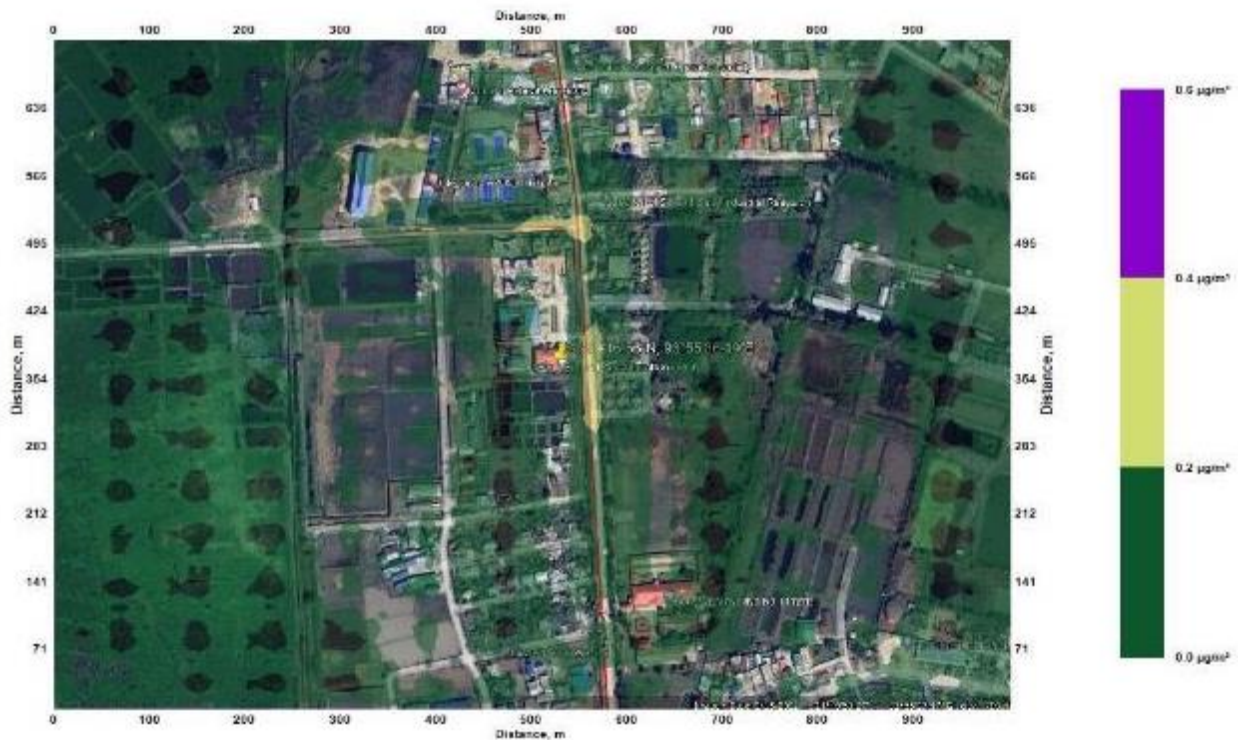


Figure 41: Isopleth for PM for the projected year 2059-60

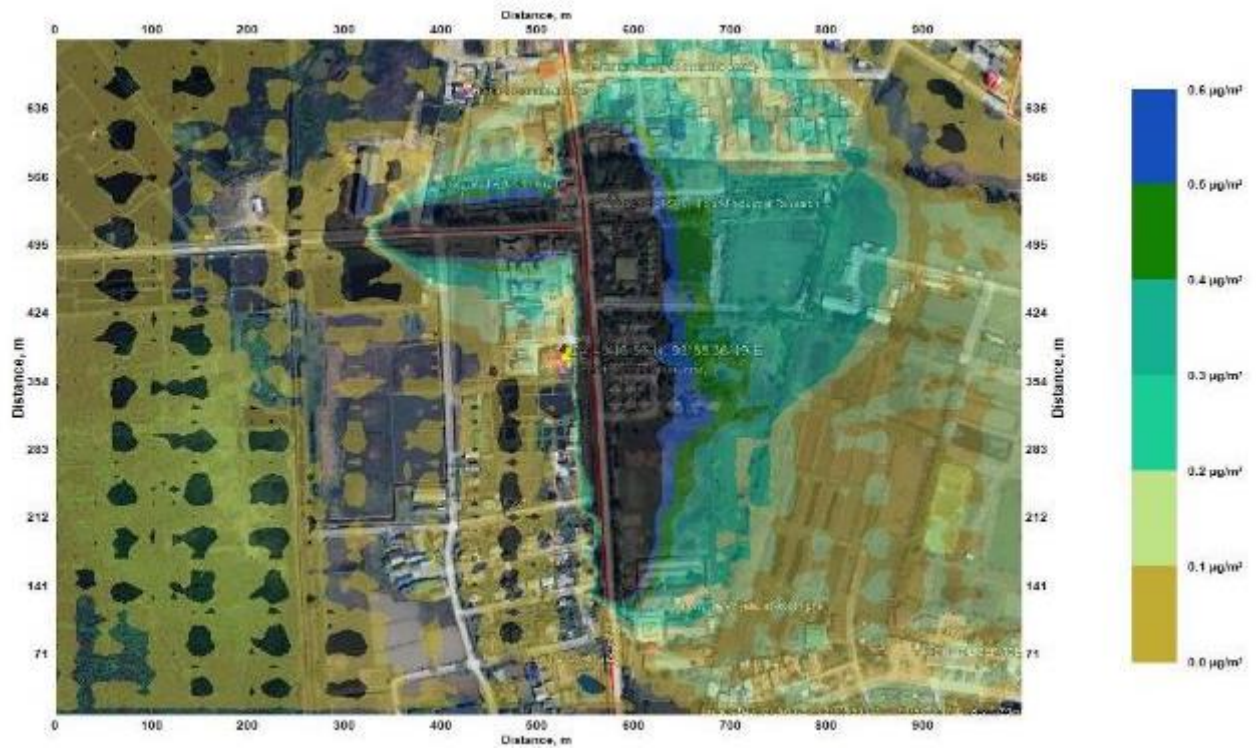


Figure 42: Isopleth for NO₂ for the projected year 2059-60

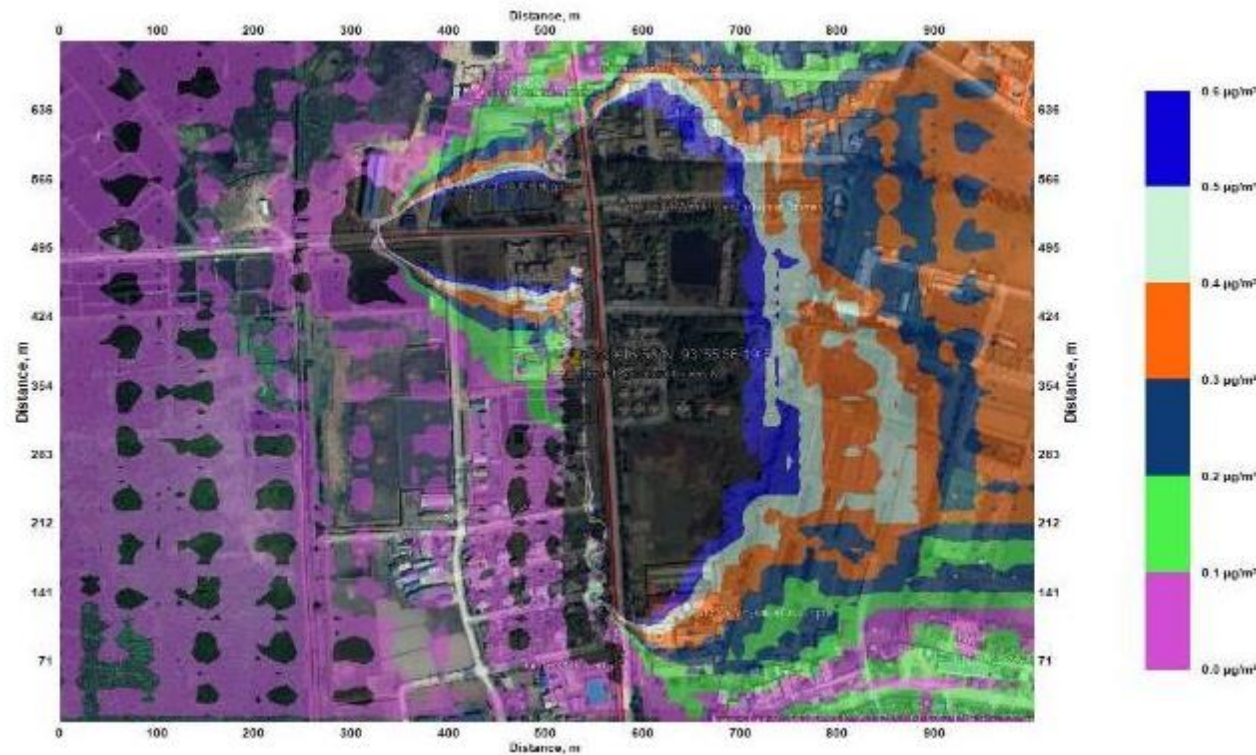


Figure 43: Isopleth for CO for the projected year 2059-60

Table 88: Baseline Incremental Value in 2059-60 near Central Agriculture University

Year	Incremental in PM in (ug/m ³)	Incremental in NO ₂ (ug/m ³)	Incremental in CO (ug/m ³)
2060	0.100	0.100	0.200

4. Herbert School

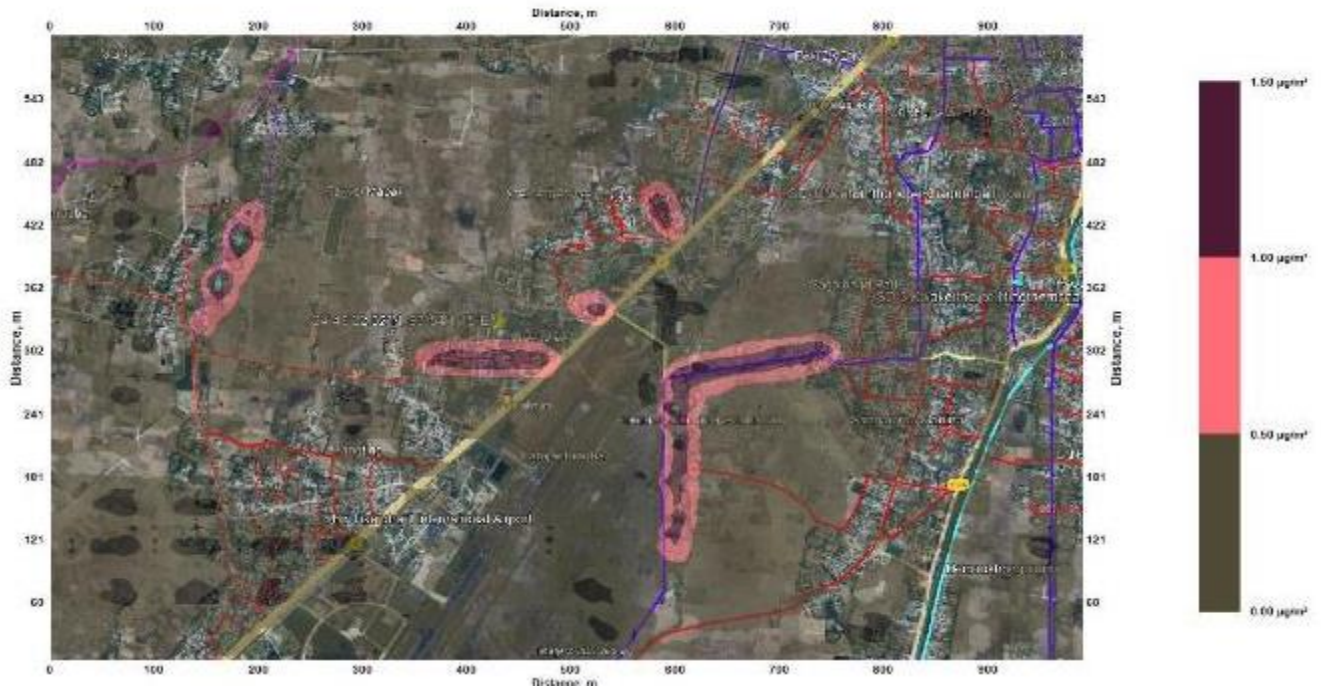


Figure 44: Isopleth for PM for the projected year 2059-60

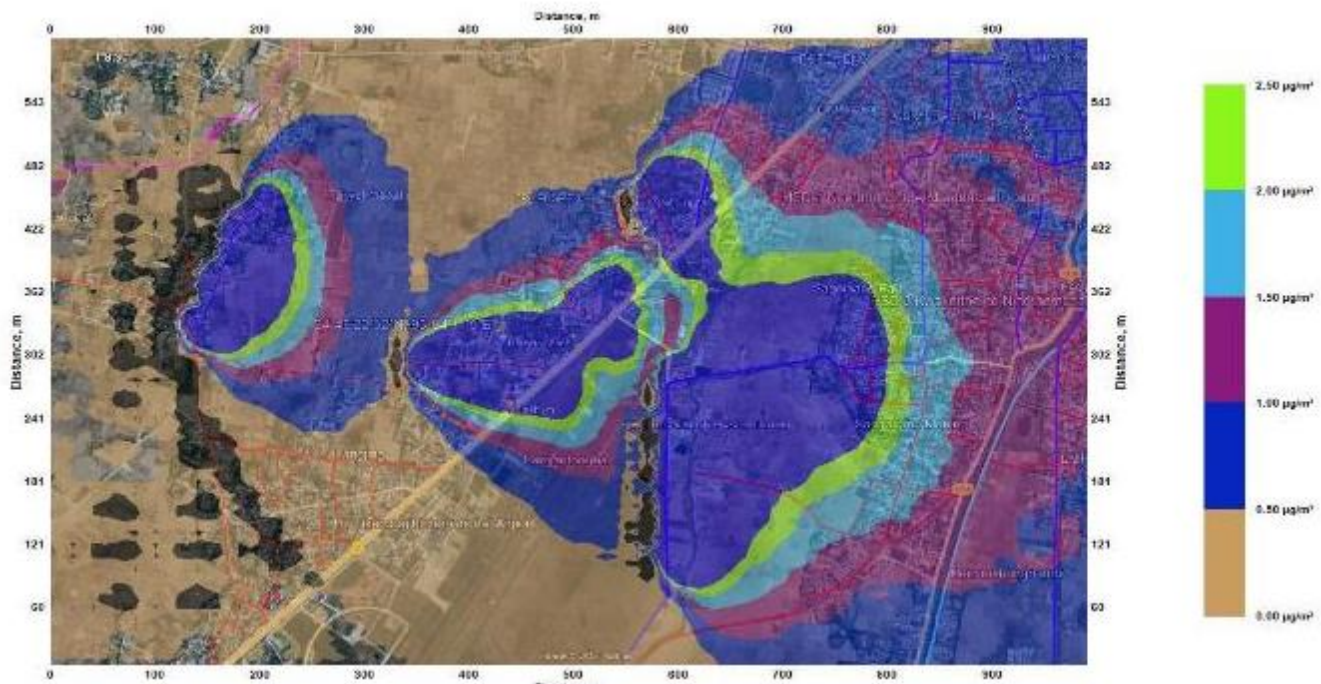


Figure 45: Isopleth for NO₂ for the projected year 2059-60

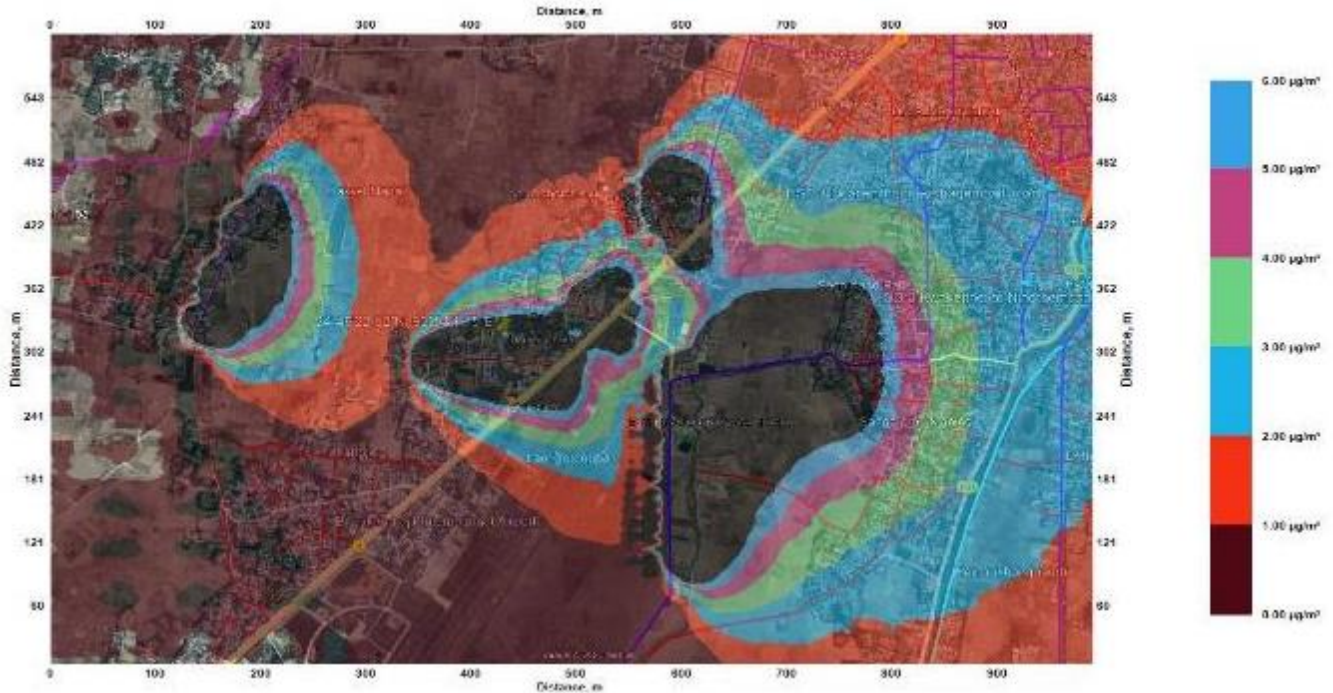


Figure 46: Isopleth for CO for the projected year 2059-60

Table 89: Baseline Incremental Value in 2059-60 near Herbert School

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO ₂ ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	1.00	2.50	2.300

5. Kongba Bazar



Figure 47: Isopleth for PM for the projected year 2059-60

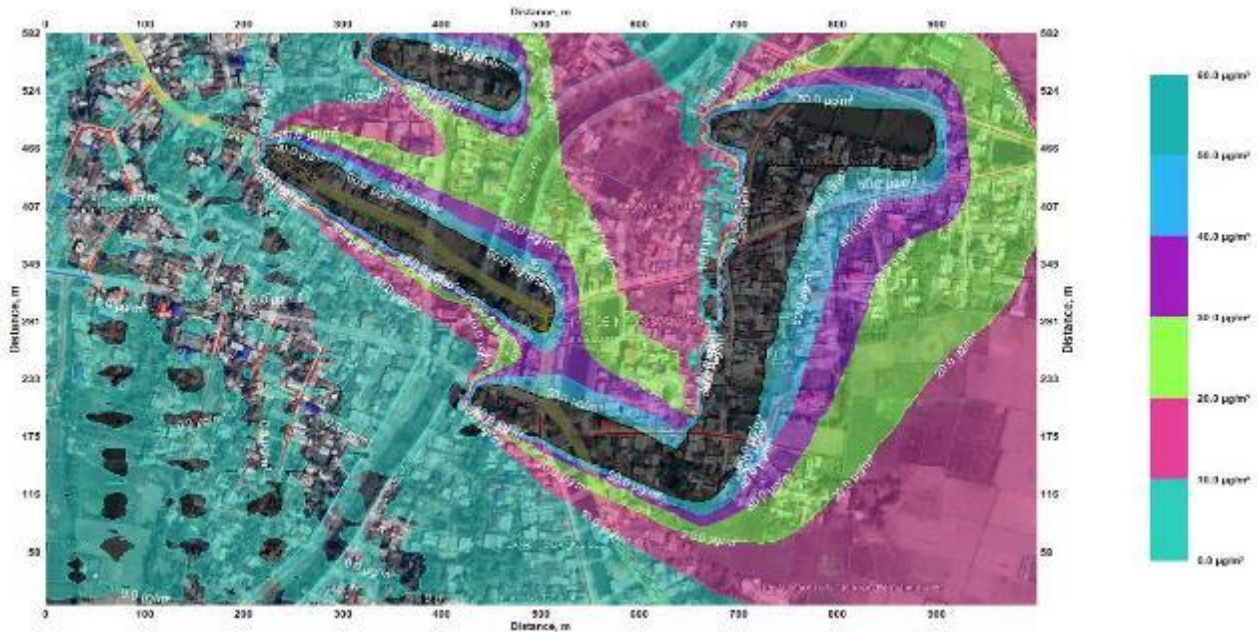


Figure 48: Isopleth for NO2 for the projected year 2059-60



Figure 49: Isopleth for CO for the projected year 2059-60

Table 90: Baseline Incremental Value in 2059-60 near Konga Bazar

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO2 ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	3.100	38.400	75.500

6. Lamlong Higher Secondary School

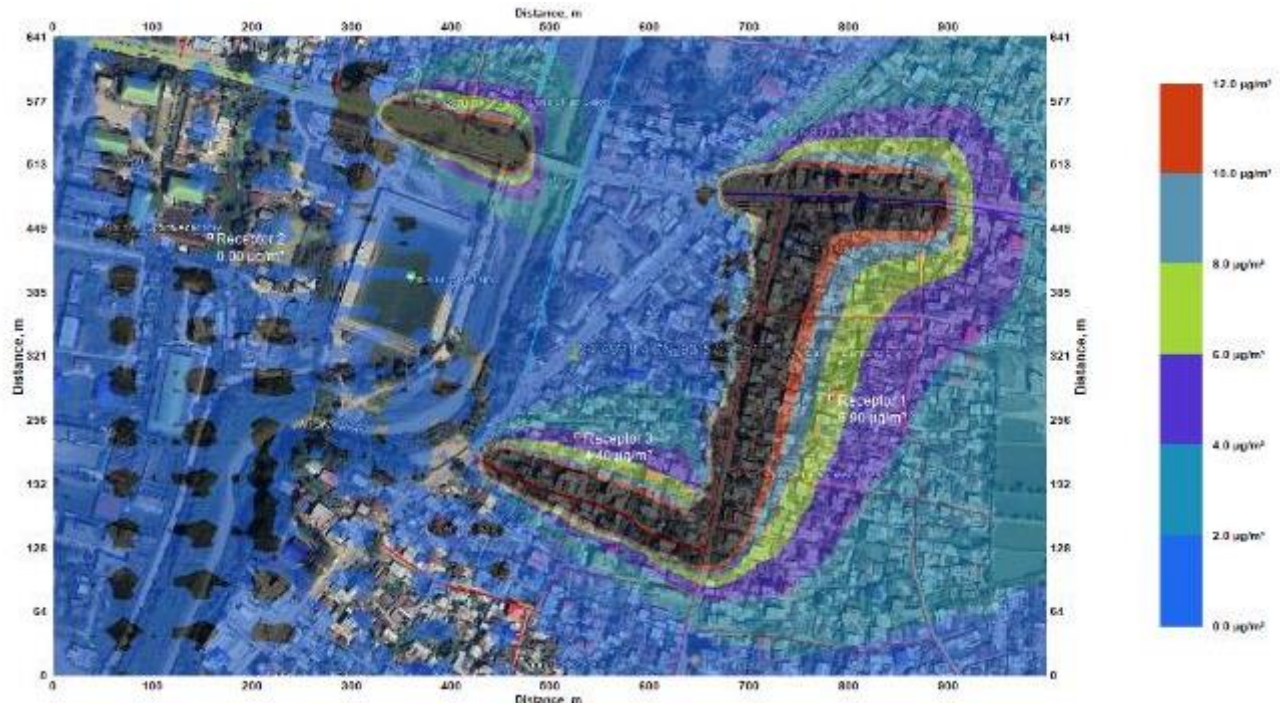


Figure 50: Isopleth for PM for the projected year 2059-60

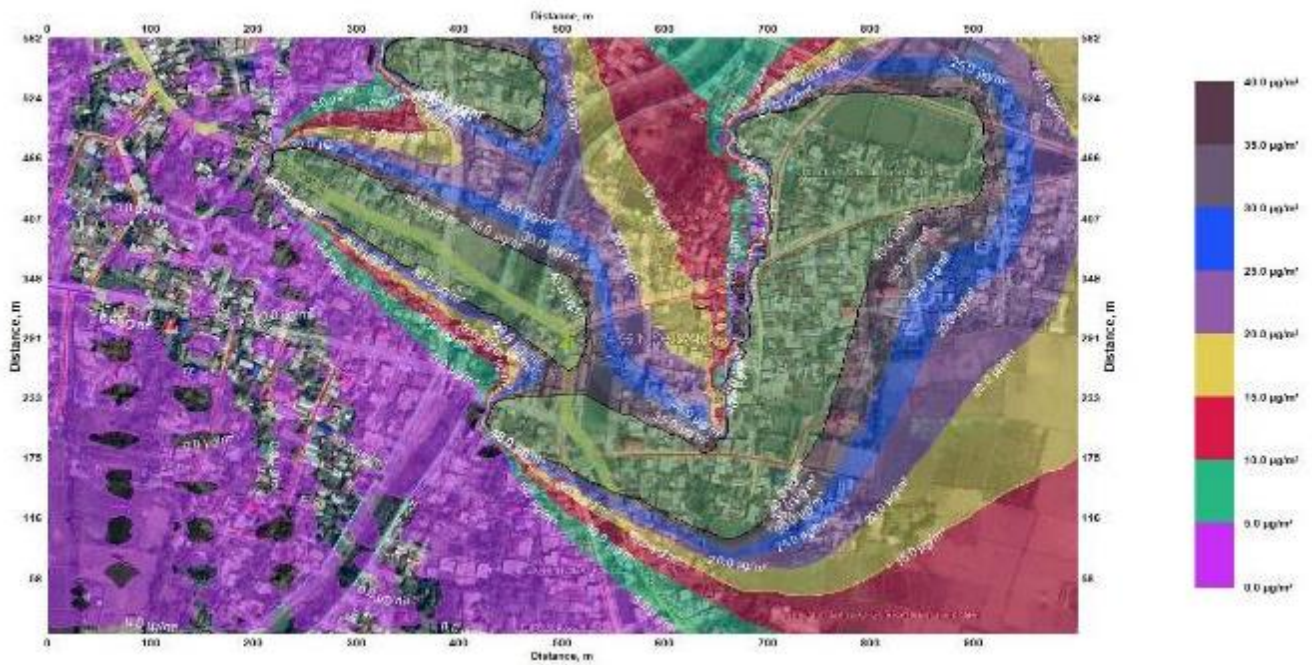


Figure 51: Isopleth for NO₂ for the projected year 2059-60

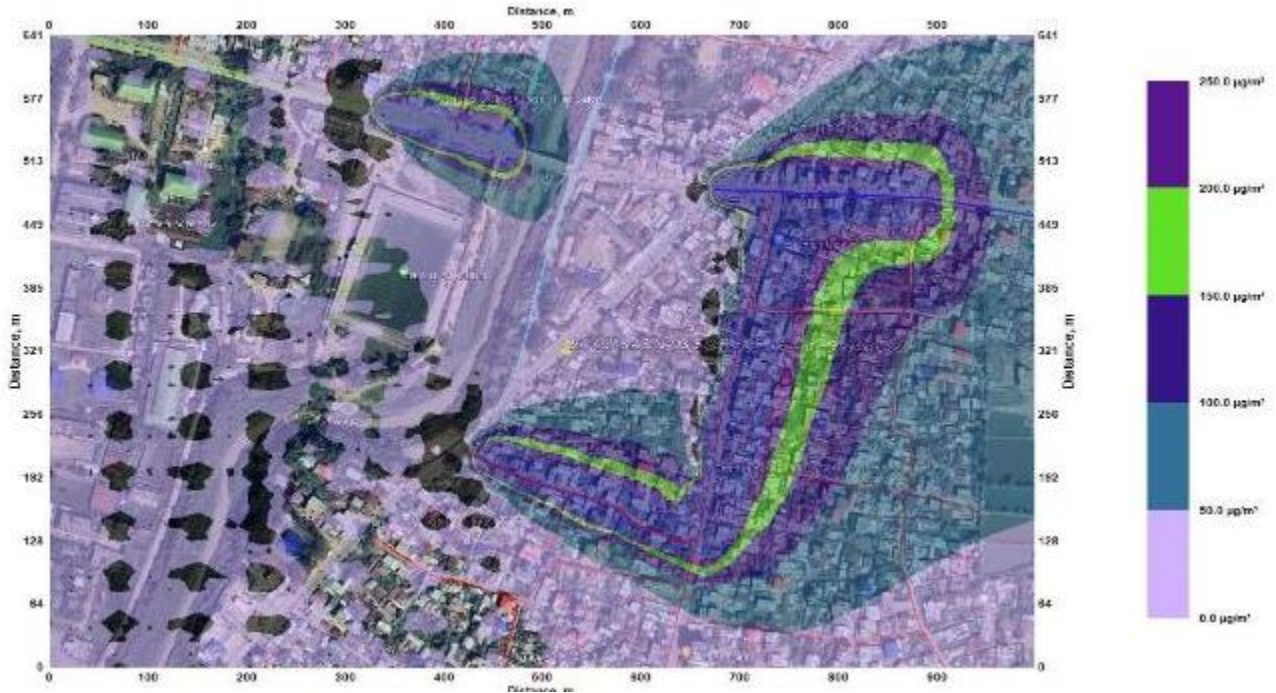


Figure 52: Isopleth for CO for the projected year 2059-60

Table 91: Baseline Incremental Value in 2059-60 near Konga Bazar

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO ₂ ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	6.900	38.400	150.600

7. Lawang Sangbam haotabi



Figure 53: Isopleth for PM for the projected year 2059-60



Figure 54: Isopleth for NO2 for the projected year 2059-60



Figure 55: Isopleth for CO for the projected year 2059-60

Table 92: Baseline Incremental Value in 2059-60 near Lawang Sangbam haotabi

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO2 ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	0.100	1.400	3.400

8. Malom Bazar



Figure 56: Isopleth for PM for the projected year 2059-60



Figure 57: Isopleth for NO2 for the projected year 2059-60

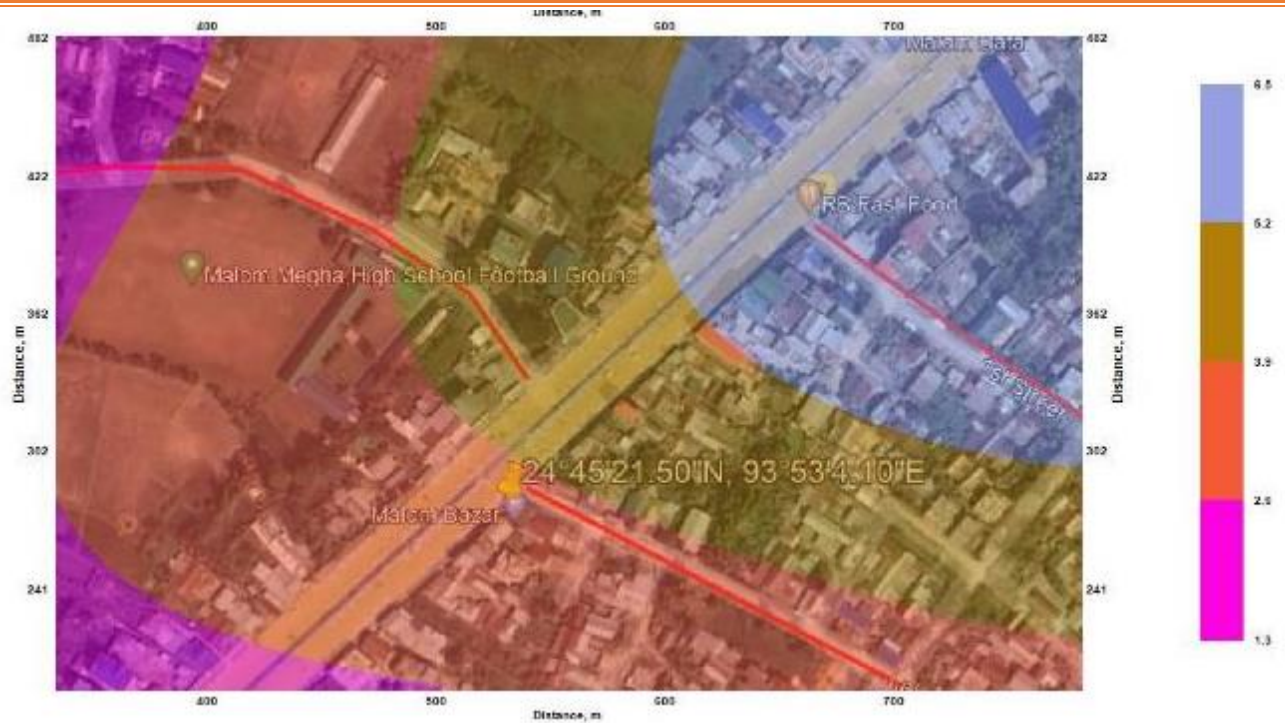


Figure 58: Isopleth for CO for the projected year 2059-60

Table 93: Baseline Incremental Value in 2059-60 near Malom Bazar

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO ₂ ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	0.100	3.0	6.50

9. New Age Public School

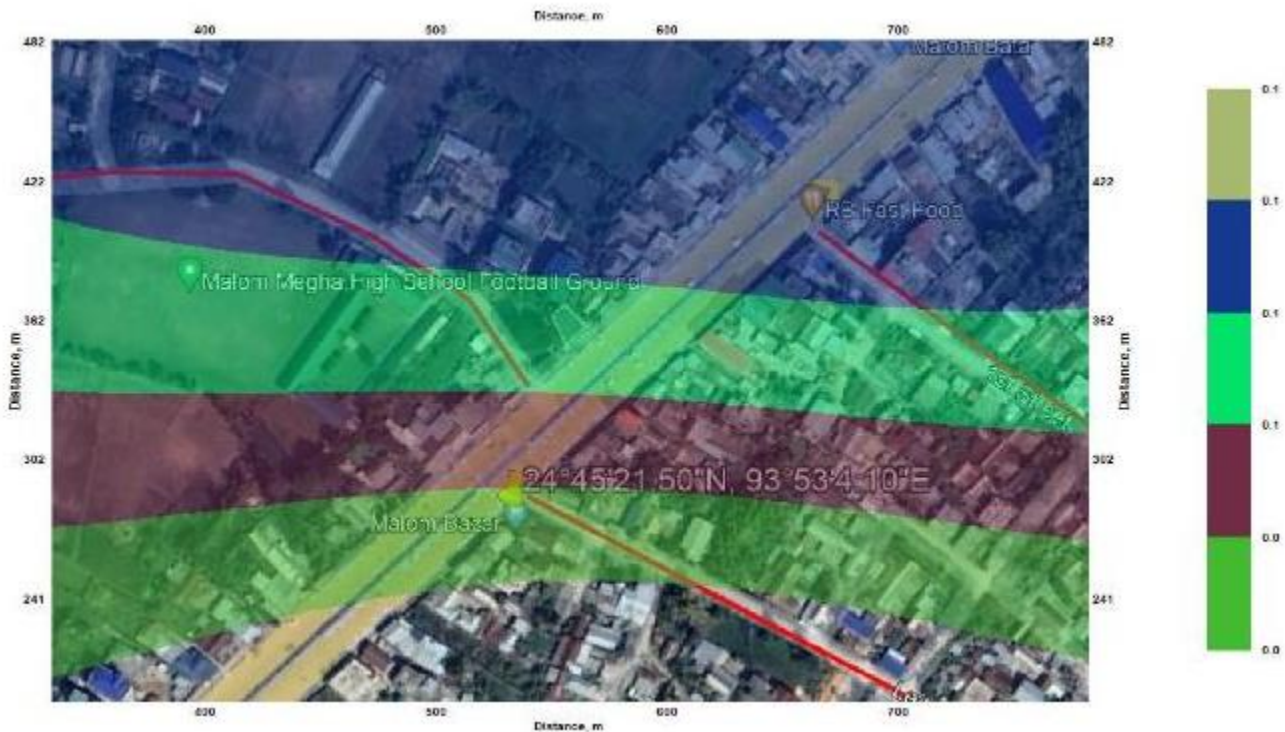


Figure 59: Isopleth for PM for the projected year 2059-60

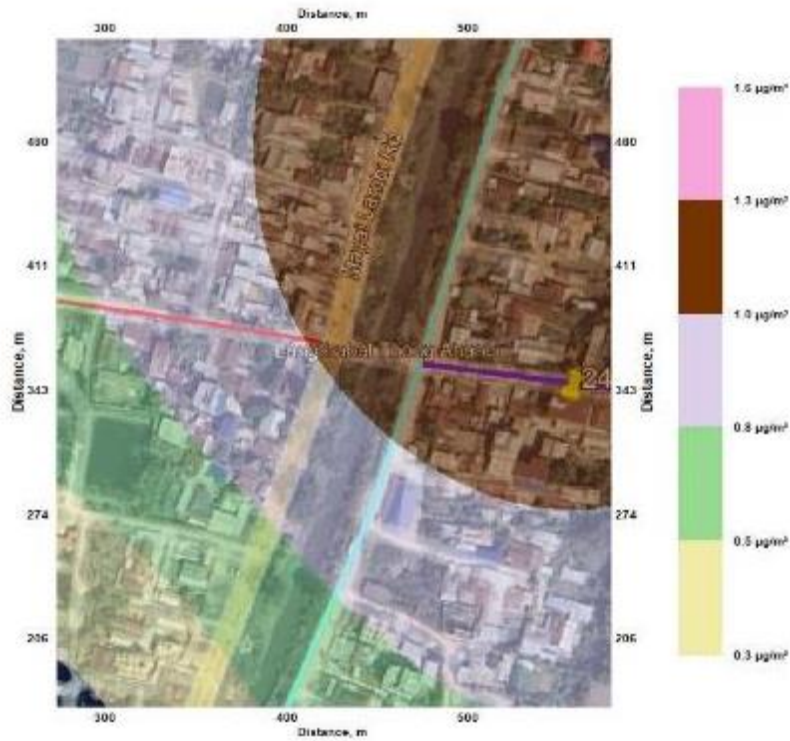


Figure 60: Isopleth for NO2 for the projected year 2059-60

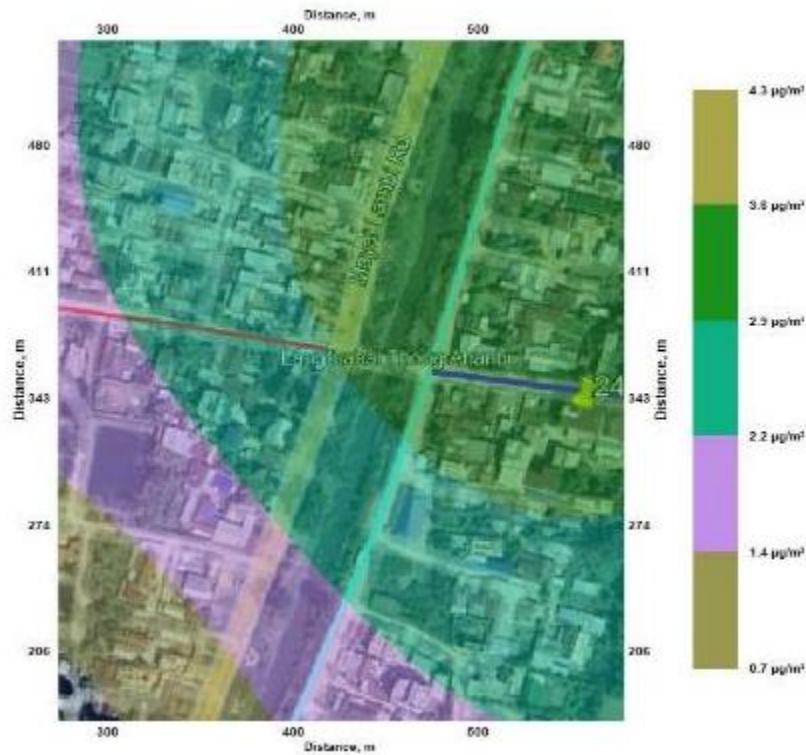


Figure 61: Isopleth for CO for the projected year 2059-60

Table 94: Baseline Incremental Value in 2059-60 near New Age Public School

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO2 ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	0.10	1.300	3.600

10. New Light Public School

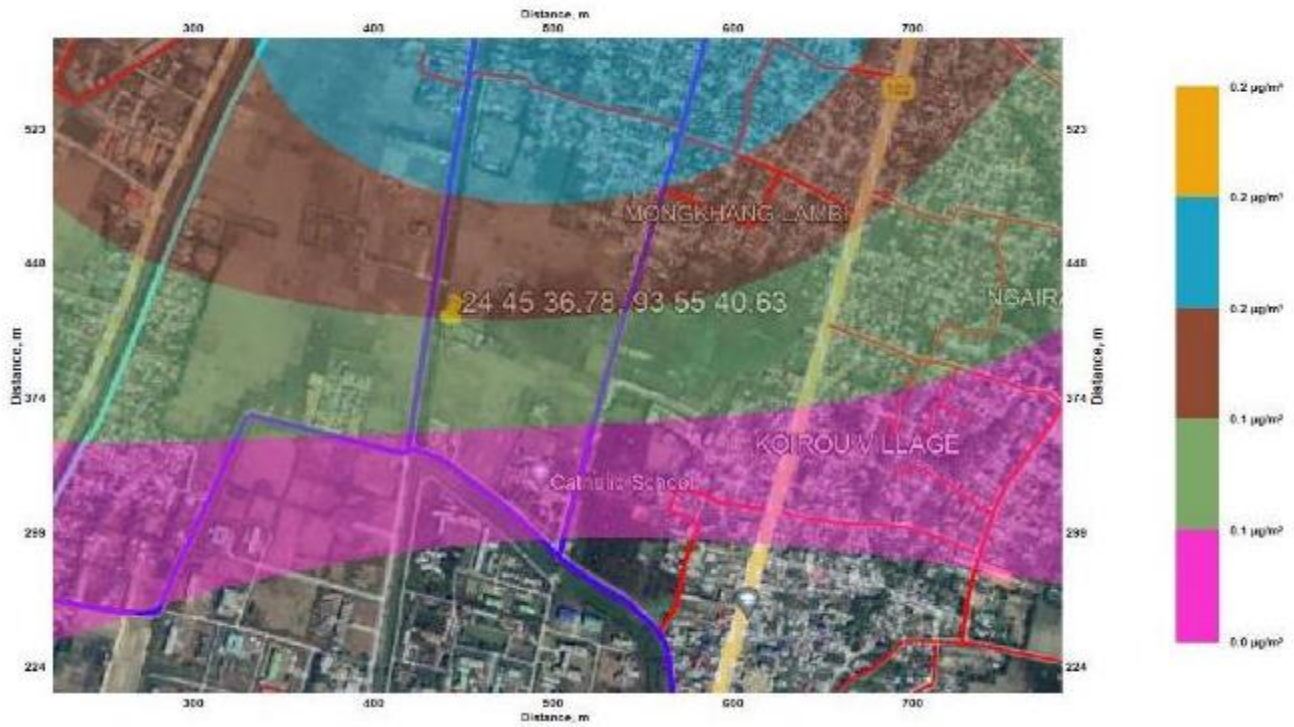


Figure 62: Isopleth for PM for the projected year 2059-60



Figure 63: Isopleth for NO2 for the projected year 2059-60

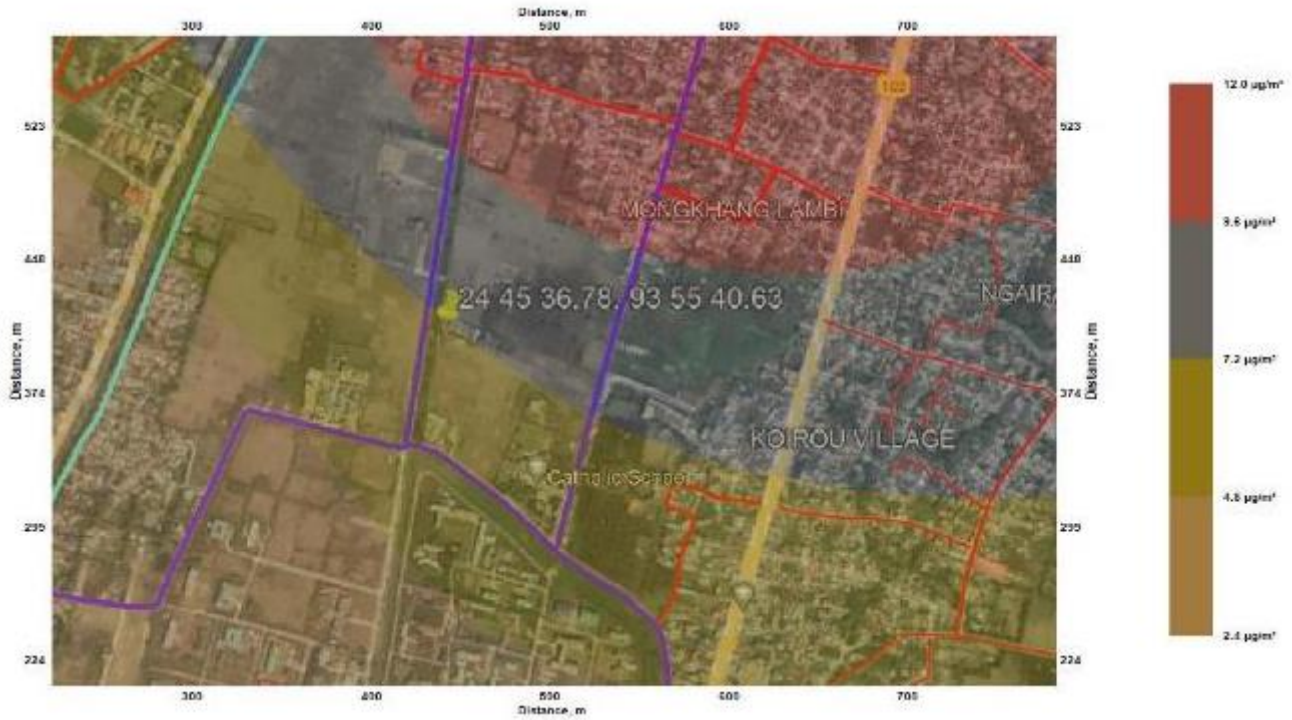


Figure 64: Isopleth for CO for the projected year 2059-60

Table 95: Baseline Incremental Value in 2059-60 near New Light Public School

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO ₂ ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	0.200	4.400	12.00

11. Prism Academy



Figure 65: Isopleth for PM for the projected year 2059-60



Figure 66: Isopleth for NO2 for the projected year 2059-60



Figure 67: Isopleth for CO for the projected year 2059-60

Table 96: Baseline Incremental Value in 2059-60 near Prism Academy

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO2 ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	1.0	13.200	27.300

12. RIMS



Figure 68: Isopleth for PM for the projected year 2059-60



Figure 69: Isopleth for NO₂ for the projected year 2059-60



Figure 70: Isopleth for CO for the projected year 2059-60

Table 97: Baseline Incremental Value in 2059-60 near RIMS

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO ₂ ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	3.10	31.5	61.8

13. Royal Academy of Science

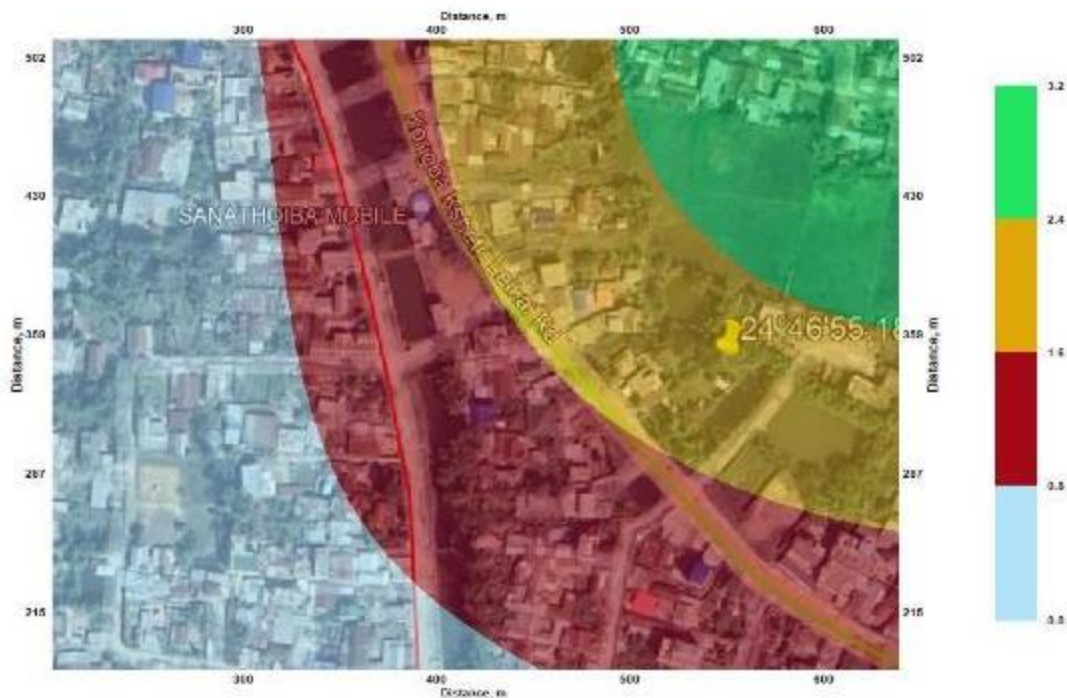


Figure 71: Isopleth for PM for the projected year 2059-60



Figure 72: Isopleth for NO2 for the projected year 2059-60



Figure 73: Isopleth for CO for the projected year 2059-60

Table 98: Baseline Incremental Value in 2059-60 near Royal Academy of Science

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO2 ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	3.1	38.5	72.10

14. Shishu Nistha Niketan



Figure 74: Isopleth for PM for the projected year 2059-60



Figure 75: Isopleth for NO2 for the projected year 2059-60



Figure 76: Isopleth for CO for the projected year 2059-60

Table 99: Baseline Incremental Value in 2059-60 near Shishu Nistha Niketan

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO ₂ ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	0	1.0	2.5

15. St Anthony's High School

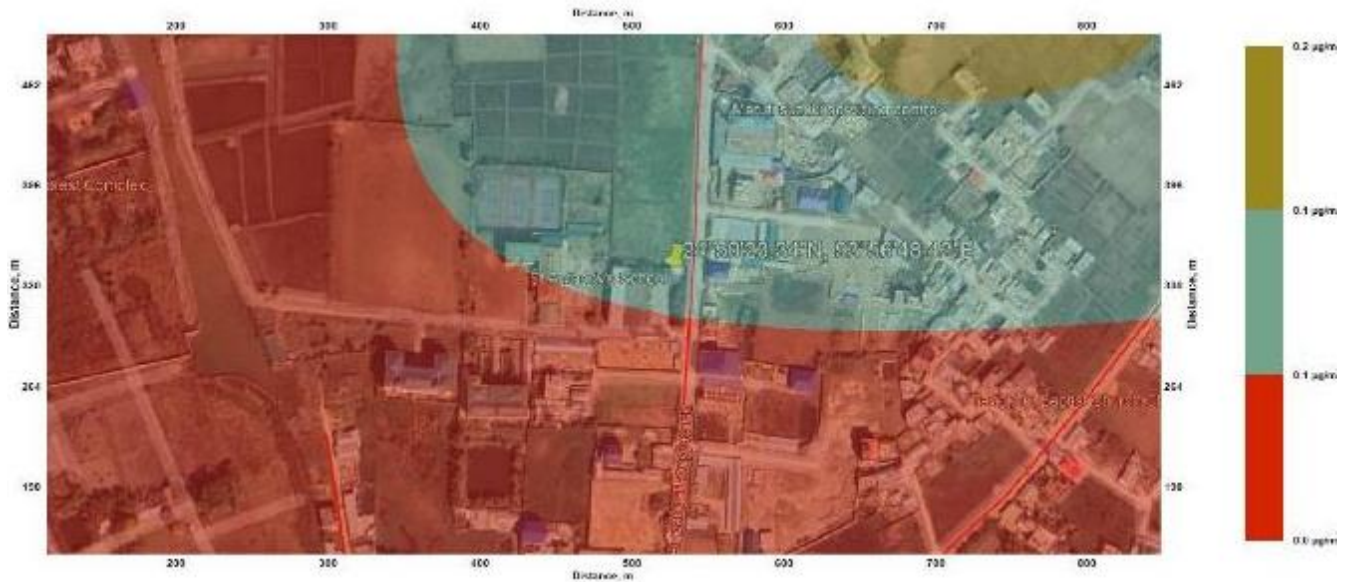


Figure 77: Isopleth for PM for the projected year 2059-60



Figure 78: Isopleth for NO2 for the projected year 2059-60



Figure 79: Isopleth for CO for the projected year 2059-60

Table 100: Baseline Incremental Value in 2059-60 near St Anthony's High School

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO2 ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	0.100	1.00	2.2

16. St Joseph School

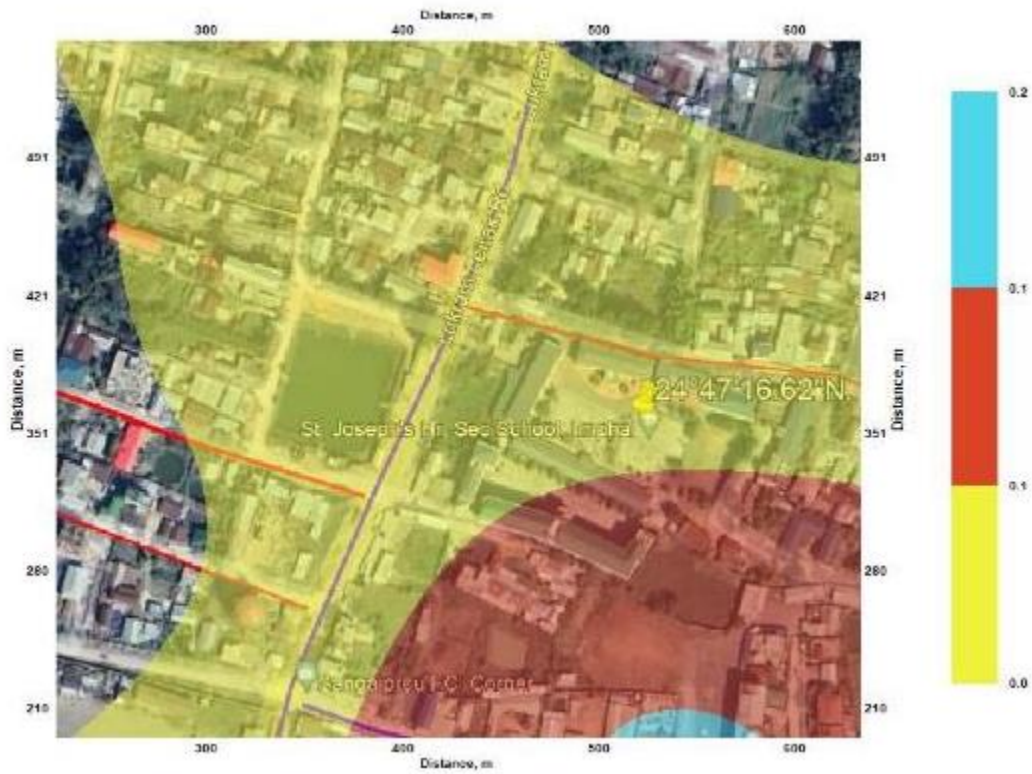


Figure 80: Isopleth for PM for the projected year 2059-60

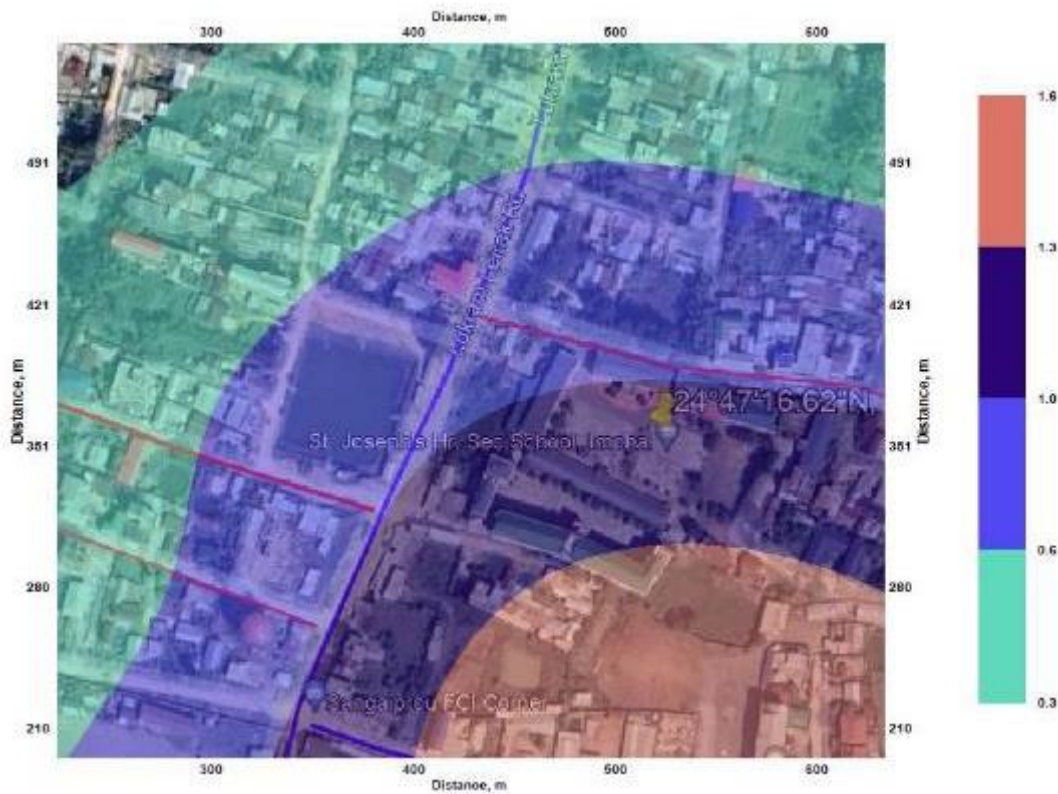


Figure 81: Isopleth for NO2 for the projected year 2059-60



Figure 82: Isopleth for CO for the projected year 2059-60

Table 101: Baseline Incremental Value in 2059-60 near St Joseph School

Year	Incremental in PM in ($\mu\text{g}/\text{m}^3$)	Incremental in NO ₂ ($\mu\text{g}/\text{m}^3$)	Incremental in CO ($\mu\text{g}/\text{m}^3$)
2060	0.100	1.6	3.7

17. Conclusion

Considering the maximum baseline ambient concentration of PM, NO_x, and CO i.e., 6.900 $\mu\text{g}/\text{m}^3$, 38.400 $\mu\text{g}/\text{m}^3$, 150.60 $\mu\text{g}/\text{m}^3$ / 0.0150 mg/m^3 and predicted incremental concentration is more than the Ambient Air Quality Standards.

5.8.2 Impact on Noise

During operation noise generating sources will be traffic noise and road-side commercial activities at some places. Noise generated due to traffic on this road will have impact on the nearby habitations. Noise level in the study area is already higher than the prescribed standards as per the baseline data collected for this IEE study. Noise level is also likely to increase in future due to increase in number of vehicles. Thus, cumulative noise level will further increase leading to issues of noise pollution.

An assessment of cumulative noise levels has been computed using vitrans Dhwani Pro v Model. As per the modeling study, resultant noise level is much higher than the prescribed standards. Detailed modeling study is attached as Annexure 7. Measures for managing the noise level during operation phase are.

- Installation of noise barriers along silence zone
- Plantation of double row of trees along the road
- Regulating the speed limit
- Regulating the movement of the heavy vehicles during peak hours
- Provision of speed regulating infrastructures like rumble strips, speed breakers
- Prohibition of honking especially near silence zones and at traffic signals

- Imposition of strict ban on usage of shrill horns, vacuum horns, musical horns
- Regular patrolling to check the encroachment of RoW to maintain the free flow of traffic and removal of encroachers if any.
- Looking for the places for shifting the temporary markets which generally cause hindrance to traffic movement.
- Running awareness programs for public minimizes the noise level and impact of high noise on human health.

5.8.3 Impact Due to Repair & Maintenance

Being CC Rigid pavement, maintenance requirements of these roads will be fairly very low as compared to bitumen pavement. However, some regular maintenance is always required to be undertaken like filling of potholes, sealing of joints, replacement of slabs, cleaning of drains, repair of drains, repairing the embankments and approaches of bridges, maintaining slopes, and pitching etc. Maintenance work shall be carried out during nighttime preferably to have minimal impact on day-to-day activity of people and to minimize hazard to community due to maintenance work during daytime. However, maintenance work shall be carried out in presence of HSE expert. Adequate barricading and lighting arrangements shall be made around the area under maintenance. Public shall be pre-informed about such maintenance works. Waste generated shall be re-used or shall be disposed of as per the waste management plan framed for construction phase and discussed in section above.

5.9 Cumulative and Induced Environmental Impacts

Cumulative impact is described as: “The combination of multiple impacts from existing projects, the proposed project, and anticipated future projects that may result in significant adverse and/ or beneficial impacts that cannot be expected in the case of a stand-alone project. The cumulative impact is sum of the impact expected by the project discussed in this IEE report and other project which are existing, planned or under implementation in the study area. Project involves improvement of road connectivity which will boost the development potential of the area and may bring the economic activities like development of area development project like housing, commercial complex, fuel station, hotels, restaurants in the area. Due to this development, traffic in the area may increase more than the expected traffic. Also, project may lead to increase the agro-industrial activities due to improved access to urban centers where there is higher demand and better prices for agricultural products. Further the increased industrial activities will significantly reduce migration. The improved road will provide better connectivity and result in (i) Reduction in travel time (ii) better mode and frequency of transport (iii) access to quality health care facilities, educational and other infrastructural facilities (iv) enhanced tourism activities in the area and state which in many terms will boost the local economy (v) better investment climate for industries creating more employment opportunities to local people. In terms of environment, the improved road surface is expected to result in less dust and noise generation as compared to emission generation when traffic moves on damaged and narrow roads. But with time traffic volume will increase which will again add to the GHG and vehicular emissions. The smoother road conditions will also result in increase in traffic speeds, hence creating more risks for accidents amongst traffic users as well as the local communities in the project area. For addressing the impacts of air pollution and noise, regular maintenance of the road surface, maintenance and monitoring of newly planted trees and installation of noise barriers where necessary have been included in the ESMP for implementation during operation stage. For addressing safety related impacts, regular maintenance of the road furniture includes safety related furniture, enforcing rules against encroachment of structures and sensitive structures inside the ROW and implementation of the emergency management system has been included in the ESMP for implementation during operation stage.

5.10 Conclusion

The interaction of activities and their impacts vary during project implementation phase. Regarding the proposed project, major activities occur in the construction phase. Therefore, major impacts are anticipated during construction and various impacts have been discussed keeping their nature in view. The impacts during construct phase vary from low to moderate significance. But these impacts are short term and are restricted only to the construction zone and time only (few days to 45 days for one road section, overall time of project is 3 years) and can be reduced significantly by adopting suggested measures.

However, some impacts due to project planning and location like land acquisition, tree cutting, vegetation removal etc. are long term and irreversible but the impact can be reduced to an acceptable level by adopting the suggested mitigation measures.

Impacts due to operation phase are generally anticipated to be positive and will significantly improve the environmental quality and quality of life in the project area. Impacts due to increase in vehicular emission and noise level during operation phase due to increase in traffic volume with time have been computed and presented in the report. This increase in traffic volume is inevitable and can only be controlled by adopting some strategic measures like development of integrated public transportation system for the region which will shift the ridership from private vehicle to cleaner and safer public vehicles. However, these measures depend on various factors including availability of funds, political decisions etc. and can be suggested as priority measures to the concerned stakeholders so that they can be taken into consideration for implementation.

6. PUBLIC CONSULTATION

6.1 Consultation and Participation Strategy

Stakeholder engagement is a continuous process throughout the project period, during project preparation, implementation, and monitoring stages. The sustainability of any infrastructure development depends on the participatory planning in which public consultation plays a major role. Experience indicates that development projects in heavily populated areas and involuntary resettlement generally cause numerous problems for the affected population. These problems can be reduced to a great extent if people are properly informed and consulted about the project and are allowed to make meaningful choices or preferences. This serves to reduce the insecurity and opposition to the project, which is otherwise likely to occur during project implementation. The overall objective of the consultation program is to minimize negative impact in the project corridors and to make people aware of the project.

Consultations are undertaken as per the AIIB ESF requirement. Meaningful consultations were held early and shall be held throughout the project development stage to allow the incorporation of relevant views of the stakeholders in the final project design, mitigation measures, implementation issues, and enhance the distribution of benefits. All the five principles of information dissemination, information solicitation, integration, coordination, and participation in the dialogue were incorporated in the consultation process. The analysis of environmental impacts likely from the project were strengthened and modified based on opinions of all those consulted, especially at the micro level by setting up dialogues with the village people from whom information on-site facts and prevailing conditions were collected. The suggestions received during public consultation have been proposed as part of the mitigation plan.

6.2 Objectives of the Consultation

Stakeholder’s consultations held with the intent to understand their concerns, apprehensions, overall opinion, and solicit recommendations to improve project design and implementation. Informal meetings and interviews were organized covering the entire project design stage. Consultations provide affected people a platform to ensure incorporation of their concerns in the decision-making process and foster co-operation among officers of PWD, the community, and the stakeholders to achieve a cordial working relationship for smooth implementation of the project. It inculcates the sense of belongingness in the public about the project.

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

6.3 Methodology for Consultations

Consultation with the stakeholders, beneficiaries, and community leaders had been carried out using interviews and discussion. Questions were designed to obtain background information and details of general environmental issues that concern people in the project area (format given below). Open-ended questions were asked to obtain maximum possible information and open view of the stakeholders on environmental issues. Environmental issues were discussed with relevant organizations, government officials, beneficiaries, community leaders, and experts. Besides, personal discussions with officials, on-site discussions with affected stakeholders, and reconnaissance visits have also been made to the project area.

Table 102: Sample Questionnaire Format

Community Consultation / FGD- Related to Environmental and Climatic Issues in Project area	
Road Name	
Road Category	
Consultation with Project Affected Person	

Type of Community Indigenous Group / Non-Indigenous Group			
Type of Group (Male/Female)			
Name of Village for Consultation with Address			
Numbers of Participants			
Key Points Discuss			
SL. No	Environmental Issue address	Community Suggestion	Remark
Attendance Sheet for Consultation			
SL No	Name of Participants	Address / Contact No	Signature

6.4 Stakeholder Consultations

6.4.1 Project Stakeholders

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

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

Table 103: Identified Stakeholders

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

6.4.2 Consultation with Government Departments

Various Govt. Dept. officials were consulted during Environmental Impact Assessment Study including PWD Officials, State pollution control board for Air, Noise, and Water quality information, IMD for the climatic data, the statistical officer for Population and demographic profile, Panchayat department for village level information, Survey of India for the topo sheet requirement, Revenue department for the land record information, PHQ officers for hand pump relocation and quality assessment, Forest Department, Manipur SEB offices for electric pole shifting, etc.

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

6.4.3 Consultation with Local People and Beneficiaries

The informal consultation generally started with explaining the project, followed by an explanation of potential impacts. Participants' views were gathered concerning all aspects of the environment which may have a direct or indirect impact on local people. Key Issues discussed are:

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

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



Figure 83: Public Consultation during the month of February 2023 within the project influenced area.

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

6.5 Public Opinion/ Views Survey

To assess the existing environment and likely impacts on the surrounding population, an interview was carried out with identified stakeholders. Precaution has been exercised during the survey to ensure that the consultation provides the representative views of the affected groups. Details of the consultations undertaken are presented below.

Table 104: List of Public consultation and Date

SI No	DATE OF FGD/GD/PUBLIC CONSULTATION	NAME OF ROAD	LENGTH OF ROAD (KM)	VILLAGE NAME	NAME OF PLACE FGD CONDUCTED	TOTAL No OF MALE	TOTAL No OF FEMALE	SUGGESTION FROM THE COMMUNITY	POSITIVE COMMENTS RECEIVED FROM COMMUNITY	NEGATIVE COMMENTS RECEIVED FROM COMMUNITY
1	28.01.2023	Chandam Leirak and Puthiba Leirak via Ashambi Leirak Road	0.62	Khurai	Chandam Leirak, Khurai	4	10	They suggested that the roads should be constructed soon to avoid heavy traffic and for easy movement of vehicles, according to the group there will be less instances of cutting of trees and destruction of water bodies while constructing the roads. So, the environment impact is minimal.	The group and locality were eagerly waiting for the road to be constructed	No negative comment from the locality but they want the project to be implemented soon.
2	29.01.2023	Top Dussera Road	1	Top Dusara	Top Dusara Community Hall	14	5	They suggested that, since there are many new planted trees at the edges of the road, they want it to be relocated somewhere else.	They said that there will be No objection regarding the improvement of the road and drainage of the road and drainage system in the water bodies as it is Not nearby the road, they said that there will be No problem with the Noise and dust if it is for the development of their society	No negative comments.
3	31.01.2023	Tangkhul Avenue from dingku road to Chingmeiro ng Kabui Khul	1.79	Chingmeiro ng	Chingmeiro ng Kabui Khul	12	2	since it may affect the surrounding many debris maybe around the pathway, the locality suggested that they prefer if the work stops on Sunday as they have church service every Sunday and may affect their fellowship, they said to water the road every Now and then when the construction starts as there will be No dust and may be problematic for the people	they said they are happy with the development, and they will be more grateful if the government plants the trees if it were to be cut down	They gave No negative comments, but they just want the government to give them prior Notice
4	2/16/2023	Pukhramba m Leirak	0.62 kms.	Wangkhei Meihoubam Leiakai, Imphal East	Pukhramba Leirak Club	9	5	The meirapaibis (group of women) and club members said that they have no specific suggestion, they just want a clean environment which will be better for their daily life after the project is implemented.	The respondents said that they were very happy that the government are taking up this social meeting to know people's opinion and they want the concerned authority to implement the project as fast as possible.	No negative comment.
5	01.02.2023	Kongba Bazar to Ucheckon Bridge	4.62	Ucheckon	Community Hall Kongba	13	7	Try to preserve the trees and water bodies as much as possible during the construction of road, dust and Noise is sure whenever road construction is done so the community will have to deal with it for the sake of development, the related authority or the agency should give awareness to the locality before the construction of the road in regard to eventualities leading to construction of roads	they ensure that they will give full support during this whole project	No negative comments from the locality
6	04.02.2023	AT Line	0.55	AT Line	Mantri Mandol	10	2	to give fair amount of compensation if any houses or shops are affected	They ensure that they will give full support during this whole project	No negative comments from the locality
7	05.02.2023	Mandop Road	0.46	Mandop Leikai	New Checkon Youth Club	10	1	They also want a sewage tank ad also a water tank to keep their environment clean in the future, they want the government to collect the waste materials from the dustbins regularly	They want to improve the road without expansion	No negative comments from the locality
8	05.02.2023	Zomi Villa	0.46	Zomi Villa	Chairman's house of Zomi Villa	8	6	to give compensation if any houses or shops are affected, to put "No PARKING ZONE" and "SPEED LIMIT" signboard.	they ensure that they will give full support during this whole project	No negative comment.
9	05.02.2023	Canchipur Kiyamgei Road	0.74	Kiyamgei	Popular Youth Club, Kiyamgei	8	10	they want plantation of trees on both sides of the road after the completion of the project	the locality was eagerly waiting for the road to be constructed, the locality will deal with the situation in case of any construction related pollution.	No negative comments.
10	06.02.2023	Thokchom Leirak to Heingang Chingya	2	Heingang	thokchom Leirak	7	8	to construct the road at thokchom leirak first	they ensure that they will give full support during this whole project	No negative comments.
11	08.02.2023	Nandeibam Leirak	0.8	Nandeibam Leikai	Ucheckon Nandeibam Leikai	16	10	They want to plant small trees or nursery plant from forestry department for planting trees on both side of the road after construction. It can control pollution.	the locality was eagerly waiting for the road to be constructed.	No negative comment.
12	10.02.2023	Pong Lambi	1.700 km	Top	KSDO Community Hall	16	8	No suggestions regarding environmental impact.	They ensure that they will give full support during this whole project	no negative comment
13	11.02, 2023	Top Awang Leikai Road	1.8 km	Top Awang Leikai	Ima Imoinu Shanglen, Top Awang Leikai, Imphal-East, Manipur-795008	8	0	No suggestions regarding environmental impact as there would be no effect.	They proposed for starting of the project at the earliest. They also stated that they will help in sorting out any issues regarding the impacts on environment during the project.	No negative comment regarding environmental impacts.
14	11.02.2023	Tinsubam Leirak	0.45	Tinsubam Leirak	Youth Athletic Star Union Community Hall	10	10	No suggestion regarding environment impact	they ensure that they will give full support during this whole project	No negative comment
15	11.02.2023	New Lambulane Street 1	0.74 km	New Lambulane	Tribal Market Second Floor	19	11	provision for installation for placing dustbins properly, provision for installation of solar streetlamp, the shortage of water is a major issue. So, works on water to be carried properly.	the locality was eagerly waiting for the road to be constructed.	No negative comment.
16	11.02.2023	Mercy Lane	0.775 km	Mercy Lane	Mercy Lane	10	7	No suggestion regarding environment impact	the locality was eagerly waiting for the road to be constructed.	No negative comment.
17	15.02.2023	Moirangthe m Leirak	0.32 km	Moirangthe m Leirak	Residence of Soibam Romendro	8	4	They want plantation of trees on both side of the road after the completion of the project. Provision for installation of solar streetlamps on both side of the road. The shortage of water is a major issue. So, works on water to be carried out properly.	The locality was eagerly waiting for the road to be constructed. They will give full support this project. The locality will deal with the situation in	No negative comments were given from the participants; they want the project to be implemented soon.

SI No	DATE OF FGD/GD/PUBLIC CONSULTATION	NAME OF ROAD	LENGTH OF ROAD (KM)	VILLAGE NAME	NAME OF PLACE FGD CONDUCTED	TOTAL No OF MALE	TOTAL No OF FEMALE	SUGGESTION FROM THE COMMUNITY	POSITIVE COMMENTS RECEIVED FROM COMMUNITY	NEGATIVE COMMENTS RECEIVED FROM COMMUNITY
					Singh, Moirangthem Leirak, Singjamei Wangma Kshetri Leikai				case of any construction related pollution.	
18	15.02.2023	Maring Lane	0.3 km	MARING LANE	MARING LANE	11	0	No suggestions regarding the environmental impact.	They are willing to bear and want to give full corporation and support during construction. They want to implement the project as soon as possible.	No negative comments from the locality.
19	18.02.2023	Lainingthou Ahanba Leirak to TV tower	0.62 km	Khurai Lamlong	Lainingghou Ahanba Community Hall	8	4	The People suggested that not having a proper drainage system in place will result in flooding of low-lying areas, thereby causing property damage and health risk. So, they want the government to construct a proper drainage system and they ask the government to down the tree for land expansion.	They said they are happy that the government are taking up this social meeting to hear people desire.	no negative comment.
20	19.02.2023	Bengali Colony Road	1.225 Km	Bengali Colony	Durga Puja Mandir, Bengali Colony, Imphal-West, Manipur-795002	12	1	The participants of the discussion suggested for starting and completion of the project at the soonest without any delay in the work of construction to minimize air and noise pollution.	The participants stated that they will help in sorting out any issues regarding the impacts on environment during the project as it is for their better convenience.	No negative remark in connection to environmental impacts.
21	19.02.2023	Top Dussera Road Connecting Jnv Road and Baruni Road	0.800 Kms	Top Mayai Leikai	S.A.C., Top Mayai Leikai, Top Dussera, Imphal-East, Manipur-795005	22	0	The participants of the discussion suggested for the completion of the project without any delay in the work of construction also thereby, maintaining the quality of the work.	The participants assured to manage the issues of noise and dust pollution from their end.	No negative remark in connection to environmental impacts.
22	19.02.2023	Okram Leirak	0.280 km	Okram Leirak	Okram Leirak	5	6	They want to implement the project as soon as possible and in a long-lasting way for future use.	They are ready to give full corporations and support during construction	No negative comment.
23	19.02.2023	Nongpok Ingkhol	0.74 km	Nongpok Ingkhol	Nongpok Ingkhol Community Hall	14	10	the locality wanted to repaired public pond. after the completion of the project the locality would like to request the concern authorities to plant on both side of the road.	The locality was eagerly waiting for the road to be constructed.	no negative comment.
24	19.02.2023	Telem Leirak -1	0.103 km	Telem Leirak	Telem Leirak	9	4	No suggestion for environmental changes, but they want to plant some trees on roadside after finishing the project. They want to finish the water supply pipeline first before construction begins.	They are ready to give full corporation and support during construction	No negative comment.
25	19.02.2023	Devi Lane	0.62km	Mantripukhr i	Devi Lane	8	7	The Meirapaibis (group of women) and club members said that they have no specific suggestions, they just want a clean environment which will be better for their daily life after the project is implemented.	They said they are happy that the government are taking up this social meeting to hear people desire and want to implement the project as fast as possible.	No negative comment.
26	20.02.2023	Ningombam Leirak	0.40 km	Ningombam Leirak	Ningombam Pato Singh's House	8	4	To give compensation if any houses or shops are affected. To put speed braker on the road.	They ensure that they will give full support during this whole project	No negative comments from the locality. J19
27	20.02.2023	KONTHA KHABAM TO CHUMBREI THONG	1.050 km	kontha khabam	YAIPHA SINDAM NAHAROL CLUB COMMUNITY HALL. KONTHA KHABAM	12	5	They wanted to construct in the proper proportion of the required material while construction. They want the concerned authority to plant some trees on roadsides after completion of project.	The locality from both sides is eagerly waiting for the project to be implemented soon as the government is neglecting the road for a long time. They promised them to will to bear the noise, dust problem, water problem while constructing the road for better future. The wanted to implement the project as soon as possible like in the coming month of 2023.	No negative comment.
28	25.2.2023	Moibunglo kpa Leirak	0.300 Kms.	Yaiskul	Moibunglok pa Leirak/Bhamon Mandop, Yaiskul Police Lane, Imphal-West, Manipur-795001	14	1	The participants of the discussion suggested for starting and completion of the project at the earliest.	The participants stated that they are ready to manage issues on air, dust, and noise pollution from their end during the construction of the road.	The improvement of the road is accepted only under the criteria for the adjustment of the width of the road without any affect to the residential structures in the area. The project would be strongly opposed in case of demolition of any residential structures.
29	26.02.2023	Shabi Leirak	0.310 km	Ningthem Pukhri Mapal	Ningthem Pukhri Mapal Club	14	10	No suggestion regarding Environmental impact.	They ensure that they will give full support during this whole project	no negative comment
30	26.02.2023	Chingangbam leirak (connecting Laiwangma Road)	0.55 km	chingangbam leirak	chingangbam leirak	25	20	Construction at least 3/4 public urinal in proper place and a public toilet. • after the completion of the project the localities wanted the authorities to plant seasonal plant along the road.	The locality was eagerly waiting for the road to be constructed.	There are many trees on the roadside the localities. The participate s don't want to cut the tree due to construction of road, instead of cutting them they want the agencies to provide alternative way.
31	26.02.2023	KSHETRI LEIRAK	0.280 km	SINGJAMEI WANGMA KSHETRI	KSHETRI LEIRAK COMMUNIT	6	4	The community want the concerned authority to upgrade the pond which is situated in east most part into public pond with separate toilet, bathroom. The community want proper sanitation on roadside like maintain dustbin, proper	The participants wanted to implement the projects as soon as possible as the present road condition is not in a good shape. They are willing to bear the	No negative comment.

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				LEIKAI	Y HALL, AKAMPAT			drainage etc. They wanted the project authority to construct the road in a proper long-lasting way for future user	noise, dust water problems if the authority promised to construct the road as soon as possible in the coming year 2023.	
32	26.2.2023	Chingmeiro ng West IVR	0.8 Kms.	Chingmeiro ng Manning Leikai	Sinam Shyama Devi Memorial Town Hall, Chingmeiro ng West, Imphal-East, Manipur-795010	2	3	The participants of the discussion suggested for proper pre-arrangement of the public water hand pump which is to be affected by the expansion of the road to prevent unwanted shortage of water in the community.	The participants stated that they will bear to manage pollution of dust, air, and noise from their end during the construction work of the project as it is for their better future convenience.	No negative remark for the impact in the environment during the project.
33	27.02.2023	ADHIKARI MAYUM LEIRAK	0.300 km	Bhamon Leikai	LAIMAYUM MANDAP, ADHIKARIM AYUM LEIRAK	10	3	The community want proper sanitation like keeping public toilet, proper dustbin, proper drainage. The community proposed closed drainage facilities on both side of the road.	The participant of this discussion wanted to implement the project as soon as possible. The even promised to bear the consequence of dust. Noise pollution during construction for future safety.	No negative comment.
34	6 th March 2023 (Monday)	Lakpam Leirak	0.350 Kms.	Lakpam Leirak	Lakpam Leirak, Imphal-East, Manipur-795008	13	2	The participants suggested for medium height visible speed brakers to be inserted during the construction of the road for road safety in the area.	No trees, bamboos, other shrubs, or water body to be affected. But the possible pollutions during the construction days to be manage by the locality.	No negative comment regarding environmental impacts.
35	16 th March 2023 (Thursday)	Sapam Leirak	0.450	Sapam Leirak, Khongman Mangjil Mamang	Sapam Leirak, Khongman Mangjil Mamang, Imphal-East, Manipur-795008	6	9	(i) A proper construction of drainage with proper water levelling is a must to sort out the issue overflowing of the drain water into the surface of the road during the rainy seasons. (ii) For road safety, some few medium high-speed breakers need to be installed during the construction of the road.	(i) There will be no impact on the environment by the project as the current width of the road is much wider from 5.75 meters (ii) Starting and completion of the project is suggested to minimize the possible pollution.	No negative opinion commented.
HIGHWAY SUBDIVISION ROADS										
1	5 th March 2023 (Sunday)	Ningthouja m Leirak	0.290 km	Ningthouja m Leirak, Singjamei	Ningthouja m Leirak, Singjamei, Imphal-East, Manipur-795008	10	3	The participants suggested for retaining walls for the affected ponds to sort out the issues of land erosion. They also suggested for a proper sewage management as drains are to be covered after the project.	They wanted the completion of the improvement of roads with rigid pavements including concrete lined drains at the earliest to reduce the possible pollution.	No negative comment regarding environmental impacts.
2	03.03.2023	LOUREMBA M LEIKAI TAMPHA LAIREMBI LEIRAK	0.770 km	LOUREMBA M LEIKAI	LOUREMBA M LEIKAI TAMPHA LAIREMBI LEIRAK	8	9	The community want the concerned authority of the project to put public dustbin for every (5-10) household and a separate public toilet on roadside. They want proper closed drainage facilities as it may protect from throwing wastage to the drainage. The community urge the concerned authority to construct the road in proper proportion for long lasting. The community want to spray water two times in a day during construction. They wanted to plant same trees on roadsides after construction.	The participant is very delighted as the road is to be constructed. They wanted to implement the project as soon as possible.	The concerned authority is neglecting this road from long time.
3	03.03.2023	Laisom leirak	0.261km	Laisom leirak	Sana Janmasthan community hall, keishampat Moirangning thou leirak,	8	3	There are 3/4 tress in the pitta land if these trees are cut down then they want a fair compensation for that.	The locality was eagerly waiting for the road to be constructed.	No negative comment.
4	03.03.2023	Malom to Hawairou	1.627km	Hawairou	Hawairou Community Hall	10	0	They suggested to construct public toilet, urinal place, waiting shed to the locality. After the completion of the project the locality would like to request the concern authorities to plant on both side of the road.	The locality was eagerly waiting for the road to be constructed.	No negative comment.
5	06.03.2023	Chintham Leirak	0.516km	Chintham Leirak	Chintham Leikai Ground	11	0	They want to construct community hall and club (20 th century Chingtham Club). After the completion of the project the localities wanted the authorities to plant along the road. They want to develop the Chintham leikai Ground with fencing, planting carpet grass. All the participants were of the opinion to complete the project in a short time span as prolong construction of road leads to dust, noise pollution and affects the health of the locals mainly children and women	The locality was eagerly waiting for the road to be constructed. And according to the participant as there is no trees and water bodies on both side of the road there will be no major environmental impact.	No negative comment.
6	18.03.2023	Malom Awang Health Centre IVR	0.310km	Malom	Ibuthou Pakhangba Community Hall, Malom Awang Leikai,	38	0	They requested for the preparation of the materials like concrete and others to be done at another site to minimize the possible pollution on the working site.	They were very happy to know that the road will be improved.	No negative comment.
7	17.03.2023	Kha Naorem to MU ring road	0.550km	Kha Naorem Leikai	In a residence of an elected Local member of Kha Naorem Leikai	9	6	Construction at least 3/4 public urinal in proper place and a public toilet. They also want to repair the public pond.	The locality was eagerly waiting for the road to be constructed.	No negative comment.
8	19.03.2023	Monshange i Maning to	1.455Kms	Monshangei Maning	Monshangei Maning	5	6	(i) Construction at least 3/4 public urinal in proper place and a public toilet. (ii) After the completion of the project, the localities wanted the authorities to plant	The locality was eagerly waiting for the road to be constructed.	No negative comment.

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		Waishel River		Leikai	Leikai			seasonal plant along the roadsides. (iii)Construction of rest shed and parking shed side by side.		
9	25 th March 2023 (Saturday)	Khoidongbam Leirak	0.420	Kwakeithel Awang Konjeng Leikai	Kwakeithel Awang Konjeng Leikai Community Hall, Imphal-West, Manipur-795001	8	2	As a road safety measurement, they suggested for proper lighting of the road and installation visible roadside indicators during the construction of the road.	Exclusion of a big standing holy banyan tree in the junction of the road leading to the southeast of Chingpu road from the project.	No negative comment regarding environmental impacts.
10	26 th March 2023 (Sunday)	Mutum leirak heirangoithong	0.455	Ahongshangbam Leikai	Ahongshangbam Leikai Anganwadi Centre, Imphal-West, Manipur-795003	8	3	As to make the future road safety, they suggested for installation of 3-4 numbers of medium high-speed breakers during the construction of the road.	Pollutions of dust and noise during the days of the construction of the road to be borne to manage from the individual's end.	Unless work quality is properly maintained, no construction work of the road is said to be allowed in the area.
11	26 th March 2023 (Sunday)	Oja Mangi leirak	0.455	Heirangoithong	Heirangoithong Volley Ground, Imphal-West, Manipur-795001	8	6	(i) For road safety measure, the participants suggested to install visible roadside sparkle light during the construction of the road. (ii)The participants desired for the construction of a club shed, a community hall, an anganwadi centre and a Meirapaibi shed for the locality in case of possibilities, as all these gathering/grouping centres were evicted under Project Nambul Eviction.	People wanted a rapid progressive work of construction to be carried out, so that it would minimize the possible pollution.	No negative opinion commented.
12	26.03.2023	Thoudam Leirak	0.765	Mongsangei	Mongsangei /Amuthoi, Convenor's Resident	13	11	a. They want the government to analyze how to minimize the pollution that might result due to road construction. b. To renovate the destructed water bodies properly if any of the water bodies are destructed. c. Plants trees on roadside after completing the construction of the road.	They were very happy to know that the road will be upgraded. Moreover, clubs and Midrapidities (women group) will definitely help the related agency.	No negative comments
15	29.03.2023	Nahakpam leirak(langt habal)	0.440	LANGTHABAL	NAHAKPAM LEIRAK, LANGTHABAL	10	7	a. The community want the concerned authority of the project to put public dustbin for every (5-10) household, separate public toilet on roadside. b. They want proper closed drainage facilities as it may protect from throwing wastage to drainage. c. The community urges the concerned authority to construct the road in proper proportion for long lasting. d. The community want to spray water two times in a day during construction. they wanted to plant same trees on roadsides after construction.	a. The participant is very delighted as the road is constructed in modern style as the present government is neglecting this road from long time. b. They wanted to implement the project as soon as possible.	No negative comment.
16	1 st March, 2023	Jailor Leirak (Top Leirak opp)	0.370	Jailor Leirak	KYDC (Konjeng-Hajari Youth Development Club), Jailor Leirak (Top Leirak Opp.), Imphal-West, Manipur-795004	5	0	They suggested that the width of the road would be better if it is 20 feet excluding the drains.	They proposed for the inclusion of the projected road in the first phase of the project to become a model road.	No negative comment regarding environmental impacts.
OTHER DISTRICT ROAD										
1	18 th March 2023 (Saturday)	Konjeng Leikai Waishel via Ningthemcha Karong (Part-I)	0.9547 Kms.	Mongsangei	SIYWO CLUB, Mongsangei, Imphal-West, Manipur-795003	6	5	As a road safety measurement, visible speed brakers are suggested to be inserted during the construction of the road.	They desire the commencement of the construction work at the earliest.	No negative comment regarding environmental impacts.
STATE HIGHWAY ROAD										
1	17.03.2023	Imphal Yairipok Road	4.5km	Kongba	The Youth Guidance Club, Kongba	46	11	a. They want the government to analyze how to minimize the pollution that might result due to road construction. b. Installed hand pump if any water bodies are destructed. And to renovate the destructed water bodies properly if any of the water bodies are destructed.	They were very happy to know that the road will be upgraded. Moreover, clubs and Meirapaibies (women group) will definitely help the related agency if required.	No negative comments



Figure 84: Photos of Public Consultation

Date: 28 January 2023
 Environmental

No.	Name	Age	Gender	Mobile no.	Signature
1	M. Minshikumar	62	Male	982750494	[Signature]
2	Jh. Shingobi	79	Male	818997435	[Signature]
3	Lachhmi Jaitheo Singh	40	Male	916377461	[Signature]
4	P. Sambipati	62	Woman	980576196	[Signature]
5	M. Moomona Devi	60	Woman	982349803	[Signature]
6	Abu Rajib Das	44	Man	936626452	[Signature]
7	A. Rabhani Devi	60	Woman		[Signature]
8	Jh. Shatanki Devi	41	Female	911912681	[Signature]
9	S. Sanam	51	F	98256494	[Signature]
10	M. Kafana	48	F	982127944	[Signature]
11	H. Saradani Devi	48	F	986502346	[Signature]
12	Manjira Devi	35	F	700510404	[Signature]
13	Jh. Sarani Devi	45	F	814934895	[Signature]
14	K. Monchori Devi	46	M	985682122	[Signature]

Improvements of Roads within Imphal City with Right Pavements Including Concrete Lined Drains under the Manipur Urban Road and Asset Management Program with Financial Assistance from Asian Infrastructure Investment Bank (AIIB)

Public Consultation on Environmental Impact of the Project
 Location: Kongla Cagar to Uchecken bridge Date: 01.02.2023

Sl. No.	Name	Age	Gender	Mobile No.	Signature
1	Socokheikho Robinson	50	Emp	985620724	[Signature]
2	S. Jaina Singh	48	M	873181076	[Signature]
3	M. Nohanki Singh	50	M	985612840	[Signature]
4	S. B. Suresh	52	M	841594413	[Signature]
5	Jh. Anujay	61	M	841588199	[Signature]
6	Jh. Noman Singh	36	M	801402155	[Signature]
7	S. Abant Singh	49	M	908923233	[Signature]
8	L. Dineshwar	32	M	986614724	[Signature]
9	Jh. Ranjana	43	F	6033881438	[Signature]
10	M. Becharakha	45	F	907799310	[Signature]
11	P. Krishnakumar	40	F	900527992	[Signature]
12	A. Seikabara	49	F	940297799	[Signature]
13	L. Pampharma	44	F	857538284	[Signature]
14	S. Lechoki Devi	54	F	985620919	[Signature]
15	Indu	55	F	600978933	[Signature]

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6	Jh. Noman Singh	36	M	801402155	[Signature]
7	S. Abant Singh	49	M	908923233	[Signature]
8	L. Dineshwar	32	M	986614724	[Signature]
9	Jh. Ranjana	43	F	6033881438	[Signature]
10	M. Becharakha	45	F	907799310	[Signature]
11	P. Krishnakumar	40	F	900527992	[Signature]
12	A. Seikabara	49	F	940297799	[Signature]
13	L. Pampharma	44	F	857538284	[Signature]
14	S. Lechoki Devi	54	F	985620919	[Signature]
15	Indu	55	F	600978933	[Signature]

Public Consultation on Environmental Impact of the Project
 Location: Kongla Cagar to Uchecken bridge Date: 01.02.2023

1. Name of the respondent: [Signature]

2. Age of the respondent: [Signature]

3. Gender of the respondent: [Signature]

4. Mobile No. of the respondent: [Signature]

5. Signature of the respondent: [Signature]

6. Name of the respondent: [Signature]

7. Age of the respondent: [Signature]

8. Gender of the respondent: [Signature]

9. Mobile No. of the respondent: [Signature]

10. Signature of the respondent: [Signature]

11. Name of the respondent: [Signature]

12. Age of the respondent: [Signature]

13. Gender of the respondent: [Signature]

14. Mobile No. of the respondent: [Signature]

15. Signature of the respondent: [Signature]

Figure 85: Attendance of Public Consultation

6.6 Disclosure

6.6.1 State Level

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

6.6.2 District Level

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

6.6.3 Disclosure requirements of AIIB

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

6.6.4 Disclosure by AIIB

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

6.7 Conclusion

It is observed from the interview survey that there is increased environmental awareness among the people. It can also be seen from above table that most of the people are in the opinion that the environmental condition of the area is currently poor. Poor road condition and vehicular emissions are the major sources they feel responsible for this. They also support the project considering that improved road conditions will significantly improve their lives, vehicle operating cost, reduce time of travelling also.

Overall, most of the people interviewed strongly support the project. The people living in the entire project area expect the different project elements to facilitate transport, employment, tourism, boost economic development, and thereby provide direct, or indirect benefits to them. They have shown concerns over the access issues, mobility issues and issues regarding the temporary facilities like Construction camps which may put stress on local resources and infrastructure nearby, especially on water resources. To prevent such problems, they suggested contractors need to provide camps with proper drinking water and sanitation facilities at a distant location from the settlements. The following are the consultants' findings regarding the project.

- Improved road conditions will reduce travel time, fuel consumption, and emissions from base traffic volumes.
- Economic development and access will be stimulated.
- Access to Health, agriculture, and education facilities will be improved.
- Disturbance to existing traffic during the construction phase.
- Fugitive dust emissions during the construction stage thus harming the air quality. Similarly, noise quality can be affected during construction as well as operational stage.

Based on available information, field visits throughout the project, discussions with project t authorities, local people, and other discussions amongst project team and local officials it has been concluded that overall, the project will be beneficial, all negative impacts during and post construction phase are manageable can be properly mitigated by adopting the designed mitigation measures.

7. GRIEVANCE REDRESS MECHANISM

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

7.1 Mechanism for Grievance Redressal

The GRM shall be established at four levels viz. Site Level (First Level Grievance), PIU Level (Second Level Grievance), EAP-PMU Level (Third Level Grievance) and Court of Law (Fourth Level Grievance) to address grievances/ complaints. The grievance redress mechanism is given in Figure 86. The project specific GRM is not intended to bypass the government's own redress process; rather it is intended to address affected people's concerns and complaints promptly, making it readily accessible to all segments of the affected people, and is scaled to the risks and impacts of the project.

First Level: Contractor shall establish a grievance redress mechanism at its level. Contractors shall display the information about the GRM at site to make people aware about the existing GRM. Contractors through liaison shall develop good relations with the community so as the community shall feel free to register any complaints to contractor, if any without any doubt. When grievances arise, complainant may first need to contact the respective person of the Contractor, CSC, and the site engineers. The site level resolution of complaints shall be done within 2 weeks. The Contractor will maintain the records of complaints and the outcome of the solutions. Contractor is required to inform to the PIU & PMU about all such grievance received and status of resolution on weekly basis.

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

Third Level: The Environmental Officer of each PIU will activate the second tier of GRM by referring the unresolved issues (with written documentation) to the PMU, who will pass unresolved complaints upward to the Grievance Redress Committee (GRC). A hearing will be called by the GRC, if necessary, where the affected person may present his/her concern/issues. The process will facilitate resolution through mediation.

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

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

- ❖ Modules in e-portal/ website of GOM with PWD.

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

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

7.2 Grievance Redress Committee (GRC)

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

The PMU level GRC will comprise of the:

- Project Director (EAP), PWD, GoM or any authorised person, who should not below the rank of Chief Engineer.
- Nodal Officer, GOM with PWD – Member Secretary
- Resettlement Officer, PMU supported by RP Implementation Agency NGO/ AE Social Expert.
- Environmental Officer, PMU supported by AE. Environmental Expert.
- Representatives from local person of repute and standing in the society or elected representative from Panchayat/ Zilla Parishad /District Council
- Representative from the PIU, supported by RP Implementation Agency
- A representative from IP community for IP related issue if any
- Representative from local forest authority if grievances of forest aspects
- Representative from Pollution Control Board if grievances of environmental aspects
- Representative of the Land Revenue department if grievances of land related issues

The PIU level GRC will comprise of the:

- Representative of PIU not below the rank of Executive Engineer
- Resettlement Officer, PIU supported by RP Implementation Agency NGO/ AE Social Expert.
- Environmental Officer, PIU supported by AE Environmental Expert
- A representative from local person of repute and standing in the society or elected representative from Panchayat/ Zilla Parishad /District Council.
- A representative for women from a relevant agency which could be from the government, or RP Implementation Agency or local community.
- A representative from Vulnerable DPs
- A representative of the local Deputy Commissioners office (land) if the grievance is of acquisition land related issues.

- A representative of local Pollution Control Authority (for environmental issues related grievances)
- A representative from IP community for IP related issues, if any.

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

Grievance Redress Committee (GRC) for Workers/Labour: AIIB ESF as amended in 2019, 2021 also requires establishment of grievance redress mechanism and committee to address the workers/labour related grievance. Accordingly, the grievance redress mechanism is designed for the workers/labour also who will be contracted/employed for the project construction. Grievance redress mechanism and committee shall remain same as proposed for the project for another stakeholder. Measures to be taken by the contractor for grievance redressal are as follows.

- Strictly abide by all the labour welfare, safety and security regulations of Government of India which includes but is not limited to: Contract Labour (Regulation & Abolition) Act, 1970, Minimum Wages Act, 1948, Payment of Wages Act, 1936, Equal Remuneration Act, 1979, Child Labour (Prohibition & Regulation) Act, 1986, The Occupational Safety, Health and Working Conditions Code, 2020, Workmen Compensation Act, 1923, Maternity Benefit Act, 1951, The Building & Other Construction Workers (Regulation of Employment & Conditions of Service) Act, 1996 etc and EHS guidelines of the funding agency and IFC
- CMC to ensure that all the contractor is abiding by all the labour welfare, safety, and security regulations of Government of India and the EHS guidelines of the funding agency and IFC.
- All contractors and sub-contractors shall establish the grievance redress mechanism of their own also in the similar lines as developed by PWD, Manipur.
- Grievance redress mechanism shall be communicated to all the workers and labour of contractors and the subcontractors in the local language.
- Contact number, email ids of the nodal person and other members of the grievance redress committee shall be displayed at the site in English and local language so as the workers/labour can raise the grievance at all the levels as required
- Sub-contractors and contractors shall maintain the record of all the grievances received and shall submit it on weekly basis to CMC. All grievances shall be resolved within 2 weeks times.
- Monthly Safety Meeting is platform for discussion of all environment and safety related concerns. Thus, representatives of labour from each contractor and sub-contractor shall mandatorily attend the monthly safety meeting and shall speak in the meeting about the concerns being faced by them. Adressal of such concerns shall be done within 15 days' time depending on the severity of the issues.
- All the workers/labour shall be issued letters of appointment and ID cards on engagement.
- All workers shall be provided with basic amenities at camps & sites, induction training, job-related safety training, other required training, dos and don'ts for site and safety equipment as per the BOCWA 1996. Any act of violation in the same shall be treated as violation and shall be liable for the penalty.

- Labour shall be inducted and made aware about the risk of HIV/AIDS and shall be provided with the period holidays/leaves to go back homes and other required facilities for prevention of HIV/AIDS
- Labour shall strictly be inducted for non-usage of any alcohol, smoke, narcotics, drugs at the site and shall be made aware of the risks involved in usage of such items.
- All-important days related to environment and safety and the important regional/national festivals shall be observed at the site and participation of labor/workers & their family shall (if at site) be encouraged.
- Other labour welfare measures and occupational health and safety plans are discussed in the EMP, and all the measures details shall strictly be followed.

7.3 Grievance Redressal Process

The Grievance Redress Process is presented in Figure 86

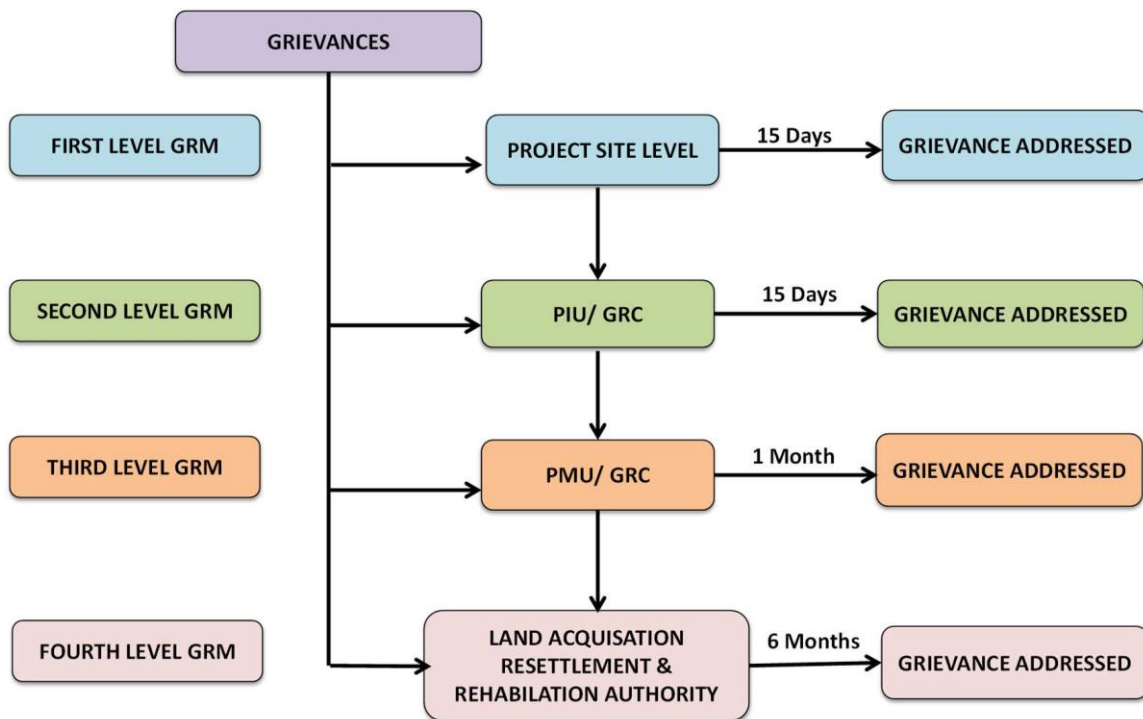


Figure 86: Environmental and Social Grievance Redressal Process

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

- Initial grievance sheet (including the description of the grievance) with an acknowledgement of receipt given to the complainant when the complaint is registered.
- The workers can directly approach the higher level GRC of the PIU if they are not comfortable to approach the site level GRC.
- Grievance monitoring sheet with actions taken (investigation, corrective measures); and
- Closure sheet, one copy of which will be handed over to the complainant after he/she has agreed to the resolution and signed off.

The updated register of grievances and complaints will be available to the public at the PMU office. Should the grievance remain unresolved, the person can seek alternative redress through the

appropriate court of law which will be the last level recourse or the AIIB's redress mechanism.

During consultation meets for preparation of IEE, communities in project areas were informed on grievance redress procedure and contact persons for lodging complaint/s. Contractor may also conduct consultation with local communities to make them aware about the grievance redress mechanism available. All the parties involved in project implementation i.e., contractor, CSC/AE, and PIU shall maintain complaint registers at their respective offices.

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

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

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

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

8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

8.1 Introduction

The Environmental Management Plan stands as a guidance material and would consist of all mitigation measures for each activity to be undertaken during the project life cycle to minimize adverse environmental impacts because of the activities of the project. It would also delineate the environmental monitoring plan for compliance of various environmental regulations and emergency response plan for dealing with emergency situations at the site.

EMP provides a well-structured planning with implementation & monitoring aspects to ensure effective & timely implementation of the proposed mitigation measures and suggestive management plans provided in EMP. EMP also comprise of enhancement measures related to the improvement of natural, physical, and aesthetic environment and enhancement of safety of community. It also provides measures for institutional strengthening and effective assessment through a defined monitoring plan, reporting corrective & preventive action planning. The components of this ESMP includes (i) mitigation of potentially adverse impacts (ii) monitoring of impacts and mitigation measures during project implementation and operation (iii) institutional capacity building and training (iv) compliance to statutory requirements (v) integration of ESMP with project planning, design, construction, and operation.

8.2 Objectives of Environmental and Social Management Plan

A project road-specific Environmental and Social Management Plan has been formulated which consists of a set of mitigation, monitoring, and institutional measures applicable to the design, construction, and operation stages of the project. The objectives of these EMP measures include:

- To propose measures for mitigation of the identified adverse impacts in timebound manner
- To design the mechanism for institutionalizing the implementation of EMP
- To define the budget for environment management
- To define the training and capacity building requirements of the organization to ensure implementation of EMP.
- To define the environmental monitoring plan for monitoring the various environmental aspects to check the effectiveness of implementation of EMP.
- To protect the natural environmental resources
- To enhance the aesthetic appeal of the proposed project
- To generate goodwill amongst local community by ensuring safety etc.

Executing agency for the project will be Project Implementation Unit (PIU), External Aided Project, Public Works Department (PWD), Government of Manipur. For the efficient implementation of the EMP of the proposed project following resources and arrangements will be required:

- Incorporation of the environment management plan and safety systems in the contractors' bid documents to ensure its implementation.
- Deployment of construction supervision consultant for supervision of the EMP implementation by contractor
- Monitoring of the environmental performance by respective agencies, PIU, PMU/PWD through periodic audits and inspections during construction and operation phases as applicable
- Arrangement/ allocation of environmental management budget
- Establishing the institutional structures and human resource with defined role & responsibilities for implementation of EMP
- Establishment of grievance redress mechanism for addressing stakeholders' grievances
- Information, communication, training, and capacity building of the concerned staff
- Development of reporting and documentation system
- Updating of EMP as and when required with a minimum frequency of one year.
- The proposed activities shall be restricted to the affected area around the project. The entire activities proposed shall be treated as projects and shall be monitored. Contractors appointed

by PWD under their supervision should take responsibility for the implementation of mitigation measures during the construction phase and PWD overall shall be responsible for implementation of EMP during operation phases. An outline of the major project activities and their potential impacts in different progressive phases i.e., planning/design, construction and operation stages have been provided.

The identified environmental, social, health & safety issues and recommended mitigation measures with institutional arrangements for implementation, supervision, and monitoring have been provided. Other than these following plans are prepared and provided as annexure to this report:

- Guidelines for Water Conservation - Annexure 10
- Cultural heritage Monument Conservation Plan - Annexure 11
- Emergency Response Plan for Disaster Management - Annexure 12
- Waste Management Plan - Annexure 13
- Traffic Management Plan - Annexure 14
- Site Rehabilitation Plan - Annexure 15
- Stockpile and topsoil soil management plan - Annexure 16

Table 105: Environmental, Social, Health and Safety Management Plan

1. Environment

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
A. Pre-Construction and Design Stage			
0. Complying to Regulatory Requirements			
0. Complying to Regulatory Requirements	<ul style="list-style-type: none"> • Contractor shall be responsible for obtaining all the permissions which may be required for carrying out the work at site and shall include but will not be limited to the following: <ul style="list-style-type: none"> ○ Tree Cutting permission (for the temporary areas or trees other than for which PWD has taken permission) ○ Permission for ground water extraction from CGWA/State Water Resource Department ○ Permission for working on or near the waterbodies and for Withdrawal of water from Surface Water bodies. ○ Consent to Establish and Consent to operate for Batching Plant, hot mix plant, Quarries, and Stone Crushers etc. ○ Pollution Under Control Certificate ○ Other permission form Centre/State/Local bodies for execution of works as required. • Contractor shall strictly comply with the conditions of statutory clearances obtained by PWD or by themselves. • Contractor shall prepare and submit the compliance reports of the conditions of clearance letter to PWD as per the requirement. • Contractor shall prepare site specific EMP detailing the environment management and monitoring measures & plan in line with the project EMP, requirement of GoI and requirement of the international funding agencies (if any) • Contractor shall strictly comply with the environment management and monitoring plan and shall implement all the project activities considering 	RoW / CoI / Project influence areas	Contractor/PWD

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>the measures specified in EMP and EMoP</p> <ul style="list-style-type: none"> • Strictly no child labour shall be allowed at work sites and supplier sites. • Contractor shall ensure that. <ul style="list-style-type: none"> ○ Specifications of crushers, hot mix plants and batching plants (existing or new) shall comply with the requirements of the relevant current emission control legislations. ○ Only Crushers licensed by the State Pollution Control Board (SPCB) shall be used. ○ The Contractor shall submit a detailed layout plan for all such sites and seek prior approval of Engineer - In charge of CSC before entering into formal agreement with the landowner for setting-up such sites. ○ The discharge standards promulgated under the Environment Protection Act, 1986 shall be strictly adhered to. All vehicles, equipment, and machinery to be procured for construction shall conform to the relevant Bureau of Indian Standard (BIS) norms. ○ Contractor will ensure that all vehicles, equipment and machinery used for construction are regularly maintained and confirm that pollution emission levels comply with the relevant requirements of SPCB Noise limits for construction equipment's to be procured such as compactors, rollers, front loaders, concrete mixers, cranes (moveable), vibrators and saws shall not exceed 75 dB (A), when measured at one meter distance from the edge of the equipment in free field, as specified in the Environment (Protection) Rules, 1986. ○ The Contractor shall maintain a record of PUC for all vehicles and machinery used during the contract period, which shall be produced at the PIU for verification whenever required. 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> ○ Ambient Air Quality, noise monitoring and environmental monitoring for other parameters must be performed by the Contractor as per the Environmental Monitoring Program and in accordance with the general and specific condition of CTE/CTO obtained by contractor. 		
1. Tree Cutting and vegetation removal			
<p>1.1. Reduction in tree cover, hence deterioration in climatic conditions. Increase in Green House effect/climate change impact.</p>	<ul style="list-style-type: none"> • Geometric adjustments were made to minimize tree cutting. • Widening to be accommodated within available ROW so as minimal tree cutting is required as possible. • Joint visit and measurement survey of tree Girth wise, Species wise shall be undertaken by project engineer with the forest department to ascertain the necessity of saving trees. • Obtain prior tree cutting permission from forest/Revenue department falling within project RoW. • Compensatory plantation in ratio 1:2 with respect to trees cut 5345 shall be undertaken with preference to fast growing species as per the directions of Forest department. • Transplantation of trees between girth 30 cm -75 cm shall be preferred. • Plantation and Transplantation shall strictly be undertaken during monsoon. • Survival rate of the plantation/transplantation shall be minimum 85% • Plantation of native trees shall be preferred, and exotic species shall be avoided. Plantation shall be carried out along roads as per IRC-SP:21-2009 strictly • Trees having large canopy, dust settling capacity, SO2 absorption capacity shall be planted. • Adequate after-care, timely watering, provision of guarding etc. shall be undertaken for transplanted and planted trees to assure high survival rate. • No firewood extraction from trees shall be allowed. 	Project areas	PWD, MANIPUR/ Forest Department

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>Firewood shall not be used for cooking or open burning. Workers shall be provided with clean cooking fuel and appropriate rest shelters & accommodation to prevent usage of wood for open burning & cooking purposes.</p> <ul style="list-style-type: none"> • Topsoil up to depth of 15 cm shall be extracted and stored separately so as it can be later used for plantation works. • Regular Monitoring of the planted trees shall be conducted on fortnightly basis. • Vegetation in areas close to the active stretches shall be sprinkled with water to remove the settled dust 		
2. Land Use and Land Acquisition			
<p>2.1. Rehabilitation and Resettlement and Social Issues</p>	<ul style="list-style-type: none"> • Detailed SIA study and RAP is being formulated for the project in line with the RFCTLARR, 2013 for the project shall strictly be followed for acquisition of the land and providing the compensation to the affected population. • The compensation to project affected persons shall be paid as per the Right to Fair Compensation & Transparency in Land Acquisition, Rehabilitation & Resettlement Act, 2013 and relevant Acts and guidelines of the Government of India and rules of concerned state governments. • Transparency shall be maintained with the landowners while sharing the project information and the details with affected landowners through regular consultation and meeting with the affected communities. • Grievance Redressal Mechanism shall be developed. • No land shall be taken forcefully (involuntary resettlement/acquisition) and without obtaining consent from landowner. • NO structure/CPR shall be demolished without obtaining consent of owner or community as applicable. • Any damage to private property occurs, contractors shall ensure that it is repaired/reconstructed as per 	<p>Project influence area</p>	<p>PWD</p>

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>original condition through contractors.</p> <ul style="list-style-type: none"> • Access alternatives shall be provided to the public to access their properties during construction works. • People shall be provided with alternate locations for parking their vehicle in nearby areas. • GRM shall be established and functional at all the prescribed level 		
2.2 Land-Use	<ul style="list-style-type: none"> • RoW clearing activities are to be carried out with least disturbance to the surrounding by restricting the project activities within the defined RoW. • Before start of construction activities, sites for C&D waste disposal shall be identified. These sites should be at minimum 500 m distance from residential, sensitive and water body location and shall always be above the HFL of the nearest water body (Ulhas River). These sites should be provided with adequate drainage and silt arresting mechanism. • Preferably waste land and barren land shall be considered for establishment of the C&D waste disposal site. • Labour camp, storage yards, casting yards and plant site (batching plant, stone crushers) should be at minimum 500 m distance from residential, sensitive and water body location. • All the sites being used for the construction purposes temporary shall be restored back to the original condition. 	RoW / Col / Project influence areas	Contractor; Environmental Officer of CSC
2.3 Utility and CPR Shifting	<ul style="list-style-type: none"> • Road formation widening will be made based on minimizing tree cutting, utility shifting, and damage to community properties. • Road design has incorporated the drainage system to avoid the accumulation of drainage water and surface run-off. • Temporary pits will be constructed at side-and cross drains to collect drainage water from demolished or damage drainage channels which will be hauled for off-site treatment. 	•	

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • All utilities requiring shifting shall be largely made before the start of construction through concerned agencies. • Alternate shall be provided to community if any utility or CPR is affected. • Stakeholders shall be pre-informed in case of any disruption of any basic service and shall be provided with alternatives. • Geometric adjustments made to minimize shifting needs or loss to any facilities. • All telephone and electrical poles/wires, underground cables/pipelines should be shifted before start of construction. • Necessary permissions and payments should be made to relevant utility service agencies to allow quick shifting and restoration. • Local people must be informed through appropriate means. About the time of shifting of utility structures and potential disruption of services if any • Relocation of wells, hand pumps at suitable locations with consent from local community. • Early completion of works for schools, colleges and health centers including shifting of gates and construction of boundary walls shall be planned during holidays so that the risk of accidents and disturbance to day-to-day activity of such institutions are minimized. • Proper placement (as per codes) of passenger shelters/bus stops shall be ensured to prevent distress to the commuters and passengers. • Relocation sites for all CPRs shall be selected in consultation with concerned communities, local administrative authorities/departments. Concerned authority, local body and public must be informed through appropriate means about the time of shifting of utility structures and potential disruption of services if any, to ensure that work does not get affected. 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
3 Climate Change			
3.1 Impact on Microclimate	<ul style="list-style-type: none"> • Minimizing number of trees to be cut • Selection of RoW to avoid forest, notified protected areas and trees (5345 nos. getting impacted) • Undertaking compensatory plantation and preferring for transplantation than cutting • Minimizing impact on forest land and wetland areas • Usage of low embodied material/recycled material/waste material for construction like excavated material, removed bitumen, fly-ash, demolition debris etc. • Provision of solar powered street/common lighting and sign boards (part of the project cost) • Provision of rainwater harvesting system to harvest rainwater and recharge ground water resources at drainage system by making drains of pavers block & porous concrete and providing recharge wells in consultation with PWD. • Design of all structures above HFL of the nearby rivers • Measures adopted for water resources conservation such as usage of curing compounds, water conservation fixtures etc. • Implementation of proposed environmental management plan to prevent impact on environmental components. • Opting for long spans to avoid piers construction in the water body. • Preferring the reflective pavements over the conventional concrete pavement to reduce the heat absorption. This can be achieved by using reflective coating or bright color mixtures in the pavement mixtures. • Proposing utility duct for housing utilities to avoid excavation in future for laying down the utilities. • Implementation of proposed environmental management plan to prevent impact on environmental components. 	RoW / CoI / Project influence areas	Contractor; Environmental Officer of CSC

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Obtaining all the permits, approval, and clearance as applicable on project prior development • All the machinery shall properly be maintained to ensure minimal emissions, noise, and energy requirement 		
3.2 Impact Due to Natural Hazards like flooding/ landslide/ earthquakes	<ul style="list-style-type: none"> • Project area is also prone to flooding; thus, infrastructure shall be planned above HFL as per 50 years return flood period. • Landslides are not common in the valley area of Manipur, but adequate testing shall be done to assess the risk of subsidence. During excavation, slopes shall be well secured by adequate shoring and benching. In case of unavailability of enough area for shoring, vertical supports such as sheets, meshes shall be provided on the vertical cuts to prevent the collapse of excavated area. • Adequate ventilation and lighting shall be provided for workers working in confined areas. • The entire Manipur falls under zone V (very high-risk zone) as per the seismic map of India and therefore the risk of damage to the project road due to an earthquake is critical. Relevant IS codes shall be adopted in the design of civil structures. 	Project Roads	Contractor
4 Safety			
4.1. Risk due to constricted sections, pavement damage due to use of unsuitable sub-grade material and inadequate drainage provisions in habitat area.	<ul style="list-style-type: none"> • CBR value of subgrade adopted in consistent to MORTH guidelines. • Increase in vent size of cross drains with inadequate waterways. • Maintain road level above HFL as per site conditions and MORTH guidelines. • Provision of new cross drainage structures 	Geometric improvement of Curves and CD structures proposed for improvement	PWD for incorporation in design and to be implemented by contractor
4.2. Safety along the proposed alignment	<ul style="list-style-type: none"> • Horizontal and vertical profile to be improved as per MORTH/IRC specifications considering land availability. • Speed limitations near built up sections and sensitive locations by installing rumble strips/speed breakers etc. 	Built-up-Stretches. Sensitive Receptors in close vicinity educational Institutions	PWD for incorporation in design and to be implemented by contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Provision of sidewalks in built up sections over cover drains. • Provision of cautionary and warning signs, boards near built up sections, sensitive receptors, and forest areas. • Provision of safety Kerb at all bridges. • Signs and marking viz. delineators, object markers, safety barriers at hazardous locations. • Improvement of all major junctions as per MORTH guidelines • Provision of Solar blinkers and Solar streetlights (part of project cost) • Adequate safety provisions like crash barriers on accident-prone areas rumble strips in community areas to regulate speed, retro-reflective warning signboards near school, hospital, and religious places are incorporated in the design. • Road Safety Audit (Design Stage) shall be conducted as per IRC SP 88 and all safety interventions shall be complied 		
4.3 Safety Procedures	<p>The Contractor shall:</p> <ul style="list-style-type: none"> • Comply with all applicable safety regulations, • Take care of the safety of all personnel who are entitled to be on the Site. • Use reasonable efforts to keep the site and works clear of unnecessary obstructions to avoid danger to personnel, • Fencing, lighting, guarding and supervision of the works shall be carried out and provided until completion and taking over. It is necessary to provide any temporary works (including roadways, footways, guards, and fences) as necessary, since the execution of these works, shall not raise a concern for the purpose of use and protection of the public and of owners as well as occupiers of adjacent land. • A construction safety checklist to be prepared and implemented 	All Construction Sites	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
1.2. Preparation, submission, and implementation of Safety Management Plan	<ul style="list-style-type: none"> The contractor shall prepare, submit, and obtain approval from the PWD/CSC for construction of the Safety Management Plan, and implement the same during construction 		Contractor
1.3. Accessibility	<ul style="list-style-type: none"> The Contractor shall provide safe and convenient passage for vehicles; pedestrians and livestock to and from roadsides and property accesses by providing temporary connecting road, as necessary. Construction activities that shall affect the use of side roads and existing accesses to individual properties, whether public or private, shall not be undertaken without providing adequate provisions to ensure uninterrupted access, as approved by the Engineer. The Contractor shall take care that the crossroads are constructed in such a sequence that construction work over the adjacent cross roads are taken up in a manner that traffic movement in any given area does not get affected. 	Through the project corridor	Contractor
B. Construction Stage			
1. High Noise & Vibration Level Generation			
1.1. Noise impacts due to Operation of Machineries, demolition works, plying of construction vehicles, loading & unloading of material, piling works etc.	<ul style="list-style-type: none"> Barricading shall be provided all along the corridor to prevent unauthorized access during construction phase. These barriers will be of full height and will also act as noise barrier. These barriers can be movable type and can be shifted as and when required depending on the activity. These barriers shall be provided with LED lights, reflector tapes. The safety of barricading boards shall be ensured by ensuring proper placements and locking to prevent any accidents. Management of construction traffic to avoid residential areas. Restriction on Honking at the project site. Heavy noise generating activities like piling preferably shall not be carried out at residential and sensitive areas during nighttime (10:00 PM to 6:00 AM). Periodic monitoring (monthly level) of noise levels to 	RoW / CoI / Project influence areas/ Construction camps/ Labour Camps/ Storage areas/ other temporary set-ups	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>check the level of pollutants and effectiveness of proposed EMP.</p> <ul style="list-style-type: none"> • Stationary noise sources like generator sets shall be provided with acoustic enclosures. The plants, equipment and vehicles used for construction should strictly conform to CPCB standards. Vehicles and equipment should be fitted with silencer and maintained accordingly. • All equipment should be fitted with silencers/noise mufflers and will be properly maintained to minimize its operational noise. Noise level will be one of the considerations in equipment selection, which will favour lower sound power levels. • Protection devices (earplugs or earmuffs) should be provided to the workers operating near high noise generating machines. • Hearing test for the workers prior to deployment at site and high noise areas followed by periodic testing every six months. • Job rotations systems for workers who will be working in high noise level areas. 		
<p>1.2 Vibration Impacts Due to Piling Operations, Operation of DG sets and other heavy machinery</p>	<ul style="list-style-type: none"> • Building damage from construction vibration is only anticipated from pile driving at very close distances to buildings (Approx 7 -8 m). If piling is more than 7-8 m from buildings, or if alternative methods such as push piling or augur piling can be used, damage from construction vibration is not expected to occur. Other sources of construction vibration do not generate high enough vibration levels for damage to occur. Prior construction, preconstruction surveys shall be conducted at locations close to piling to document the existing condition of buildings in case damage is reported during or after construction. Damaged buildings would be repaired, or compensation paid to the owners. • Provision of anti-damping floor and noise absorption material for placement of high noise/vibration causing 	<p>RoW / CoI / Project influence areas/ Construction camps/ Labour Camps/ Storage areas/ other temporary set-ups</p>	<p>Contractor</p>

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>machinery like DG sets/compressors etc.</p> <ul style="list-style-type: none"> • Notify the local people prior to undertaking the construction activities associated with higher vibration level such as activities using vibrating rollers. • After assessing potential human impacts (or building damage) from construction vibrations, the next step is to identify control measures. • Route heavily loaded trucks away from residential streets, if possible. Selects street with fewest homes if no alternatives available. • Operate earthmoving equipment on the construction plot as far away from vibration-sensitive sites. • Phase demolition, earthmoving and ground-impacting operations so as not occur at the same time. • Avoid night-time activities. People are more aware of vibration in their homes during the night-time hours. • sonic or vibratory pile driver causes lower vibration levels where geological conditions permit their use. However, continuous operation at a fixed frequency may be more noticeable to nearby residents, even at lower vibration levels. Furthermore, the steady-state excitation of the ground may increase resonance response of building components. Resonant response may be unacceptable in cases of fragile buildings or vibration-sensitive manufacturing processes. Impact pile drivers, in contrast, produce a high vibration level for a short time (0.2 s) with sufficient time between impacts to allow any resonant response to decay. • Select demolition methods not involving impact, where possible. • Avoid vibratory rollers and packers near sensitive areas. 		
2. Establishment of Construction Plants and Procurement of Machinery and establishment of labour/construction camps			
2.1. Concrete Mixing, Batching Plants, Plants and Crushers etc.	<ul style="list-style-type: none"> • Consent should be obtained before establishment and operation of work sites for the establishment and operation from State Pollution Control Boards. 	RoW / CoI / Project influence areas/ Construction camps/ Labour Camps/ Storage	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Compliance with relevant emission control legislation at the State level must be ensured for all equipment, machines, engines, generators, and vehicles which are involved in the crushers, and concrete batching plants and material transfer. • At least 500 m distance must be maintained between these plants and the human settlements/sensitive receptors/forest land/water bodies in the downwind direction. • All suggested mitigation measures for air and dust pollution, noise pollution, water pollution etc. shall strictly be implemented. • Compliance report to the condition of these consents shall be prepared and submitted to respective SPCBs. • Establishment of the casting yard, labour camps, storage yard, site offices etc. shall not require cutting of trees/clearing of any major vegetation and if require prior permission from forest department/concerned authority shall be obtained. • The disposal of any type of waste or material will not be allowed into a nearby watercourse or any nearby sensitive areas or others land as it may pollute surface water or can cause inconvenience to the community. • The construction camp, storage of fuel and lubricants should be avoided at the riverbank. • All temporary sites & infrastructure shall be designed above HFL 	areas/ other temporary set-ups	
2.2. Installation of Construction machinery and the vehicles	<ul style="list-style-type: none"> • Fuel exhaust standards for all the engines/vehicles must be checked with those as defined under EPA, 1986 and Motor Vehicles Act, 1988 before deploying on the work. • Bureau of India Standard (BIS) norms must be complied for engines, machinery equipment's and vehicles. • PUC certificate shall be obtained for all the construction machinery & vehicles as applicable. • Old machinery/engines/vehicles/loaders must not be 	RoW / CoI / Project influence areas/ Construction camps/ Labour Camps/ Storage areas/ other temporary set-ups	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>used on site.</p> <ul style="list-style-type: none"> • All machinery and vehicles shall be properly and timely be services and maintained to prevent noise issues and accidents. • All electrical/power equipment and heavy machinery shall be inspected prior to installation and commissioning. • Construction methodology and method statement for each construction activity/installation of heavy machinery shall be submitted for approval and shall comprise of guidelines on environment and safety management 		
<p>Establishment of construction/labour camps/other facilities</p>	<ul style="list-style-type: none"> • Layout of camps shall be prepared by contractor and reviewed& approved by PWD/CSC. • Construction camps/labour camps/stockyard's locations should be carefully selected to avoid the land use categories: residential, water bodies and sensitive & Eco sensitive areas. Distance of minimum 500 m shall be maintained between the said land use and camp/yard locations. Camps sites shall preferably be established on waste and barren land so as the vegetation removal and tree cutting can be minimized. • Labour Camps shall also be established at approx. 500 m distance from the water bodies to prevent any impact on the water body. • NOC shall be obtained from the landowner and the concerned authority prior to establishment of the labour camp. • Land shall be restored back to its original condition immediately after the completion of construction works and prior handing over the land back to the landowner. All waste materials, temporary/permanent structures etc. shall be removed from the camp site and the site shall be re-vegetated with the native species of trees. • Training and awareness shall be provided to the labour to not indulge in unfair practices. 	<p>Construction Camps/Labour Camps/ Storage yards</p>	<p>Contractor</p>

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Labour camp should be enclosed with boundary wall. • Movement of the workers should be monitored by providing adequate security checks and all the workers should be checked for availability of valid ID cards. • A cooked food canteen on a moderate scale shall be provided for workers so that they can have their meal at a definite place. All the waste generated from the canteen shall be treated/disposed of as detailed in the other sections of the waste disposal. The labour need not depend on the nearby facilities for food and so interaction with the nearby community will be minimized. • Firewood and other conventional fuels like dung cakes, paper, waste materials etc. shall not be used for cooking and campfire. Project proponents must provide only clean fuel for cooking like LPG gas. • Health problems of the workers should be taken care of by providing basic health care facilities at the construction sites, casting yard, labour accommodation, etc. Some arrangements will be made with the nearest hospital to refer patients during health emergencies. • Facilities at the camp sites shall be provided as per BOCWA, 1996 to establish proper sanitation facility and waste management system at the site to prevent impact on air, water, and soil quality of the area. Details are presented below: • Construction camps shall be provided with sanitary latrines and urinals with water facilities. Drainage systems and the proper sewage disposal system according to the local conditions should be provided for proper disposal meeting the standards as prescribed by CPCB. If sewage generation is more than 10 KLD then STP shall be provided if less than 10 KLD then sewage can be disposed through septic tank. Soak pits shall not be provided within 100 m of the water body or any water source to prevent impact on water 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>quality.</p> <ul style="list-style-type: none"> • Food waste shall be handed over to the piggeries or any pig farm in nearby areas. • All the municipal waste shall be disposed of through the authorized local waste management agencies only if any in-house treatment facility is not available. • There must be proper sewage and solid waste handling and management for the labour accommodations. The drainage must be proper in the camp area with no stagnancy of the water. Also, the drainage from the camps must not affect the domestic supply of the public water 		
3. Procurement of Resources			
3.1 Water for Construction	<ul style="list-style-type: none"> • Priority shall be given to use surface water wherever surface water source is available. • Ground and Surface water may be used only after obtaining necessary permissions from the respective Government authorities. • Statutory permits must be obtained from the Central Ground Water Authority and concerned State Irrigation Departments as applicable. • Rainwater harvesting provisions shall be made in design of drains. • STP treated water shall be procured from nearby STPs and shall be used preferably for sprinkling and landscaping. • Minimizing water requirement by using water conservation measures such as covering the water tanks, providing visual notice for water conservation, low flow taps in toilets etc. • Regular inspection to detect leakage in water pipelines and water tanks. 	Project Influence Area	Contractor
3.2 Procurement of Construction Material	<ul style="list-style-type: none"> • Procure materials from licensed suppliers preferably. • Use existing quarry sites and sources permitted by Government. • Verify the suitability of all sourced material prior 	Project Influence Area	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>procurement.</p> <ul style="list-style-type: none"> • New quarry site/crusher shall be established only after obtaining environmental clearance and consent from BPCB as applicable. • Documentation detailing the source of materials shall be maintained. • Borrow pits shall not be selected at the forest land/agricultural land/close to water bodies/existing roads/settlement areas. • The Indian Road Congress (IRC):10-1961 guideline should be used for the selection of borrow pits and the amount of material that can be borrowed. To the extent possible, borrowed areas shall be sited away from inhabited areas. • The depths in borrow pits to be regulated so that the sides shall not be steeper than 25%. Minimum distance of 8 m shall be maintained between two borrow pits. • Aggregates will be sourced from existing licensed quarries. Copies of consent/ approval/rehabilitation plan for a new quarry or use of existing sources will be submitted to EO, PIU. The contractor will develop a Quarry Redevelopment plan, as per the Mining Rules of the state, and submit a copy of it for the approval to EA if new quarries are opened. • The depth of borrow pits shall not exceed 45 cm and it may be dug out to a depth of not more than 30 cm after stripping the 15 cm topsoil aside. • Prior permission shall be obtained from District Collector for establishment of borrow area. • For the redevelopment of the borrow area, the project proponent shall evolve site-specific redevelopment plan for each borrow area location, which shall be implemented after the completion of borrowing. • Borrow areas shall be leveled with salvaged material or other filling materials which do not pose contamination of soil. In addition, it may be converted into fishpond in consultation with the fishery 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	department and if desired by the landowner/community. <ul style="list-style-type: none"> • The haul roads and borrow areas will be managed and maintained by the Project proponent as established. • Topsoil shall be preserved in stockpiles and re-used for greening or farming 		
3.3 Deployment of Manpower	<ul style="list-style-type: none"> • Local People shall be preferred during construction phase for skilled, semi-skilled and unskilled works. • Females shall also be employed during project implementation. • All rights of the employees shall be secured in terms of payment, provision of facilities, provision of safe working environment. • All the permissions shall be obtained as per various acts like CLA/BOCWA for the building works and contracted labour. • All facilities as per BOCWA requirements shall be provided to deployed labour. • All the Labour Codes and Acts in effect will have to be maintained properly. • No Child labour (person below 14 years of age) will be allowed to work in any capacity in the construction. 	Project Influence Area	Contractor
3. Air Quality			
3.1 Dust Control Measures	<ul style="list-style-type: none"> • Siting of stone quarry plant, batching plant, hot mix plant, stone crushers plant (if any) should be done in down wind direction. • Proper and prior planning and appropriate sequencing and scheduling of all major construction activities will be done, and timely availability of infrastructural supports needed for construction will be ensured to shorten the construction period vis a vis reduce pollution. • Construction materials shall be stored in covered condition to prevent fugitive emissions. • Construction materials and debris shall be transported in the covered conditions. 	<ul style="list-style-type: none"> • Built-up-Stretches. • Sensitive Receptors in close vicinity • Project Influence Area 	<ul style="list-style-type: none"> • Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Adequate dust suppression measures such as regular water sprinkling on unpaved haul roads, stone quarry, batching plant and stone crushers sites & fugitive dust during material handling, loading/unloading & other activities at haul road particularly at vulnerable areas near habitation shall be controlled especially in the dry seasons. • Provision of wheel wash facility • Dust during loading and unloading will be controlled with careful handling and by following measures: <ul style="list-style-type: none"> ○ Increasing moisture content: In some cases, slight moisture may be added to the material to reduce dust during loading. ○ Reducing falling distance: Shortening the falling distance between the material discharge point and the material pile will slow material velocity and reduce particle impacts, lessening dust generation. ○ Adding physical barriers at the loading point: Create walls or areas where personnel are removed from the affected area to avoid dust exposure that could occur. 		
3.2 Other Emission Control Measures	<ul style="list-style-type: none"> • such as 'Consent to Establish' and 'Consent to Operate' for batching plant, stone crushers area (if any), stone quarry (if any) shall be obtained from the State Pollution Control Board and complying with all the conditions. All vehicles operating for the Project proponent shall obtain Pollution under Control (PUC) certificate. • Environmental clearances shall be obtained from authorities for establishing new quarries, borrow areas and crushers as applicable. Project proponent shall strictly comply with all the conditions in the clearances. • DG sets shall be provided with stack of adequate height as per CPCB norms ($H = h + 0.2\sqrt{KVA}$, where H= total height of the stack, h=height of the building in meters, 	<ul style="list-style-type: none"> • Built-up-Stretches. • Sensitive Receptors in close vicinity • Project Influence Area 	<ul style="list-style-type: none"> • Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>KVA=total generator capacity of the set in KVA)</p> <ul style="list-style-type: none"> • It will be ensured that all the construction equipment & vehicles are in good working condition and maintained to keep emissions within permissible limits. Idling of vehicles shall be minimized and engines should be turned off when not in use to reduce pollution. • Only clean fuel shall be utilized for all cooking purposes at labor camps. • Raw materials shall be procured from nearest local sources. • Provision of wheel wash facility will be installed to contain project site dust within the site. • Recycled construction materials like fly-ash and sludge from cement plants for construction purposes may be utilized. • Temporary Electricity connections at the sites will be obtained to minimize usage of DG sets etc. 		
4. Land and Soil			
4.1. Land use Change and Loss of productive/ topsoil	<ul style="list-style-type: none"> • No agricultural areas to be used as borrow areas and establishment of the temporary facilities to the extent possible. • Land for temporary facilities like construction camp, storage areas etc. Shall be brought back to its original land use. • If using agricultural land, topsoil to be preserved and laid over on embankment slope for growing vegetation. 	Throughout project section and borrow areas and Land identified for construction camp	Contractor
4.2. Slope failure and soil erosion due to construction activities, earthwork and cut and fill stockpiles etc.	<ul style="list-style-type: none"> • Care should be taken that the slope gradient shall not be steeper than 2H:1V. • Earth stockpiles to be provided with gentle slopes to avoid soil erosion. • Excavated pits shall be stabilized by shoring to prevent any collapse of excavation and soil erosion. • Excavation shall not be carried out during monsoon 	Throughout the project road	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>and excavated pits shall be covered with tarpaulin to prevent filling with water. Soil laden water filled in the pit shall be pumped into sedimentation tank and the settled silt shall be re-used within the project.</p> <ul style="list-style-type: none"> • Approaches for bridges shall be stabilized and pitched as required to prevent any erosion. • Excavated earth/stockpiles shall not be piled at construction sites and shall regularly be removed. They shall be stored in covered condition to prevent erosion due to wind and water action. Height of the stockpiles shall be maintained. High and very close stockpiles shall be avoided. Drainage facility shall be provided in the stockpile area to prevent erosion/washing away of stockpiles. • Nearby land shall not be used for any purpose like parking of vehicles, storage of materials etc. as any work movement/activity 		
4.3. Borrow area management	<ul style="list-style-type: none"> • Non-productive barren land shall be used for borrowing earth with the necessary permissions/consents. • Depths of borrow pits to be regulated and sides not steeper than 25%. • The 15 cm topsoil to be stockpiled within the site of identified borrow area for use at the rehabilitation stage as preventive measure. The stockpiles shall be covered with gunny bags / tarpaulin. • Follow IRC recommended practice for borrow pits (IRC 10: 1961) for identification of location, its operation and rehabilitation. • Borrow areas not to be dug continuously. • Redevelopment of borrow areas shall be taken up in accordance with the plans approved by the Authority Engineer 	Borrow site location as identified in DPR or any selected borrow area.	Contractor
4.4. Quarry Operations (if any quarry is established)	<ul style="list-style-type: none"> • No quarry and/or crusher units shall be established, which is within 500 m from the residential/settlement locations, forest boundary, wildlife movement path, breeding and nesting habitats and 	Quarry site	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>national parks/sanctuaries.</p> <ul style="list-style-type: none"> • Aggregates should be sourced from existing licensed quarries. • Copies of consent/approval/ rehabilitation plan for new quarry or use of existing quarries should be sought. • The contractor will develop a quarry redevelopment plan as per mining rules of state. • Obtain environmental clearance from SEIAA in case of opening new quarry. • Contractor shall work out haul road network to be used for transport of quarry materials and report to Authority Engineer who shall inspect and approve the same. 		
<p>4.5. Contamination of soil due to leakage/spillage of oil, bituminous debris generated from demolition and road construction</p>	<ul style="list-style-type: none"> • Topsoil from the RoW shall be removed up to the depth of 15 cm and shall be stored for later usage for landscaping and dressing of the temporarily affected areas at the time of restoration. • Topsoil shall be stored in the form of stockpiles. Slope and height of the stockpile shall be maintained as per the angle of repose of the material. Minimum distance of 250 m shall be maintained b/w the two-stock pile to allow access. These stockpiles shall be sprinkled with water to minimize the erosion. • Excavated slopes shall be stabilized through appropriate engineering and biological measures like pitching, mulching, tariffing etc. • Loose construction material, construction debris and excavated earth shall be stored and transported in covered conditions. • Stockpiles of construction materials, construction debris, topsoil and excavated earth shall be located away from rivers, streams, fertile agricultural lands, recorded forest lands or inhabited area. • Appropriate measures like silt fence, perimeter dikes, water bars etc. be installed around stockpiles to retain silt from run-off. 	<p>Fueling station, construction sites, construction camps and disposal location</p>	<p>Contractor</p>

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Temporarily drainage shall be provided at the construction sites and excavated areas to divert the runoff. These drains shall be provided with sedimentation tanks to arrest the silt. • Silt fencing shall be done near all the water bodies prior to the start of work. • Provision of side drains to guide the water to natural outfalls. • When soil is spread on slopes for permanent disposal, it shall be buttressed at the toe by retaining walls. • Side slopes of the embankment shall not be steeper than 2H: 1V. Turfing of embankment slopes shall be done along the stretch. • Shrubs shall be planted in loose soil areas. • In rural stretches, longitudinal side drains shall be intercepted by drains serving absolute channels to reduce the erosion. • IRC: 56 -2011 recommended practice for the treatment of embankment slopes for erosion control shall be taken into consideration. • Soil erosion shall be visually checked on slopes and high embankment areas. In case soil erosion is found, suitable measures shall be taken to control the soil erosion further including bio-turfing. • During excavations, the Contractor will take all adequate precautions against soil erosion as per MoRTH Specification for Road and Bridge works (5th Revision) Clause no. 306. • The earth stockpiles to be located shall be provided with gentle slopes to prevent soil erosion and flow with water. • Fuel/waste oil shall be stored in covered HDPE containers only on paved surface having provision of containment of spillage. Oil interceptors shall be provided with drains near the fuel/waste oil storage. Oil spill management kits shall be available at the site to manage the spill if any. 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Sewage from Labour accommodation & construction sites and effluent from workshops shall be treated to the acceptable discharge/re-use standards as prescribed CPCB in EP Rules, 1986 • Waste to be generated during pre-construction and construction phase shall be stored, managed, and disposed off as per the relevant waste management rules. Waste management plan is given in the sections below. • All transportation vehicles and machinery shall be provided with drip trays and collected fuel shall be disposed off through authorized vendors only. • Explore possibility of usage of fly ash to reduce the soil/sand requirement for construction purposes. • Conduct regular soil quality monitoring especially at the fuel storage sites, debris disposal sites as per the environment management plan 		
<p>4.6. Compaction of soil and impact on quarry haul roads due to movement of vehicles and equipment</p>	<ul style="list-style-type: none"> • Construction vehicles and equipment will be maintained and refueled in such a fashion that oil/diesel spillage does not contaminate the soil. • Fuel storage and refueling sites to be kept away from drainage channels. • Unusable debris shall be dumped in ditches and low-lying areas. • Construction vehicles, machinery, and equipment are to be stationed in the designated ROW to avoid compaction. • Approach roads/haul roads shall be designed along the barren and hard soil area to reduce the compaction. • Transportation of quarry material to the dumping site through existing major roads to the extent possible to restrict wear and tear to the village roads. • Land taken for construction camp and other temporary facility shall be restored to its original facility. 	<p>Parking area, haulage roads and construction yards</p>	<p>Contractor</p>
<p>5. Water Resources</p>			

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
5.1. Sourcing of water during Construction and water conservation	<ul style="list-style-type: none"> • Requisite permissions shall be obtained for abstraction of groundwater if used. • Water availability to nearby communities should remain unaffected. • Water intensive activities not to be carried out during summer and water conservation measures shall be adopted like usage of curing agents in place if water, usage of water efficient fixtures, routine inspection & monitoring of tanks & pipelines to check leakage for timely repair. • Provision of water harvesting structures to augment groundwater condition in the area. • STP treated water shall be precured from nearby STPs and shall be used preferably for sprinkling and landscaping. • Any abandoned pond/waterbody/well shall be enhanced/improved/adopted to form a water collection;/recharge structure. • All the established quarry bits and borrow pits can be reclaimed as the pond 	Throughout the project site especially construction sites/camps.	Contractor
5.2. Alteration in surface water hydrology due to embankment	<ul style="list-style-type: none"> • Existing drainage pattern shall be retained, and no water body shall be closed/blocked/diverted. • Prefabricated structures shall be used to expedite the construction works within the river. • All the drains along the RoW and near the camps site shall be cleared off prior to the onset of monsoon. • C&D waste, excavated muck and other waste shall be stored, transported, and disposed off as per the waste management plan and waste management rules/guidelines. • No construction material will be stored or disposed near any water body except for reusing it for enhancement measures such as embankment raising. • No material should be dumped into natural drains that may block, impede, or alter drainage channels. • Adequate cross drainage structures and longitudinal drains shall be provided in & along roads to ensure 	Waterways streams/ nallahs along the section	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>the cross drainage of the runoff as required. The cross-drainage structure of service road shall be connected to the nearest existing drainage system. If necessary, the walls of the drains shall be designed to retain the adjoining earth.</p> <ul style="list-style-type: none"> • Culverts reconstruction shall be done during lean flow period. In some cases, these minor channels may be diverted for a very short period and shall be brought back to their original course immediately after construction. • The embankment height shall be designed consistent with the existing topography of the region and shall be higher than the HFL. An elaborate drainage system shall be provided to drain the stormwater from the roadway and embankment and to ensure minimum disturbance to natural drainage of surface and sub-surface water of the area. • The design of the drainage system such as surface and sub-surface drainage shall be carried out as per IRC: SP: 42 and IRC: SP: 50. • IRC: 34-2011: Recommendations for road construction in the waterlogged area and IRC: 75 and MORT&H guidelines for the Design of High Embankments shall be referred for construction of roads in such areas. • Drains along the road proposed shall be provided with pavers blocks and porous concrete to allow percolation of water down the aquifers and minimize run-off entering the waterbodies. This water can be channeled to deeper aquifers also by provision of injection wells. This system if provided shall be cleaned pre and post monsoon every year to maintain the functionality. 		
<p>5.3. Siltation in water bodies due to construction activities/earthwork.</p>	<ul style="list-style-type: none"> • Embankment slopes to be modified suitably to restrict the soil debris entering water bodies. • Provision of Silt fencing shall be made at water bodies. 	<p>Drainage and water bodies in project influence area</p>	<p>Contractor</p>

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Earthworks and stonework to be prevented from impeding natural flow of rivers, streams and water canals or existing drainage system. • Drainage shall be provided with paver block, porous concrete and recharge well systems at the outfall points to ensure the recharge of ground water aquifers. • Silt and sediments shall be collected and stockpiled for possible reuse. • Silt/sediment should be collected and stockpiled for possible reuse as surfacing of slopes where they must be re-vegetated. • Earthwork should be prevented from impeding natural flow of rivers and streams for existing drainage system. • Desalination of water bodies shall also be carried out periodically to maintain the carrying capacity of these water bodies. • Contractor shall prepare monsoon preparedness plan and shall implement it prior to the onset of monsoon. All filled material from water body or temporary access structures (if any) shall be removed from the waterbody prior consent of the monsoon. All the drainage of the project influence area shall be cleaned and checked for blockage. No loose material of waste shall be stored close to water body/drains 		
<p>5.4. Deterioration in surface & ground water quality due to leakage from vehicles and equipment and wastes from construction camps</p>	<ul style="list-style-type: none"> • Ground and Surface water may be used only after obtaining necessary permissions from the respective Government authorities. • STP treated water shall be precured from nearby STPs and shall be used preferably for sprinkling and landscaping. • Minimizing water requirement by using water conservation measures such as covering the water tanks, providing visual notice for water conservation, low flow taps in toilets etc. • Regular inspection to detect leakage in water 	<p>Surface water bodies and ground water resources throughout the project influence area</p>	<p>Contractor</p>

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>pipelines and water tanks.</p> <ul style="list-style-type: none"> • Labour accommodation, plant sites, casting yards, parking area, workshops, material, and fuel storage areas should be located at minimum 500 m distance from the water body. • Fuel and all hazardous materials/waste on-site should be stored on paved surfaces having the provisions of containments. • Concrete flooring with slope drains and oil interceptors should be proposed for hot mix plant area and workshop, vehicle washing and fuel handling area so that spilled oil can be collected without contaminating soil or run-off. In case of any oil spills, it should be cleaned properly. • Oil and grease interceptors shall be provided with drains at construction sites, material storage areas, parking sites and workshops. • Oil spill kits shall be provided at the site and the staff shall be trained to use these kits during emergencies. • A floating oil collection boom may be placed on waterbody to collect the oil in case of working inside or near the water body (especially for construction of bridges) • All equipment operators, drivers, and warehouse personnel will be trained in immediate response for spill containment and eventual cleanup. Readily available, simple to understand and preferably written in the local language emergency response procedure, including reporting, will be provided by the contractors Construction camps shall be sited away from water bodies. • Suitable drainage at construction site/camp/plant site should be provided to avoid formation of stagnant pool of water that leads to water logging and breeding of mosquitoes. • Excavation activities shall not be undertaken during monsoon season. All excavated pits and borrow area 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>sites shall be covered with tarpaulins during rains. Garland drains shall be provided around the excavated pits and borrow sites to prevent entry of run-off from surroundings into the excavated pits.</p> <ul style="list-style-type: none"> • Stockpiled soil and other loose material should be stored in covered areas or should be covered with tarpaulin. Drains with sedimentation tanks shall be provided in this area to facilitate drainage of run-off and arresting the silt from run-off. • Silt fencing or appropriate silt arresting measures shall be taken while working in and near the water body to prevent entry of sediment in the water bodies. • Work shall be undertaken during low water season. All temporary structures, filling material, coffer dams etc. shall be removed prior to the onset of monsoon. • All drainage in project area shall be cleared prior to the onset of monsoon. • Vehicle and TM washing shall not be undertaken at any waterbody or in project RoW or at land. Vehicle and TM washing shall be carried out at minimum 100 m distance from any waterbody Proper facility comprising of Sedimentation tank shall be provided for TM washing. Concrete slurry shall regularly be removed from the sedimentation tank and shall be re-used or recycled at project site or disposed off as per C&D waste Management Rules • Concrete slurry/dried concrete shall not be disposed off on land/water body. • No vehicles or equipment should be parked or refueled near water bodies to avoid contamination from fuel and lubricants. • All chemicals and oil shall be stored away from water bodies. And concreted platform with catchment pit for spills collection • Oil/Grease traps shall be provided at outlet of vehicle washing & maintenance facility. 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Proper sanitation facilities (toilet with water facility) at the construction sites and Labour accommodation shall be provided (guidelines as given in BOCWA, 1996 shall be followed) • Sewage from toilets at labour accommodation and construction sites shall be disposed off complying with the guideline of CPHEEO and SPCB/CPCB. Sewage shall be disposed off through septic tanks and soak pits. Septic tanks shall be evacuated through authorized agencies only at the STP locations or at authorized locations only approved by local bodies. Soak pits shall not be provided anywhere within 100 m of any water body or where ground water table is less than 4 m. If sewage generation at one site is more than 10 KLD, then preferably STP shall be provided. Sewage shall be treated up to tertiary level and shall meet the discharge standards as specified by CPCB. Treated water shall be used at site for water sprinkling and landscaping. • Water quality monitoring shall be conducted as per environment monitoring plan 		
6. Flora and Fauna			
6.1. Vegetation loss due to site preparation and construction activities.	<ul style="list-style-type: none"> • No labour accommodation, plant site, construction plants etc. shall be established on the forest land. • Alternate clean fuel shall be provided to the laborers in the labour accommodations to ensure that no firewood will be used for cooking etc. • Smoking, hunting & fishing shall be prohibited for workers. Regular awareness training related to non-use of firewood, prohibition on smoking in natural areas, bush fires accidents, safe handling of animals (if encountered), prohibition of fishing etc. shall be conducted for labor. • Noise will be kept under control by regular maintenance of equipment and vehicles. Noisy activity shall be prohibited during night in forest areas. 	Throughout the project corridor	PWD, MANIPUR/ Forest Department

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Dust control measures will be adequately applied with the dust generating activities. • Trees located outside the RoW shall not be felled. Minimum number of trees will be felled within the Row with translocation of trees up to maximum possible extent will be performed as much as possible. • The loss of trees shall be compensated through compensatory plantations (1:2 ratio) in accordance with requirement of State Forest Department for the impacted 5345 trees. • Plantation shall be carried out along roads as per IRC-SP:21-2009 strictly • Proper protection and aftercare shall be undertaken for the planted trees for minimum period of 5 years with regular monitoring of planted vegetation on fortnightly basis. • Vertical gardens/tree wall shall be developed on noise barriers, on bridge piers and the other locations as possible. • Vehicle washing, TM Washing, establishment of batching plant, hot-mix plant etc. shall not be permitted in the vicinity of any water body to avoid the deterioration of water quality and any human induced impact on aquatic life nor shall workers be permitted to use waterbodies for bathing and washing. • Proper sanitation facilities at site (toilets, washrooms, bathroom, kitchen) and accommodation area shall be provided for workers and the sewage shall be treated in STP (if sewage is more than 10 KLD) or disposed off in septic tanks. STP sludge/septage shall be disposed off through the authorized agency only. STP treated water shall meet the prescribed standard for re-use and shall be used for horticulture or dust suppression purposes. • Designates place will be used to store the 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>construction material. Proper care will be taken that no spill of the construction material or the debris shall take place and get mixed into any river body or washed away in heavy rains.</p> <ul style="list-style-type: none"> • Moreover, all provisions of Environmental Management Plan made for the air, water, noise pollution control will be implemented, and thus will also be helpful to control the negative impacts on the flora as well. • Use of LPG for cooking in camps to avoid tree cutting. • Integrate vegetation management (IVM) with the carriage way completely clear of vegetation Controlled use of pesticides and fertilizers. 		
6.2 Disturbance to fauna	<ul style="list-style-type: none"> • Smoking, hunting & fishing shall be prohibited in the natural habitats/forests/water bodies. • Awareness will be spread among the workers towards nature's conservation. • All staff / workers will be instructed not to chase/hunt if any wildlife is seen near the project area. The incidence of sighting wildlife near project site should be reported to Forest Department for safe handling. • Construction activities will be avoided at nighttime near the natural habitats. • All kinds of the pollution and noise causing machinery/engines will be properly serviced to keep the disturbance level at minimum or below the prescribed limits. • Construction in and near waterbodies shall be undertaken during low water level (summertime) • No waste/sewage disposal shall be carried out in any water body. • Construction/hazardous material/waste shall not be stored close to any water body 		
7. Cultural and Heritage of Project Area			
7.1 Impacts on archaeological, historical and cultural	<ul style="list-style-type: none"> • Consult State Department of Archaeology to obtain an expert assessment for construction near 	Archaeological monuments in project area (Table 58 of	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
properties	<p>archaeological monuments. Consider alternatives if the site is found to be of medium or high risk.</p> <ul style="list-style-type: none"> • Develop a protocol for use by the Contractors in conducting any excavation work close to archaeological monuments (as listed in baseline chapter table 58 of IEE) and elsewhere in project area, to ensure that any chance finds are recognized, and measures are taken to ensure they are protected and conserved. • If fossils, coins, articles of value or antiquity, structures, and their remains of geologic or archaeological interest are found, local government shall be immediately informed of such discovery and excavation shall be stopped until identification of cultural relics by the authorized institution and clearance is given for proceeding with work. All the above discovered on site shall be the property of the Government and shall be dealt with as per provisions of the relevant legislation. • The contractor shall take reasonable precaution to prevent his workmen or any other persons from removing and damaging any such article or thing. • Contractor shall, immediately upon discovery thereof and before removal acquaint the Employer and ASI of such discovery and carry out their instructions for dealing with the same. • In case there is an impact on religious and/ or cultural properties, they will be relocated to suitable locations, as desired by the community before construction starts. • For partially impacted structures enhancement measures shall be applied at the same sites before construction begins, depending on the availability of space, requirement of the communities and fund availability. • As far as possible, the architectural elements of the structure should be conserved/ reflected/ translated 	IEE report), close to temples, old buildings, libraries, places of religious/ cultural/ historic importance and Entire Project Influence Area	

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>into the design of new structures in accordance with consultations with the community.</p> <ul style="list-style-type: none"> • Meaningful Community meetings shall be conducted to discuss relocation aspects, siting of structures etc. • Relocation sites for all cultural properties shall be selected in consultation with concerned communities, local administrative authorities/departments. 		
8. Construction & Demolition Works and Management of Construction Debris			
8.1. Demolition of structures and Generation of C & D waste	<ul style="list-style-type: none"> • Structures falling within the RoW, Bridges and culverts shall be planned for demolished and it is expected that approx. 58425 cum of demolition waste will be generated. This waste shall be used for construction purposes or may be given to other construction projects in the project area or may be disposed off as per the requirements of the local bodies in the project area. • Metal waste, wood waste and other recyclable waste shall be sold to authorized recyclers. • Bridges and culvert demolition shall be undertaken during dry season when the flows are lowest. • In case of perennial streams, water shall be diverted away from the work area temporarily and water way shall be protected from contamination through silt fencing. • Prevent earthwork, stonework, materials, and appendage from impeding cross-drainage at rivers, streams, water canals and existing irrigation and drainage systems. 	Structures to be demolished and Bridge and Culvert locations which are proposed to be demolished for reconstruction	Contractor
8.2. Selection of dumping site	<ul style="list-style-type: none"> • Contractor to submit a waste/spoil disposal plan and get it approved by PWD/Supervision consultant and local bodies. • Create controlled dumping sites with a non-permeable lining incorporated in the pit design to avoid leachate seepage into the soil, which may later affect ground water quality. • Unproductive/ waste land shall be selected for 	Throughout the project corridor	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>dumping sites away from residential areas and water bodies.</p> <ul style="list-style-type: none"> • Dumping sites must have adequate capacity equal to the number of debris generated. • Public perception and consent from the village Panchayats must be obtained before finalizing the location. • Dumping sites shall be planned above HFL level and shall be provided with drainage system to carry away the contaminated run-off and the leachate. Run-off from the dumping site shall pass through the sedimentation tank prior entering the natural drainage system 		
<p>8.3. Reuse and disposal of construction and dismantled waste</p>	<ul style="list-style-type: none"> • All excavated materials from roadway, shoulders, verges, drains, cross drainage will be used for backfilling embankments, filling pits, and landscaping. • Unusable and non-bituminous debris materials should be suitably disposed of at pre-designated disposal locations, with approval of the concerned authority. • The bituminous waste shall be disposed in secure landfill sites only in environmentally accepted manner. For removal of debris, wastes and its disposal, MORTH guidelines should be followed. • Unusable and surplus materials, as determined by the Project Engineer, will be removed, and disposed off-site. 	<p>Throughout the project corridor</p>	<p>Contractor</p>
<p>8.4 Other Waste Generation and its Management</p>	<ul style="list-style-type: none"> • Contractor shall follow and comply with all the rules pertaining to the management and disposal of waste in India. • Contractor shall obtain NOC for generation, management, and disposal of all kinds of waste generated from SPCBs and local bodies as applicable. • Contractor shall follow the conditions of all the NOC obtained pertaining to the waste generation. • Waste generated at the site shall be segregated at 	<p>Throughout the project corridor</p>	<p>Contractor</p>

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>source and treated or re-used at site to the extent possible. Recyclable materials shall be segregated and sold to the authorized recyclers. Rejection of waste shall be disposed-off through the authorized local waste management agencies in the area.</p> <ul style="list-style-type: none"> • If local agencies/facilities for waste collection and disposal are not available for municipal and C&D waste, in the project area then project proponent shall identify the sites for waste/construction debris disposal. Debris disposal sites shall be selected prior to the start of construction. • Any hazardous materials to be used will also need to be stored and handled correctly to prevent spills and pollution. Hazardous material shall be stored in covered conditions only in the confined location and shall be provided with the containment for any spillage. Hazardous waste containers shall properly be marked and kept in isolated locations only. Hazardous waste transportation shall be carried out only through the authorized transporters and TREM card shall be maintained for transportation. • Effort shall be made to re-use C&D waste to the possible extent such as filling material for casting yards or other local construction projects. Surplus shall be sent for recycling to the recyclers or for disposal at approved sites. • Excavated soil shall be used for backfilling excavations and surplus shall be given to the other construction projects in vicinity or disposed-off to the C&D waste disposal site. • No dumping should be carried out outside the RoW including private and government land, roadside, low lying areas, wetlands, water bodies, forest area, ecologically sensitive areas etc. • All the workers engaged in waste management shall be provided with adequate PPEs like jackets, gloves, masks, face shield etc. 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> Waste generation shall be minimized by providing adequate material storage and covering facility and providing training to the workers for proper handling of the material and machinery 		
9. Site Restoration and rehabilitation			
9.1. Clean-up Operations, Restoration and Rehabilitation	<ul style="list-style-type: none"> Contractor will prepare site restoration plans, which will be approved by the PWD and Supervision Consultants (SC) The clean-up and restoration operations are to be implemented by the contractor prior to demobilization. All construction zones including culverts, road-side areas, camps, hot mix plant sites, crushers, batching plant sites and any other area used/affected by the project will be left clean and tidy, to the satisfaction of the PWD/SC All the opened borrow areas and quarry sites will be rehabilitated and PWD/SC will certify. 	Throughout the project corridor, construction camp sites, borrow area and quarry sites	Contractor
10. Increase in Traffic, Traffic Diversion and Management and Traffic Safety			
10.1 Impacts due to increase in traffic due to construction works and Diversion of Traffic	<ul style="list-style-type: none"> Traffic management plan for whole project and for each specific road (micro plan) shall be submitted by contractor to PWD/CSC for approval. The traffic control plans shall contain details of diversions; traffic safety arrangements during construction; safety measures for nighttime traffic and precautions for transportation of hazardous materials. Timing and scheduling to be done so that transportation of dangerous goods is done during least number of people and other vehicles on the road. The Contractor will ensure that the diversion/detour is always maintained in running condition, particularly during the monsoon to avoid disruption to traffic flow. On stretches where it is not possible to pass the traffic on the part width of existing carriageway, temporary 	Throughout the project corridor	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>paved diversions will be constructed.</p> <ul style="list-style-type: none"> • Restriction of construction activity to only one side of the existing road if possible (if adequate width available in case of SH & MDR) • The contractor shall inform local community of changes to traffic routes, and pedestrian access arrangements with assistance from “PWD/CSC”. • Use of adequate signage’s to ensure traffic management and safety. Conduct of regular safety audit on safety measures. • Plan transportation routes so that heavy vehicles do not use narrow local roads, except nearby delivery sites. • Schedule transport and hauling activities during non-peak hours. • Locate entry and exit points in areas where there is low potential for traffic congestion. • Keep the site free from all unnecessary obstructions. • Drive vehicles in a considerate manner. • Provide free access to households and businesses/shops along the ROWs during the construction phase. • Parking of transportation/construction vehicles/machinery on road shall not be allowed on public roads. • All activities including stockpiling of materials/debris etc. shall be exclusively undertaken within RoW. • Proper traffic safety measures like provision of adequate barricading and safety signages shall be provided at all the roads to be blocked/diverted to prevent any accident. Site specific traffic diversion/management shall be prepared. • Public shall be pre-informed about the completely/temporarily blocked roads through appropriate media and shall be suggested to take alternate routes. 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Road blockage/diversion signages shall be provided from at least 1 km of the affected point. • People shall be pre-informed through appropriate mode about such blockages 		
10.2. Safety during road works	<ul style="list-style-type: none"> • The contractor shall provide adequate signage and markings as per the instruction of the Engineer in the construction zones. Clauses 112.4. of MoRTH (Traffic safety), Clause 112.5. of MoRTH (Maintenance and Diversions) and IRC: SP:55 (Road signage and markings) shall be referred to for preparation of the relevant signage. 	All along the project corridor and haul roads	contractor
10.3. Traffic Safety and Pedestrian Safety	<ul style="list-style-type: none"> • Pedestrian Safety should be ensured. Pedestrian circulation shall be demarcated prior to start & unsafe areas shall be cordoned off. Ref Clause 112. of MoRTH (Arrangement for traffic during construction) 	All along the project corridor	Contractor
10.4. Safety of Workers and accident risk from construction activities	<ul style="list-style-type: none"> • Contractors to adopt and maintain safe working practices. • Usage of fluorescent and retroreflector signage, in local language at the construction sites. • Training workers on safety procedures and precautions. • Mandatory appointment of safety officer. • All regulations regarding safe scaffolding, ladders, working platforms, gangway, stairwells, excavations, trenches and safe entry and egress shall be complied with. • Provision of PPEs to workers. • Provision of a readily available first aid unit including an adequate supply of dressing materials. • The contractor shall not employ any person under the age of 18 years for any work and declare at site. • Use of hazardous material should be minimized and restricted. • Emergency plan (to be approved by engineer) shall be prepared to respond to any accidents or 	Construction sites	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>emergencies.</p> <ul style="list-style-type: none"> • Accident Prevention Officer must be appointed 		
10.5. Accident risk to local community	<ul style="list-style-type: none"> • Restrict access to construction sites only to authorized personnel. • Physical separation must be provided for movement of vehicular and human traffic. • All measures for the safety of traffic during construction viz. signs, markings, flags, lights, and flagmen as proposed in the Traffic Control Plan/Drawings shall be taken. • Provision of temporary diversions and awareness to locals before opening new construction fronts. • Alternate access facility to common properties near construction zones • Speed limitation wherever animal movement is anticipated. 	Throughout the project corridor, construction sites	Contractor
10.6. Pedestrians, cattle movement	<ul style="list-style-type: none"> • Temporary access and diversion, with proper drainage facilities. • Access to the schools, temples and other public places must be maintained when construction takes place near them. • Speed Limitation wherever cattle movement is expected. • If any wild animal is found near the construction site at any point of time, the contractor shall acquaint the Engineer and execute the PWD/CSC instructions for dealing with the same. • PWD/CSC shall report to the nearby forest office (range office) and shall take appropriate steps/ measures in consultation with the forest officials 	Near habitation on both sides of schools, temples, hospitals, graveyards, construction sites, haulage roads, diversion sites.	Contractor
10.7. Road Safety Audit / Inspections at Construction stage	<ul style="list-style-type: none"> • Work zone safety audit as per IR SP 88 shall be carried out and findings of the audit to be complied with as per IRC SP 55. • The work zone safety audits shall be conducted on quarterly basis 	All along the project corridor, access roads and junctions	Contractor with Safety Expert
10.8. Road Safety Audit /	<ul style="list-style-type: none"> • Road safety audit as per IR SP 88 shall be carried out 	All along the project	Contractor with

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
Inspection at Preopening Stage	<ul style="list-style-type: none"> • and findings of the audit to be complied with before pre-opening. 	corridor, access roads and junctions	Safety Expert
11. Health and Safety			
11.1 Occupational Health	<ul style="list-style-type: none"> • Project proponent shall have safety and health management system for all the construction activities to control and prevent any occupational accidents as per the National and International guidelines whichever is stringent as applicable. • Project proponent shall implement workers health awareness and surveillance program including health check-ups, regular health monitoring systems for the workers, vaccination drives for prevention of diseases and awareness program. • Project proponent shall ensure availability of adequate first aid kits, first aiders as per the National guidelines whichever and shall have tie up with nearby hospital to deal accident/emergency cases. • Workers shall be provided with hydrating drinks like ORS as required to prevent heat stress/exhaustion. • Provision of covered rest areas at regular intervals with proper facilities like resting desks, drinking water facility, toilets etc. • Project proponent shall provide all the facilities such as potable drinking water, toilets with water facility, kitchen area, clean cooking fuel, proper bedding, adequate no of toilets and bathing areas, maintenance of cleanliness and sanitation etc. at the labour camp site. Labour camp establishment shall strictly follow the BOCWA, 1996 • Ambulances with all the required facilities as per BOCWA, 1996, should be provided at all work sites to take injured persons to hospitals. • Emergency contact details (including nearest hospitals and first aiders should be displayed at appropriate locations at construction sites &labour accommodations. 	Throughout the project corridor	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Full-time medical facilities should be provided at each labour camp with first aid kits & first aiders. • Sufficient supply of potable water should be ensured for all workers and employees on-site. Conducting regular monitoring of drinking water quality at site and labour accommodations • Provision of dust and noise shields and maintenance of adequate distance between the workers and noise/dust generation activities as applicable • Project proponent shall implement administrative controls like practicing job rotation, maintaining work hours of labour, implementing work permit system, implementing LOTO, for the workers to prevent continuous exposure to dust, noise, heat, etc. • Workers shall be provided with proper training to handle any health-related emergency, if any. • All workers and staff should be provided with Personal Protective Equipment (PPE) appropriate to their job on site to minimize exposure to the dust and noise like masks, ear plugs etc. • Safety measures for working on height shall be taken. For working on height, workers shall be tested for Vertigo. Proper working platform with railings shall be provided for working on height. Workers shall be provided with harness, helmet, and Goggles for working on height. Also, proper training shall be imparted to workers for working on height. • Safety measures for working on water bodies shall be taken. Safe access to railings shall be provided. Safety jackets, floats, and rescue boats shall also be available. Lifeguards for saving people from drowning should be available at work sites. • EMP for dust and noise control shall strictly be followed as suggested. • Framing and implementation of drugs/intoxicants prohibition policy by project proponent during the construction phase 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Anti-venoms can be kept in the nearest hospitals/PHCs to treat snake bites if any. • Drinking water quality, air quality and noise level shall regularly be monitored at all the labour accommodations sites as per CPCB guidelines in regular intervals as suggested in EMoP 		
11.2 Occupational Safety	<ul style="list-style-type: none"> • Safe work method statement including HIRA shall be prepared and implemented for all the construction activities. • Provision of adequate fire detection and firefighting system at the site like extinguishers, sand buckets, fire blankets, usage of fire-resistant materials/wires etc. • Emergency preparedness plan shall be prepared to handle any contingency due to construction accidents and natural or man-made disasters like earthquakes, floods, and dust storms. • Traffic management plan shall be prepared to prevent any traffic-related accidents at or outside the site. Defensive training to the drivers to minimize accidents. • Provide proper earthing for all electric panels, machinery, DG sets etc. and proper safety & warning signs and conduct security patrols. • Ensure provision of safe work environment, provision of competent supervision, provision of safe equipment & machinery and provision of proper training to ensure safety at work site. • Project proponents should appoint an agency to provide awareness about the prevention of STDs among the workers. The agency shall work in close coordination with NACO and SACS for organizing the awareness campaigns. Workers shall be provided with condoms and diaphragms as required for minimizing spread of STDs. • All workers shall be provided with job specific training, behavioral based safety training and 	Throughout the project corridor	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>awareness for ensuring safety.</p> <ul style="list-style-type: none"> • Smoking shall be prohibited at the site to prevent health and fire hazard. • All construction sites should be barricaded with proper tamper proof fencing & security lighting and conduct regular security patrols and other security measures. All the construction activity and storage of material shall be strictly within the RoW. All hazardous chemicals & waste shall be stored as per the guidelines in the respective laws. • Avoiding usage of the chemicals or paints which may impact the health of the workers or community and shall encourage use of the VOC free paints etc. No banned material like asbestos shall be used at the construction site. • Antifouling paints shall only be used for painting structures which are under water. • All workers and staff should be provided with Personal Protective Equipment (PPE) like safety jackets, helmets, gloves, goggles, life jackets in case of work on/near water body appropriate to their job on site to minimize exposure to the hazards. • Coordination with local police to curb the anti-social activities and usage of drugs & narcotics. 		
11.3 Community Health & Safety	<ul style="list-style-type: none"> • All construction sites should be surrounded with secure tamper proof fence, with security lighting, regular security patrols and other security measures to prevent trespassing. Only authorized people shall be allowed to enter the construction camps/sites. • Project proponents shall have health and safety management system to effectively prevent any accidents happening at construction sites. • All materials and components should be stored and stacked safely in dedicated secure areas. • Avoid use of any paints containing lead or its compounds as well as high VoCs and any banned material like CFC, asbestos etc. 	Throughout the project corridor	Contractor

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Public health system capacity relies on detecting, testing, contact tracing, and isolating those who are or might be sick, or have been exposed to known or suspected communicable diseases. It is important to stop broader community transmission and prevent communities from having to implement or strengthen further community mitigation efforts. This can be done by organizing regular community health check-ups. Awareness program and vaccination camps will be organized in the nearby settlements/villages. • Ensure that first aid kits are available in all working areas, supplied with adequate material and medicine as per the BOCWA 1996. Facility of ambulance needs to be ensured. • Records of all nearest hospitals and health centers should be kept at each construction site. • EMP for dust and noise control shall strictly be followed as suggested. • Labour accommodation shall preferably be established at minimum distance of 500m from the residential/institutional areas. • Framing and implementation of drugs/intoxicants prohibition policy by project proponent during the construction phase • Project design involves provision of road safety infrastructure including crash barrier, rumble strips, lighting etc. which will prevent occurrence of accident and impact on residents and cattle. • Crash barriers shall also be installed at appropriate locations particularly near the school to provide safety for schoolchildren. The provision of speed breakers or rumble strips shall be made near schools, health centers etc. • Retro-Reflector zed traffic caution signs shall be used during construction. Regular safety audit or periodic reviews shall be made to assess the effectiveness of 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>safety measures adopted during construction.</p> <ul style="list-style-type: none"> • Adequate caution signage near the school, sensitive locations, speed control, caution notes shall be fixed at appropriate locations. These shall be preferable with Retro-reflective paints. • No manhole or trench shall be left open without cover or appropriate barricading. • Access to the construction site shall be controlled by placing barricading boards and deputing the security staff especially during night time. • Adequate lighting should be provided at workplace during nighttime. • Project proponents will have regular monitoring and audits/inspection system for ensuring effective implementation of safety management system and shall ensure continuous improvement of its safety management system. • A general regard for the social and ecological well-being of the site and adjacent areas is expected of the site staff. Workers need to be made aware of the following general rules: (i) no alcohol/drugs on site; (ii) prevent excessive noise; (iii) construction staff are to make use of the facilities provided for them, as opposed to ad hoc alternatives (e.g. fires for cooking, the use of surrounding bushes as a toilet facility); (iv) no fires permitted on site except if needed for the construction works; (v) trespassing on private/commercial properties adjoining the site is forbidden; (vi) other than pre-approved security staff, no workers shall be permitted to live on the construction site; and (vii) no worker may be forced to do work that is potentially dangerous or that he/she is not trained to do. • Interested and affected parties need to be made aware of the existence of the complaints book and the methods of communication available to them. The contractor must address queries and complaints by: 		

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	(i) documenting details of such communications; (ii) submitting these for inclusion in complaints register; (iii) bringing issues to the environmental and social specialist attention immediately; and (iv) taking remedial action as per environmental and social specialist instruction.		
11.4 Community Welfare	<ul style="list-style-type: none"> • Leave space for access between mounds of soil. • Provide walkways and metal sheets that were required to maintain access to shops/businesses along trenches. • Consult businesses and institutions regarding operating hours and factoring this into work schedules. • Provide signboards for pedestrians to inform the nature and duration of construction works and contact numbers for concerns/complaints. • Employ local persons to the extent possible 	Throughout the project corridor	Contractor
11.5 Covid-19 Health & Safety (General Directions to the workers)	<ul style="list-style-type: none"> • Avoid handshake, Only Namaste • Non-essential physical work that requires close contact between workers should not be carried out. • Work requiring physical contact should not be carried out. • Plan all other work to minimize contact between workers. • Wash hands often (every 1-2 hrs. or frequently as possible) with soap for at least 20 seconds • Use hand sanitizer. • No person should enter the work site other than the authorized persons mentioned by supervisor during start of work. • All must implement social distancing by always maintaining a minimum distance of 6-feet from others to eliminate the potential of cross contamination. • Avoid face to face meetings – critical situations requiring in-person discussion must follow social 	All construction camps.	Contractor

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

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>meeting rooms, corridors, washrooms/toilets, etc. as appropriate.</p> <ul style="list-style-type: none"> • Avoid touching eyes, nose, and mouth with your hands. • To avoid sharing germs, please clean up after Yourself. DO NOT make others responsible for moving, unpacking, and packing up your personal belongings. • Work schedules are adjusted to provide time for proper cleaning and disinfecting as required. 		
<p>11.6 Workplace prevention practices (Safety measures for ongoing Covid-19 Pandemic)</p>	<ul style="list-style-type: none"> • At the start of each shift, confirm with all employees that they are healthy and inform all workers of reusable and disposable PPE. • Outside person(s) should be strictly prohibited at worksite • All construction workers will be required to wear cut-resistant gloves or the equivalent. • Use of eye protection (reusable safety goggles/face shields) is recommended. The supply of eye protection equipment to the workers is considered as a standard part of PPE during construction works. • In work conditions where required social distancing is impossible to achieve, such employees shall be supplied with standard face masks, gloves, and eye protection. • All employees shall drive to work site as per the prevailing guidelines of the Government. • When entering a machine or vehicle which you are not sure you were the last person to enter, make sure that you wipe down the interior and door handles with disinfectant (with 1% sodium hypochlorite solution daily) prior to entry. Adequate quantity of the disinfectant shall be provided by the Contractor at all such site-specific locations. • Workers should maintain separation of 6' from each other. • Multi person activities will be limited where feasible 	<p>All construction camps.</p>	<p>Contractor</p>

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>(two persons lifting activities)</p> <ul style="list-style-type: none"> • Gathering places on the site such as sheds and/or break areas will be eliminated, and instead small break areas will be used with seating limited to ensure social distancing. • Contact the cleaning person of the worksite and ensure proper COVID-19 sanitation processes. Increase cleaning/disinfection visits to at least 2 times a day. Cleaning person(s) to be provided with gloves, gown, and face mask for each cycle of cleaning. • The Contractor shall make available adequate supply of PPE and All construction camp Contractor chemicals while the threat of COVID-19 continues. • Clean all high contact surfaces a minimum of twice a day to minimize the spread of germs in areas that people touch frequently. This includes but is not limited to desks, laptops, and vehicles. • All employees maintain good health by getting adequate sleep; eating a balanced, healthy diet, avoiding alcohol; and consuming plenty of fluids. • Continuation of works in construction project with workers available on site and no workers to be brought in from outside. • The site offices shall have adequate ventilation. The air conditioning or ventilation systems installed at the site offices would have high efficiency air filters to reduce the risk of infection. The frequency of air changes may be increased for areas where close personal proximity cannot be fully prevented such as control rooms, elevators, waiting rooms, etc. • The Contractor shall carry out contactless temperature checks for the workers prior to site entrance, during working hours and after site works to identify persons showing signs of being unwell with the COVID-19 symptoms. 		
11.7 Grievance Redress Mechanism for Workers	<ul style="list-style-type: none"> • Welfare measures as per BOCWA, 1996, Factories Act, CLA, 1970 and as per proposed E&S Management 	Labour Camps/Work Sites/Construction Camps	Contractor, PWD Manipur and GC

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<p>Plan prepared for this project shall be adopted</p> <ul style="list-style-type: none"> • Labour shall be allowed to select their representative for representing their grievances/issues being faced to the project executing & management agencies (contractor, GC & PWD Manipur) • Grievance Redress Committee for workers as defined in this IEE report shall be formulated which will address the grievances reported by workers • Disclosure of details of each level of GRC shall be provided to the workers/labour so as they can raise their issue at the desired level 		
C. Operation Stage			
1. Air Quality			
<p>1.1. Air pollution due to vehicular movement.</p>	<ul style="list-style-type: none"> • Compensatory tree plantations shall be maintained to achieve the survival rate of minimum 85% • Regular maintenance of the road will be done to ensure good surface condition. • Ambient air quality monitoring. If monitored parameters exceed prescribed limit, suitable control measures must be taken. • Signages shall be provided reminding the drivers/road users to properly maintain their vehicles to economize on fuel consumption. • Enforcement of vehicle emission rules in coordination with transport department or installing emission checking equipment. 	Throughout the corridor	PWD/Operation and Maintenance Agency
2. Noise			
<p>2.1. Noise due to movement of traffic</p>	<ul style="list-style-type: none"> • Effective traffic management and good riding conditions shall be maintained. • The effectiveness of the measures should be monitored. • Solid noise barriers shall be placed close to the silence zones and residential areas. • Ambient Noise Quality monitoring shall be conducted. • Speed limitation and honking restrictions near 	Sensitive receptors and Residential Areas	PWD/Operation and Maintenance Agency

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	sensitive receptors locations.		
3. Land and Soil			
3.1 Soil erosion at embankment during heavy rainfall.	<ul style="list-style-type: none"> • Periodic checking to be carried out to assess the effectiveness of the stabilization measures viz. turfing, stone pitching, river training structures, drainage. • Necessary measures to be followed wherever there are failures 	At embankment slopes, drains and other probable soil erosion areas.	PWD/Operation and Maintenance Agency
4. Water resources			
4.1 Siltation	<ul style="list-style-type: none"> • Regular visual checks shall be made to observe any incidence of blockade of drains. Regular checks shall be made for soil erosion. • Monitoring of surface water bodies 	Near surface water bodies	PWD/Operation and Maintenance Agency
4.2 Waterlogging due to blockage of drains, culverts, or streams	<ul style="list-style-type: none"> • Regular visual checks and cleaning (at least once before monsoon) of drains to ensure that flow of water is maintained through cross drains and other channels/streams. • Monitoring of water borne diseases due to stagnant water bodies 	Near water bodies and cross drainage structures and side drains	PWD/Operation and Maintenance Agency
5. Flora			
5.1 Vegetation	<ul style="list-style-type: none"> • Planted trees, shrubs, and grasses to be properly maintained. • The tree survival audit to be conducted at least once in a year to assess the effectiveness 	Project tree plantation site	PWD/Operation and Maintenance Agency
6. Maintenance of Right of Way and Safety			
6.1. Accident Risk due to uncontrolled growth of vegetation	<ul style="list-style-type: none"> • Maintain shoulder completely clear of vegetation. • Minimum offset as prescribed in IRC: SP:21-2009 to be maintained. • Regular maintenance/trimming of plantation along the roadside • No invasive plantation near the road. • Ensure no fuel accumulation and clearances of vegetation by burning near forest areas to avoid forest fires 	Throughout the corridor especially near accident prone curves and forest areas	Operation and Maintenance Agency
6.2. Accident risks associated with traffic movement	<ul style="list-style-type: none"> • Traffic control measures, including speed limits, will be forced strictly. 	Throughout the Project route	Operation and Maintenance

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
	<ul style="list-style-type: none"> • Further encroachment of squatters within the ROW will be prevented. • No school or hospital will be allowed to be established beyond the stipulated planning line as per relevant local law. • Monitor/ensure that all safety provisions included in design and construction phase are properly maintained. • Highway patrol unit(s) for round the clock patrolling. Help lines for accident reporting and ambulance services with minimum response time for rescue of any accident victims, if possible. 		Agency
6.3. Transport of Dangerous Goods	<ul style="list-style-type: none"> • Existence of spill prevention and control and emergency responsive system • Emergency plan for vehicles carrying hazardous material. 	MI: Status of emergency system – whether operational or not PT: Fully functional emergency system	Operation and Maintenance Agency
6.4. Road Safety and Maintenance of Assets	<ul style="list-style-type: none"> • No advertisement/hoardings shall be allowed within the Right of Way limits of the project road. • Regular maintenance and cleaning of assets such as sign boards, bus stops, drains etc. shall be undertaken. 	All along the project corridor	Operation and Maintenance Agency
6.5. Monitoring and Evaluation of Operational Performance of Environmental Mitigation Measures	<ul style="list-style-type: none"> • The PIU shall monitor the operational performance of the various mitigation/ enhancement measures carried out as part of the project. Monitoring and performance indicators have been indicated in Environmental Monitoring Plan 	All along the project corridor	Operation and Maintenance Agency
6.6. Maintenance of Drainage	<ul style="list-style-type: none"> • PIU shall ensure that all drains (side drains and all cross drainages) are periodically cleared especially before monsoon season to facilitate the quick passage of rainwater and avoid flooding without damaging the spurs and check dams erected to stabilize the course and flow of all such drainage channels. • PIU shall ensure that all the sediment/oil and grease traps set up at the water bodies are cleared once in every three months 	At locations where bridge works, culvert works and side drains (built up areas) proposed.	Operation and Maintenance Agency

Environmental Issues	Measures to be adopted	Location	Implementation Responsibility
6.7. Road Safety Audits / Inspections at O&M Stage	<ul style="list-style-type: none"> • O&M stage safety audit as per IR SP 88 shall be carried out and findings of the audit to be complied with as per IRC SP 55. • The O&M stage safety audits shall be conducted on quarterly basis for the first year followed by half yearly in subsequent years. 	All along the project corridor, access roads and junctions	O&M agency with Safety Expert

8.3 Environmental and Social Monitoring Program

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

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

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

- Construction Stage: (36 months of construction period)
- Monitoring shall be carried out by the Contractor.
- Six Monthly monitoring by the external agency shall be arranged by PIU from the Project cost budget. The monitoring report will be submitted by the agency to PWD.
- Monitoring Program and schedule for Key Performance Indicators (Physical, biological, and environmental management components identified as of its significance) are given in the following section:

8.3.1 Ambient Air Quality (AAQ) Monitoring

Ambient air quality parameters recommended for monitoring road development projects are PM2.5, PM10, Carbon Monoxide (CO), Oxides of Nitrogen (NOx), and Sulphur Dioxide (SO₂). These are to be monitored, right from the commencement of construction activity at selected locations of plants and machinery, crushers on sites, excavation works, etc. The locations, duration, and pollution parameters to be monitored are detailed in the Environmental Monitoring Plan. National Ambient Air Quality Standards by CPCB for 2009 are given below in Table 106.

Table 106: National Ambient Air Quality Standards

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
1	Sulphur Dioxide (SO ₂), µg/m ³	Annual* 24 hours**	50 80	20 80	-Improved West and Geake -Ultraviolet fluorescence
2	Nitrogen Dioxide (NO ₂), µg/m ³	Annual* 24 hours**	40 80	30 80	-Modified Jacob & Hochheiser (Na-Arsenite) -Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM ₁₀ µg/m ³	Annual* 24 hours**	60 100	60 100	-Gravimetric -TOEM -Beta attenuation
4	Particulate Matter (size less than 2.5µm) or PM ₂₅ µg/m ³	Annual* 24 hours**	40 60	40 60	-Gravimetric -TOEM -Beta attenuation

Sl. No	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
5	Ozone (O ₂) µg/m ³	8 hours* 1 hours**	100 180	100 180	-UV photometric -Chemiluminescence -Chemical Method
6	Lead (Pb) µg/m ³	Annual* 24 hours**	0.50 1.0	0.50 1.0	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper -ED-XRF using Tefloa filter
7	Carbon Monoxide (CO) µg/m ³	8 hours* 1 hours**	02 04	02 04	-Non-Dispersive Infra-Red (NDIR) spectroscopy
8	Ammonia (NH ₃) µg/m ³	Annual* 24 hours**	100 400	100 400	-Chemiluminescence -Indophenol blue method
9	Benzene (C ₆ H ₆) µg/m ³	Annual*	05	05	-Gas chromatography based continuous analyses -Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) particulate phase only, µg/m ³	Annual*	01	01	-Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As) µg/m ³	Annual*	06	06	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper
12	Nickel (Ni) µg/m ³	Annual*	20	20	-AAS/ICP method after sampling on EMP 2000 or equivalent filter paper

*Annual arithmetic means of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals

**24 hourly or (8 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

8.3.2 Water Quality Monitoring

The physical and chemical parameters recommended for analysis of water quality relevant to road development project are pH, total solids, total dissolved solids, total suspended solids, and oil & grease. The monitoring of the water quality is to be carried out at all identified locations in accordance with the Indian Standard Drinking Water Specification – IS10500: 2012. The locations, duration, and pollution parameters to be monitored are detailed in the Environmental Monitoring Plan.

8.3.3 Noise Levels Monitoring

The measurements for monitoring noise levels would be carried out at designated locations in accordance with the ambient Noise Standards formulated by the Ministry of Environment Forests and Climate Change (MoEF&CC) as given (Table 92). The noise level would be monitored on a twenty-four-hour basis. Noise should be recorded at “A” weighted frequency using a slow time response mode of the measuring instrument. The measurement location, duration, and the noise pollution parameters to be monitored and the responsible institutional arrangements are detailed in the Environmental Monitoring Plan.

Table 107: National Ambient Noise Quality Standards

Area Code	Category of Zones	limits of Leq in dB(A) Day*	Night*
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45

Area Code	Category of Zones	limits of Leq in dB(A) Day*	Night*
D	Silence Zone **	50	40

* Daytime shall mean from 6.00am to 10.00 pm and Night shall mean from 10.00 pm to 6.00 am

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

8.3.4 Tree Plantation and Transplantation

The survival of tree-plantation shall be monitored for three years of the operation phase. If the survival rate is found below 85%, additional compensatory plantation shall be done by the agency responsible for plantation and its maintenance. The survival rate monitoring shall be again taken up after 5 years. This cycle should continue until the 85% survival rate is achieved. Tree plantation would be done through the forest department, monitoring shall be carried out by PWD. Tree transplantations shall be preferred based on eligible trees and direction by the department. Plantation shall be carried out along roads as per IRC-SP:21-2009 strictly. Some of the tree species for plantation under compensatory afforestation are: Ailanthus excelsa, Albizia chinensis, A. lucida, Artocarpus integrifolia, Bahunia purpurea, Celtis australis, Ficus cunia, Ficus hispida, Figaenia prunox, Grewia oppositifolia, Litsea polyalthia, Lylosoma longifolia, Phoebe haissiona, Quercus dealbata, Quercus pachyphylla, Phyllanthus embelica, Pyrus communis, Mangifera indica, Juglans regia, Elaeocarpus serratus, Averrhoa carambola, Psidium guajava, Schima wallichii etc.

8.3.5 Soil Erosion and Drainage Congestion

Visual checks shall be carried out in the project area, especially areas close to the waterbodies to check for soil erosion & drainage.

8.3.6 Social Monitoring

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

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

Table 108: Environmental Monitoring Plan

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Air	Construction	SO ₂ , NO _x , PM ₁₀ , PM _{2.5} , CO,	High volume sampler to be located 50m from the construction plant/pollution source in the Downwind direction. Use method specified by CPCB for sampling & analysis	Air (prevention and Control of Pollution) Rules, CPCB, 2009	Monthly--24 hourly sample (Three seasons in a year)	24 hours Sampling	Along the project roads (1 residential location and 1 sensitive location for each road where work is being undertaken), 1 location each at operational casting yard, batching plant, crusher, hot mix plant etc., 1 sensitive location & residential location within 100 m of each such operational unit (casting yard, batching plant, crusher, hot mix plan) Anticipating working of 10 roads at a time, no of locations to be monitored is 35	Contractor under the supervision of CSC through NABL accredited laboratory
	Operation				Six monthly -- 24 hourly sample, not to be done in monsoon		At locations where baseline data is collected -16 nos.	PIU under supervision of PMU through NABL accredited laboratory

INITIAL ENVIRONMENTAL EXAMINATION
Manipur Urban Road and Asset Management Improvement Project (MURAMP)

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Water (Drinking/GW/SW)	Construction	All essential characteristics and some of desirable characteristics as approved by PWD/Supervision consultant	Grab sample collected from source and analyzed as per Standard Methods for Examination of Water and Wastewater	Indian Standards for Inland Surface Waters (IS: 2296, 1982) for surface water bodies, IS 10500 for ground water and drinking water	Quarterly (all four seasons for Drinking water and three seasons for surface water & Ground water- monsoon season to be excluded for GW & SW monitoring) If STP is installed, then inlet and outlet sample must be tested every month (considering 4 STPs)-8 samples/month	Grab Sampling	New GW structure developed & existing structures being used by contractor (casting yard, batching plant, along road etc.) and 1 GW monitoring location close to the residential area of every active road section. All surface water bodies were intercepted by project (for active road sections also). Drinking water quality monitoring at each labour camp & active construction site Anticipating working of 10 roads at a time, GW locations: 15 locations Surface water locations (may vary with the roads) 25 locations can be considered. Drinking Water: 10 locations	Contractor under the supervision of CSC through NABL accredited laboratory
	Operation				Six monthly (Not to be done during monsoon)		At locations where baseline data is collected for surface and ground water -16 nos. each	PIU under supervision of PMU through NABL accredited laboratory

INITIAL ENVIRONMENTAL EXAMINATION
Manipur Urban Road and Asset Management Improvement Project (MURAMP)

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Noise	Construction	Noise levels on dB (A) scale	Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement Equivalent noise levels using an integrated noise level meter kept at a distance of 15 from edge of pavement	MoEF&CC Noise Rules, 2000	Weekly--24 hourly sample (All four seasons)	24 hours Sampling	Along the project roads (1 residential location and 1 sensitive location for each road where work is being undertaken), 1 location each at operational casting yard, batching plant, crusher, hot mix plant etc., 1 sensitive location & residential location within 100 m of each such operational unit (casting yard, batching plant, crusher, hot mix plan) Anticipating working of 10 roads at a time, no of locations to be monitored is 35	Contractor under the supervision of CSC through NABL accredited laboratory
	Operation				Monthly --24 hourly sample (All four seasons)		At locations where baseline data is collected -16 nos.	PIU under supervision of PMU through NABL accredited laboratory
Soil/Bottom Sediments	Construction	Monitoring of Pb, SAR and Oil & Grease	Sample of soil collected to acidified and analyzed using absorption Spectrophotometer	Threshold for each contaminant set by IRIS database of USEPA until national standards are promulgated	Quarterly (excluding monsoon)	Grab Sampling	Soil: Casting yard, fuel storage area, material storage area, disposal sites developed by contractor/PWD batching plant & crusher and soil leachate sample at batching plant, STP installation site and 1 location along the active road sections, Locations: 15 Bottom sediments: All	Contractor under the supervision of CSC through NABL accredited laboratory

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
							major rivers on which work of bridge construction/approach road construction is being done, Locations: 5	
	Operation				Six monthly (Not to be done during monsoon)		At locations where baseline data is collected -16 nos.	PIU under supervision of PMU through NABL accredited laboratory
H&S (including COVID-19)	Construction	As per the H&S plan given in EMP	Comply with IFC EHS Guidelines on Occupational Health and Safety		Once a month for Normal Health check-up	Biweekly for COVID 19	Construction and labour camps	Contractor under the supervision of CSC
Borrow area/Quarry site/crusher site (if established)	Construction	As per Guidelines in EMP	Visual Observation		Once in a month		Borrow area/Quarry/Crusher locations	Contractor under the supervision of CSC
Ecology/Tree plantation/ Tree Transplantation/ Aquatic Ecology/ Avifauna	Construction stage	As per Guidelines in EMP	Field visits, sampling, and observations		Six Monthly (excluding monsoon)		Impacted water bodies during construction. Location: 25	Contractor under the supervision of CSC till contract period through a certified Ecology expert
	Operation stage	As per Guidelines in EMP	Field visits, sampling, and observations		Once in a year		All impacted major river: 5	PIU under supervision of PMU post completion of contract through a certified Ecology expert
Labour Camps, construction camps, batching plants, storage yards, debris disposal sites, scrap yards, waste storage areas, drainage, and other project facilities	Construction stage	As per Guidelines in EMP	Visual Observation		Monthly		At the mentioned locations in column no 1	Contractor under the supervision of CSC till contract period

Attribute	Project Stage	Parameter	Special Guidance	Standards	Frequency	Duration	Location	Implementation
Note: Prior to the start of construction works, each contractor shall conduct one-time comprehensive baseline monitoring at each package so as the monitoring results during construction phase can be compared easily with the baseline data.								

Table 109: Environmental Monitoring Cost

S. No.	Parameters / Components	Unit Cost/Sample (Rs)	Total Cost (Rs)
1	Ambient Air Monitoring: At construction Stage (including one time baseline monitoring): At minimum 35 locations as suggested in Table above (Total 35 baseline monitoring samples and 315 samples in a year for 3 years = 945 samples in 3 years and total is 980 samples)	5,000	49,00,000
	At Operation Stage: At minimum 16 locations as suggested in Table above (Total 32 samples in 1 year for 3 years = 96 samples)	5,000	4,80,000
2	Ground Water Quality At Construction Stage (including one time baseline monitoring): At minimum 15 locations as suggested in Table above (Total 15 samples for baseline monitoring samples and 45 samples in a year = 135 samples in 3 years and total are 150 samples)	5,000	7,50,000
	At Operation Stage: At minimum 16 locations as suggested in Table above (Total 32 samples in 1 year for 3 years = 96 samples)	5,000	4,80,000
3	Drinking Water Quality At Construction Stage: At minimum 10 locations as suggested in Table above (Total 40 samples in a year = 120 samples in 3 years)	4,000	4,80,000
4	Surface Water Quality At Construction Stage (including one time baseline monitoring): At minimum 25 locations as suggested in Table above (Total 25 samples for baseline monitoring samples and 75 samples in a year = 225 samples in 3 years and total are 250 samples)	5,000	12,50,000
	At minimum 16 locations as suggested in Table above (Total 32 samples in 1 year for 3 years = 96 samples)	5,000	4,80,000
5	Noise At construction Stage (including one time baseline monitoring): At minimum 35 locations as suggested in Table above (Total 35 baseline monitoring samples and 1680 samples in a year for 3 years = 5040 samples in 3 years and total is 5075 samples)	1,500	76,12,500
	At Operation stage: At minimum 16 locations as suggested in Table above	1,500	8,64,000

S. No.	Parameters / Components	Unit Cost/Sample (Rs)	Total Cost (Rs)
	(Total 192 samples in 1 year for 3 years = 576 samples)		
6	Soil Monitoring: At Construction Stage (including one time baseline monitoring): At minimum 15 locations as suggested in Table above (Total 15 samples for baseline monitoring samples and 45 samples in a year = 135 samples in 3 years and total are 150 samples)	5,000	7,50,000
	At Operation Stage: At minimum 16 locations as suggested in Table above (Total 32 samples in 1 year for 3 years = 96 samples)	5,000	4,80,000
7	Bottom Sediments Monitoring: At Construction Stage (including one time baseline monitoring): At minimum 5 locations as suggested in Table above (Total 5 samples for baseline monitoring samples and 15 samples in a year = 45 samples in 3 years and total are 50 samples)	8,000	4,00,000
	At Operation Stage: At minimum 16 locations as suggested in Table above (Total 32 samples in 1 year for 3 years = 96 samples)	8,000	7,68,000
8	Ecology: At Construction Stage (including one time baseline monitoring): At minimum 25 locations as suggested in Table above (Total 25 samples for baseline monitoring samples and 50 samples in a year = 150 samples in 3 years and total are 175 samples)	20,000	35,00,000
	Ecology: At Operation Stage: At minimum 5 locations as suggested in Table above (Total 5 samples in 1 year for 3 years = 15 samples)	50,000	7,50,000
Total			2,39,44,500

8.4 Institutional Requirements

PMU, Public Works Roads Department (PWD), Government of Manipur will be the executing agency. The Project Director (EAP) will be the head for EAP – Project Management Unit (PMU). PD PMU will be assisted by an Executive Engineer as Nodal Officer of GOM with PWD Program.

8.4.1 Responsibilities of the Project Management Unit (PMU)

The PMU will oversee overall execution and technical supervision, monitoring, and financial control of the project. The PMU will be responsible for the following:

- appointing Independent External Monitors, RP Implementing Agencies, Authority Engineers, Contract Supervision Consultants, Civil work contractors, other Implementing Agencies for PIU level/ Contract level/ Project level/ PMU level, as and when where required.
- Liaising with district administration for direct purchase or land acquisition
- Preparation of ESMPPF, Resettlement Planning Framework (RPF), Indigenous Peoples Planning Framework (IPPF) for ASRIP projects of GOM with PWD program.
- Review and approving of Resettlement Plan (RP), Environmental and Social Management Plan (ESMP) and all other social and environmental safeguards documents and reports.
- Ensuring timely disbursement of compensation and assistance to the displaced persons in close coordination with the concerned line departments.
- Monitoring of implementation and monitoring of RP and ESMP.
- Proactive and timely measures to address all social and environmental safeguards including measures and clearances.
- monitoring, addressing, and resolving grievances.
- ensuring availability of budget for implementation activities; and
- ensuring disclosure of relevant frameworks, implementation, and management plans and monitoring documents.

The PMU will seek government clearances for submission and disclosure of the environmental, social and resettlement report to AIIB. It will also coordinate with national and state agencies to resolve inter-departmental issues, if any.

8.4.2 Responsibilities of the Project Implementation Units (PIUs)

The PWD had already established separate state road divisions in each district. These will be responsible to implement all the project related activities in their respective districts/divisions including the road strengthening and widening works, implementation of road rehabilitation works, land acquisition and forest clearances, data-collection, preparation and implementation of contracts and coordination with local administration and local communities to seek their support.

The PWD's Superintending Engineers (SEs) in the field will closely monitor and guide the field divisions in implementing all the project related activities in their respective jurisdiction. The SEs will undertake quarterly management meetings with the contractors; coordinate with district administration, forest department, water supply, electricity, and revenue departments to resolve any land acquisition, site readiness, material availability, and law and order or social issue. The PIUs will be supported by CSC and RP Implementation Agency (RIA) to implement environmental and social safeguards activities. The PIU will undertake internal monitoring and supervision and record observations throughout the project period to ensure that the safeguards and mitigation measures are provided as intended.

8.4.3 Responsibilities of Construction Supervision Consultant (CSC)/ Authority Engineer (AE)

The CSC is the supervising authority for contractors following item rates and the AE is the supervising authority for contractors that follow the EPC modality. They are also responsible for reviewing and approving the detailed engineering design prepared by the EPC contractor. Other than the difference mentioned above, the following are the responsibilities of the CSC and AE:

- Review the environmental and social reports and management plans to understand the background issues of the respective project corridor.
- Review and approve the revised ESMP and other required sub-plans such as traffic management plan, health and safety plan, waste management plan etc. prepared by the contractor.
- Conduct regular site inspections and monitor implementation of the ESMP And EMoP by the contractor.
- Provide on-site training and technical guidance to the contractor workers as necessary.
- Review the monthly reports prepared and submitted by the contractor.
- Where necessary identify the need for corrective actions and issue official notices to the contractor to implement the corrective actions with clear timeline
- If there are any complaints or grievances, facilitate consultations with the respective complainant and ensure the grievances are addressed in accordance with the GRM system.
- Regularly convene meetings to discuss progress or issues on environmental safeguards to ensure that all parties (contractor, PIU, PCMC) are on the same page on requirements and milestones for environment safeguards.
- Based on site inspections and review of reports submitted by the contractor, prepare semi-annual (for category A project corridors) and annual (for category B project corridors) Environmental Monitoring Reports for review and approval by the PMU/PCMC. These reports shall be further forwarded to AIIB for disclosure on their website.

8.4.4 RP Implementation Agency (RIA)

An RP Implementation Agencies will be hired to assist PIU to, (i) implement the Resettlement Plans and Indigenous Peoples Plan, if any (ii) conduct consultations and create public participation in the project and conduct verification surveys and (iii) update respective Resettlement Plan and Indigenous Peoples Plan, if required, in line with the Resettlement Planning Framework and Indigenous Peoples Planning Framework, respectively.

8.4.5 Capacity Building and Training

The Environmental and Social officers of the PMC will provide the basic training required for environmental and social awareness. Specific modules customized for the available skill set will be devised after assessing the capabilities of the members of the Training Programmed and the requirements of the project. The entire training would cover basic principles of environmental and social assessment and management, mitigation plans, implementation techniques, monitoring methods and tools. The proposed training program along with the frequency of sessions is presented in Table 110.

Table 110: Environmental and Social Training Modules

S.No.	Training Program	Duration	Target Group	Responsibility
1	Workshop on: <ul style="list-style-type: none"> • Introduction to Environment and Society: • Basic Concept of surrounding • Environment and Society 	¼ Working Day	PWD& Contractor	Environmental and social officer of the PMC

	<ul style="list-style-type: none"> • Environmental and Social Regulations and Statutory requirements as per Govt. of India and AIIB 			
2	Environmental and Social management, environmental provisions, implementation arrangements, methodology of assessment, good engineering practices to be integrated into contract/ bid documents	¼ Working Day	PWD& Contractor	Environmental and social officer of the PMC
3	Roles and Responsibilities of officials/contractors/consultants towards protection of environment	¼ Working Day	PWD& Contractor	Environmental and social officer of the PMC
4	Monitoring and reporting system to the target audience such as Engineers and staff of implementing agencies (PWD, Manipur)	¼ Working Day	PWD& Contractor	Environmental and social officer of the PMC
5	Orientation of contractors at the time of issuing work orders on the implementation of SMF	¼ Working Day	PWD& Contractor	Environmental and social officer of the PMC
6	Overview of Land Securing and Entitlement Provisions: <ul style="list-style-type: none"> ➤ Direct Acquisition ➤ Gift Deed / MoU ➤ Relocation of Common Property Resources ➤ Avoidance of encroachments during the post-construction scenario 	¼ Working Day	PWD& Contractor	Environmental and social officer of the PMC

8.5 Environmental and Social Reporting System

The reporting system will operate linearly with the contractor who is at the lowest rank of the implementation system reporting to the CSC's Engineer, who in turn shall report to the PIU of PWD, Manipur. All reporting by the contractor and CSC's Engineer shall be quarterly.

The PIU shall be responsible for preparing targets for each of the identified ESMP activities.

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

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

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

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

implementation of the ESMP.

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

- Preconstruction stage
- Construction Stage
- Operation Stage
- This reporting shall be done through:
 - Reporting by the Contractor to the CSC's Engineer
 - Reporting by CSC's Engineer to PIU.
 - Reporting by PIU to PMU.
 - Reporting by the PMU to AIIB

Table 111: Detailed stage-wise reporting system

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

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

Social Reporting Requirements

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

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

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

8.6 Environmental and Social Management Budget

An environmental and social management budget is 1.33% of the project civil cost and has been estimated for the implementation of the environmental and social management plan. This budget also includes the cost of environmental monitoring and associated training. Details of the environmental and social management budget are given during bidding documents.

Table 112: Environment and Social Management Cost

Environment and Social Management Cost covered mitigation cost and management cost.

Sl. No.	Item	Quantity	Unit	Unit Cost (INR)	Total Cost (INR)
1	For compensatory plantation	1:2 of affected trees = 10,690 trees (5345 X 2)	Nos.	3000/ tree for plantation plus 5 years of maintenance	3,20,70,000
2	Noise Barriers Along Silence zones	220 schools 27 colleges 8 libraries 20 health centres 27 hospitals 13 temples 11 mosques 19 churches 134 cremation/burial grounds 479 locations total, 50 m barrier at each location, total length of barrier = 23950 m	Rmt	6000 for 1 m length and 1-2 m height	14,37,00,000
3	Sprinkling water on the road, especially in/near the settlement Areas	5 months in a year = 15 months (70 tankers in a day) = 31,500 tankers	Per Tanker Cost	800	2,52,00,000
4	Training and Awareness Programme for workers and staff	72 (2 trainings per month for 36 months)	Nos	25,000	18,00,000
5	Cost of Rainwater Harvesting System and Recharge Wells (cost of drainage is included in project cost) with oil & grease traps at drainage outlet points	102 units (1@5 km of road section) of deep recharge/injection wells to take water to deeper aquifers	Nos	2,50,000	2,55,00,000
6	Env Monitoring			Refer Table 8.9	2,39,44,500
7	Solar lights and blinkers and signages	Included in project cost	--	--	--
8	Provision of toilets and other sanitation facilities for labour at labour camps and site and modular STPs	Included in project cost	--	--	--
9	Provision of amenities for labour	Included in project cost	--	--	--
10	Provision of planks for providing temporary access to affected people	Included in project cost	--	--	--
Additional Cost as per Applicability					
1	Restoration of borrow pit site by compaction, landscaping, and re-vegetating	20	Site	1,00,000	20,00,000
2	Restoration of quarry site by stabilizing landscaping and re-vegetating	1	Site	10,00,000	10,00,000
Total					25,52,14,500

9 CONCLUSIONS AND RECOMMENDATIONS

The proposed project of Improvement of Roads within Imphal City with Rigid Pavement including Concrete Lined Drains falls under Category B as per AIIB's ESP and ESS. The project road corridor is neither a new State Highway nor a State Highway expansion project in hilly areas (above 1000 MSL) and not located within any eco sensitive area. Environmental Clearance from MOEF&CC is not required as per EIA Notification 2006 (amended to date) and NOC from the Standing Committee of National Board for Wildlife is also not required. The project is unlikely to cause any major significant environmental impacts, few impacts have been identified, all of which are localized, temporary, and easy to mitigate. Most of the impacts are short term and limited to the construction stage. Key conclusions on the environmental implications of the project are given in the paras below.

9.1 Environmental Gains Due to Proposed Work Justifying Implementation

The project entails various impacts on the project setting. There are many positive impacts bearing benefits to the area against the limited number and magnitude of negative impacts. These include (i) The project will substantially improve transport efficiency on the roads. (ii) The project once implemented will improve the overall environmental conditions with better roads, fuel efficiency, and environmental protection measures (iii) will reduce traffic congestion particularly at junctions hence, air pollution due to the idling of the vehicles.

9.2 Potential Impacts and Mitigation

The finding of IEE indicates that the project is unlikely to cause any significant adverse environmental impacts. While some of the minor impacts are negative, there are many bearing benefits to the area. Most of the impacts are likely to occur during the construction stage and are temporary. Anticipated minor impacts will be mitigated through the implementation of mitigation measures summarized in the Environmental and Social Management Plan.

Factors contributing to minimal impacts include the widening of the project road confined within the available RoW with minimum land acquisition at some locations, the impacts would not be severe and will be mitigated as per the Environmental and Social Management Plan (ESMP). However, some of the impacts are unavoidable. These impacts with mitigation measures are indicated below:

5345 numbers of trees will need to be cut with the prior permission of forest authorities. Compensatory Tree plantation of 5345 number of trees in PWD identified non-residential areas as per the direction of the forest department/DC Social Forest in East and West Imphal will be made to compensate for this loss. Equally tree transplantation is also done for healthy and sustainable trees for a specific defined location. Preventive measures shall be taken during the construction phase, especially in rainy months, to prevent soil erosion because of tree cutting and alteration of ground flora.

- Air pollution due to construction activities and operation of hot mix plants will be controlled through the adoption of dust suppression measures and provision of the high stack for good dispersion of gaseous emission from hot mix plants.
- Noise levels may increase during the construction phase due to the operation of construction machinery. All the construction equipment and DG set will be well maintained and fitted with silencers.
- Waste materials generated during the construction phase may contaminate soil, surface, and groundwater resources. Waste shall be segregated and reused or disposed of in an environmentally safe manner.
- Along the project stretch, few schools, hospitals, and religious structures are located. Appropriate design options are exercised to minimize the loss of such structures.
- The social issues are addressed through Social Safeguards Due Diligence report prepared as per AIIB's ESP and ESS. Application of these measures in parallel with MoRTH environmentally

friendly road construction practices will reduce significantly any potential environmental impact. Impacts remaining on the physical environment (air and water pollution) are temporary and often occur away from the presence of people.

9.3 Irreplaceable Resources

The project roads networks do not pass through any protected areas in the state. The construction material will also be sourced from identified and approved sources. As such, there are no environmentally sensitive resources found in the project area, which is likely to be affected due to the project.

9.4 Post IEE Study Surveillance and Monitoring

While an IEE is meant to provide a comprehensive understanding of the environment status of the area under the study, post surveillance is the means to ensure that the significant impacts identified are adequately mitigated as per the proposed mitigation plan. A detailed monitoring plan has been provided as part of the Environmental and Social Management Plan. Air, water quality, noise, soil erosion, and tree survival rate monitoring and reporting along with the follow-up actions in case of deviation from the norms have been detailed out. The frequency has been set in consideration of the likely impacts.

9.5 Recommendations

Adequate mitigations shall be taken up both during the construction and operation stage of the project road network to avoid/minimize adverse environmental impacts due to this event and any such event in the future as suggested in the AIIB. Effective ESMP implementation is essential for the elimination or minimization of the identified impacts. The EAP-PMU-PWD shall ensure that ESMP and EMoP are included in the Bill of Quantity (BOQ) and forms part of the bid-document and civil works contract. The same shall be revised if necessary, during project implementation, or if there is any change in the project design. PWD needs capacity building and practical exposure. Adequate training shall be imparted as proposed under the environmental and social management plan to enhance the capability of concerned EA officials.