

**Consultancy Services for the** 

## **Due Diligence and Options Analysis**

for the proposed Mindanao Transport Connectivity Improvement Project

# Environment and Social Impact Assessment (ESIA)

Version 2.3 | May 24, 2024

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## **ABBREVIATIONS & ACRONYMS**

ADB	Asian Development Bank				
BMB	Biodiversity Management Bureau				
CADT	Certificate of Ancestral Domain Title				
CARP	Comprehensive Agrarian Reform Program				
	Cadavan de Oro City				
CEP	Chance Find Procedure				
	Certificate of Land Ownership Agreement				
	Certificate of Van Coverage				
	Certificate of Non-Coverage				
	Environmental Impact Assessment				
ECP					
EMB					
ESS	Environmental and Social Standards				
dB	decibels				
DAO	DENR Administrative Order				
DDOA	Due Diligence and Option Analysis				
DED	Detailed engineering design				
DPWH	Department Public Works and Highway				
DENR	Department of Environment and Natural Resources				
DEO	District Engineering Office				
DOLE	Department of Labor and Employment				
DRAM	DPWH Right-of-Way Acquisition Manual				
GAA	General Appropriations Act				
HLURB	Housing and Land Use Regulatory Board				
IAEECC	Inter-Agency Energy Efficiency and Conservation Committee				
ICC	Indigenous Cultural Community				
IPRA	Indigenous People Republic Act				
IUCN	International Union for Conservation of Nature				
IMB	Land Management Bureau				
MC	Main Corridor				
MGB	Mines and Geosciences Bureau				
MTCIP	Mindanao Transport Connectivity Improvement Project				
NAMRIA	National Manning and Resource Information Authority				
NIPAS	National Integrated Protection Areas System				
	National Climate Change Action Plan				
	National Commission of indigenous Reenle				
	National Commission of mulgenous reople				
	National Pollution Control Commission				
NPCC	National Pollution Control Commission				
PAGASA	Administration				
PD	Administration				
PD	Presidential Decree				
PEISS	Philippine Environmental Impact Statement System				
PHIVOLCS	Philippine Institute for Volcanology and Seismology				
PNSDW	Philippine National Standard for Drinking Water				
RAP	Resettlement Action Plan				
RROW	Road Right of Way				
SEA	Sexual Exploitation and Abuse				
SH	Sexual Harassment				
LR	Link Road				
LGU	Local Government Unit				
UDHA	Urban Development and Housing Act				
UNFCC	United Nations Framework Convention on Climate Change				
WHO	World Health Organization				

#### EXECUTIVE SUMMARY

## ES.1 Project Background

The Mindanao Transport Connectivity Improvement Project (MTCIP) is a comprehensive initiative aimed at enhancing road infrastructure in the Main Corridor, a vital national highway network linking the cities of Cagayan de Oro, Davao, and General Santos.

In addition to its tangible infrastructural improvements, the MTCIP is expected to generate a wide array of socio-economic benefits for the communities along the Main Corridor and beyond. These include improved access to markets, increased trade opportunities, enhanced connectivity for residents and businesses, and ultimately, a boost to the overall economic growth and development of Mindanao.

#### ES.2 Purpose of the Draft Environmental and Social Impact Assessment

The Draft Environmental and Social Impact Assessment (ESIA) Report is conducted to evaluate the project's design and potential impacts comprehensively. This assessment focuses on gathering and analyzing baseline data related to land, water, air, and people aspects within project influence areas. By identifying alternative options and integrating mitigating measures, the ESIA aims to minimize adverse effects while ensuring a balance between development, environmental protection, and social considerations.

#### ES.3 Policy, Legal, and Administrative Frameworks

The Draft ESIA Report aligns with the legal and institutional framework as well as relevant regulations governing the environmental and social sectors in the Philippines. In addition to adhering to Government of the Philippines (GoP) laws and regulations, the ESIA also complies with the World Bank Environmental and Social Standards (ESSs), thereby enhancing the overall impact assessment process.

The MTCIP are categorized as Category B (*Link Roads*) and D (*Main Corridor*) as per the Revised Procedural Manual for Department of Environment and Natural Resources (DENR) Administrative Order, Series of 2003, and Environmental Management Bureau (EMB) MC 2014-005 (Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippine EIS System). Under this category, multiple Certificate of Non-Coverage (CNC) will be secured for the 20 sections (less than 2 km in length, scattered across the three regions) of the Multiple Corridor subject to improvement. Meanwhile, Environmental Compliance Certificate (ECC) will be secured for Link Roads.

On the other hand, based on the WB risk rating classification, the environmental and social risk classification for MTCIP is assessed to be "Substantial" due to potential risks and significant impacts arising from the type, magnitude/scale and location of the project. MTCIP covers mostly existing roads; however, project activities will require substantial quantities of construction materials, power, and water. Repair and construction of roads and bridges will generate noise, dust, gaseous pollutants, vibration, and waste, which will continue even during the project operational phase and pose public health concerns, especially to sensitive receptors adjacent to the roads, though anticipated to be within GOP regulatory standards.

Road widening and clearing activities, which will result in the loss of roadside vegetation and

wildlife disturbances, again to a limited extent within the RROW, can be avoided and/or reduced, compensated for, or offset through tree planting. The construction of new bridges, which may lead to soil erosion, siltation of waterways, changes in surface runoff direction, and impacts on aquatic organisms, shall be compliant with regulatory standards, temporary, and reversible. The presence of sensitive receptors, steep slopes, and hydro-geological hazards also contribute to risks to community and public health and safety; however, these risks can be mitigated through engineering design measures and the application of nature-based solutions. Project activities are not expected to be located in ecologically sensitive or biodiversity-rich areas and will take place within existing road segments. In addition, project activities or sources of construction material, e.g., quarry sites and/or camp sites, will follow exclusion principles to avoid ecologically sensitive areas. Potential risks and impacts may be significant but are mostly temporary, predictable, mitigable, and/or reversible, and the magnitude and spatial extent are likely to be limited in geographic scope and within the technical footprint of the project. The legal and regulatory environment of the project is welldefined and consistent with ESS3, ESS4, and ESS6 requirements. DPWH is well experienced in implementing projects financed by the WB and other financial institutions. It also has the technical and institutional capacity to manage risks and impacts consistent with the WB's ESF and the country's regulations.

Social risks are rated "Substantial" owing to the significant involuntary resettlement that will be involved in the infrastructure components of the Project, some subproject areas being in ancestral domains and the involvement of Indigenous Peoples (some of whom may need to be relocated), and the conflict situation in which the Project will be implemented. The project will entail hiring workers, who may originate outside the project sites and LGUs. This will lead to a labor influx in the local community, presenting risks of sexual exploitation and abuse/sexual harassment (SEA/SH) and an increase in gender and child related violence and cultural insensitivity. However, Philippine legislations on labor management, right-of-way acquisition and Indigenous Peoples are substantially aligned with ESS 2,4,5,6,7 and 8 with some gaps on compensation for income losses and on cases involving expropriation. DPWH has extensive experience in land acquisition using Philippine laws, but some local practices would need to be fully aligned with the requirements of ESS 5. Indigenous Peoples are among the beneficiaries of the three subproject link roads under Component 1.

#### ES.3.1 Environmental Standards

In addition to national laws and policies (environmental standards on water quality, air quality, noise level, land acquisition and resettlement, indigenous peoples, labor, and cultural heritage), international conventions, treaties, and protocols (ICTPs) ratified by the GoP will also govern the implementation of the proposed MTCIP.

The proposed Project will also comply with the World Bank Environmental and Social Framework (ESF) and World Bank Environmental, Health, and Safety (EHS) Guidelines for Road Projects.

#### **ES.4 Project Description**

The key components of the MTCIP include upgrading major national highways, or Main Corridor, and local roads, or Link Roads, in Regions X, XI, and XII. Implementation will be spearheaded by the Department of Public Works and Highways (DPWH), with oversight from the Unified Project Management Office (UPMO)—Roads Management Cluster II (RMC II). Additionally, support from DPWH Region X, XI, and XII offices, as well as district offices,

ensures comprehensive coverage and efficient execution across the designated regions.

The project will span from 2024 to 2030, encompassing several phases: pre-construction, construction, demobilization, and operation. These phases involve detailed engineering design, civil works such as road widening and rehabilitation, dismantling of temporary facilities, and long-term performance-based maintenance.

This project, with a total project cost of US\$661.17 million jointly financed by the World Bank and the GoP, seeks to bolster transportation connectivity, particularly benefiting the agricultural sector by facilitating product movement and enhancing access to rural areas.

#### ES.5 Summary of Natural and Socio-Economic Features of the Project Area

The Project Influence Area (PIA) was delineated to determine the area to be impacted by the project. Primary and secondary data on land, water, air, and people were collected to determine the baseline environmental conditions of the PIA.

#### ES.6 Assessment of Environmental and Social Impacts and Mitigating Measures

The potential risks and impacts of the project on the land, water, air, and people were assessed as to whether positive or negative, magnitude (i.e., in terms of extent, duration, and intensity), and likelihood or probability of the impact happening per project development phase and activities. Significant negative impacts will be formulated with mitigation measures following the WB Mitigation Hierarchy (i.e., avoid or prevent where possible, mitigate, reduce, minimize, compensate, and/or offset) to acceptable levels or compliance with regulations.

#### ES.7 Analysis of Alternatives

Analysis of alternatives were conducted considering the alternatives for project categorization, alignment options, project management, resources and no project option. The Technical Options Analysis for the MTCIP subprojects—the Main Corridor (MC) and the Link Roads (LR) 1; 2; and 3—was conducted taking into consideration salient aspects of the project, including the technical, environmental, social, financial, and economic aspects of the different project alternatives. The different criteria under environmental and social are presented in **Table ES** - **1**. These criteria are rated based on their impact level following a seven-point scale ('1" being highly negative, "4" being not significant or neutral, and "7" being major or highly positive). Considering a wide range of impacts and stakeholder perspectives, factors in the identification and selection of criteria for the environmental and social categories included expert judgment, especially due to the limited availability of historical and research data. The results of ESRA are specifically analyzed in correlation to the relevant World Bank E&S Standards (ESS).

Environmental	
Water Quality	The effect on local water bodies, including measures for water pollution control,
	sediment runoff, and protection of aquatic ecosystems.
No. of Trees	Loss of trees along the proposed rehabilitation areas.
Affected	
Geologic	Length of the alignment that runs through areas that are identified as landslide-
Hazards	prone and flood-prone.
Land Use	Effected land use change of forestland and agricultural lands along the project
	alignment.

Table ES-1.	Criteria	under	Environmental	and	Social	Categories

Social	
No. of Affected	Loss of residential, residential-commercial, commercial and community
Structures	structures along the proposed rehabilitation areas.
No. of PAP for	Physical and economic displacement of project affected people (PAPS) due

Social	
Relocation	to land acquisition for the proposed road rehabilitation.
Impact to	The potential for the project to stimulate economic growth, create job
Population	opportunities, increase property values, and enhance the local economy.
Impact to	Road safety and security of PAPs considered as vulnerable groups.
Vulnerable Groups	

## ES.8 Stakeholders' Engagement and Grievance Redress Mechanism (GRM)

The stakeholders, including vulnerable groups that could be impacted by the project were identified. The stakeholders' engagement was conducted following the national laws and regulations to inform them about the project and to gather suggestions for mitigating the negative impacts.

The stakeholder's engagement was conducted in September 2023. About 242 people participated in the activity. About 40 people were interviewed as part of the Key Informant Interviews (KII) in October 2023, and 8 people participated in the Focus Group Discussions (FGDs). The public consultations in September 2023 and the focus group discussions in October 2023 provided opportunities not only for DPWH UPMO to introduce MTCIP but also generated information on the perceived risks and impacts and suggested mitigation measures. Follow-up key informant interviews with Local Government Unit (LGU) officials in October and November 2023 were made to validate these inputs.

The stakeholder consultations for MTCIP apply WB ESS10: open engagement with stakeholders and providing opportunities for stakeholder views to be considered in the project design and during implementation. Even at the DDOA phase, the consultations initiate the implementation of the MTCIP Stakeholder Engagement Plan.

Grievance Redress Mechanism (GRM) is established for the project in compliance with Republic Act 10752, the DPWH Right-of-Way Acquisition Manual (DRAM), and World Bank safeguard requirements.

## ES.9 Environmental and Social Management Plan (ESMP)

The Draft ESIA includes a generic Environmental and Social Management Plan (ESMP) that will be updated during the Detailed Engineering Design (DED) of the Project, during the construction and operational phases of the project. The matrix of the ESMP is presented in the **Table ES-2**. An Environmental and Social Monitoring Plan (ESMoP) will be required at all project phases to ensure the implementation of the commitments and to verify the effectiveness of the measures in mitigating the identified potential impacts.

## ES.10 Project Timeline

**Figure ES-1** shows the timeline for the main phases of the project where in the steps of the E and S Management will be implemented and applied from Detailed Engineering Design (DED) onwards.

#### WORLD BANK

#### Proposed Timeline for the Mindanao Transport Connectivity Improvement Project (MTCIP)

		2	1024			20	25			20	26			20	27		2028	2029	2030		20	31	
PROJECT	Q1	Q2	Q3	Q4	Q1	0,2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	anna a	0.p.p.p.	0.000	Q1	Q2	03	Q4
MINDANAO TRANSPORT CONNECTIVITY IMPROVEMENT	*   *   2	19191	12121	181818	1112	2 2 2 2	2 2 3	81818	*   *   3	2 2 2 2	5 5 8	81918	1113	2 2 2 2	2 2 2 1 2	81918				*[*]3	2 2 2 2		81918
SUBMISSION OF PROJECT PROPOSAL TO NEDA-ICC		FEB 25	NA																				
NEDA-ICC TECHNICAL BOARD APPROVAL		FEB 2024 2 M	- MAR 2024 ONTHS																				
ICC CABINET COMMITTEE APPROVAL			APR 2024 - 5 2 MON	AT 2024 NS																			
APPRAISAL, PREPARATION, AND APPROVAL OF LOAN AGREEMENT				A/N 2024 - AU 6 MONT	6 2024 15																		
PROCUREMENT OF DED CONSULTANTS					56.P 2024 4 MG	- DEC 3524 24/745																	
DETAILED ENGINEERING DESIGN (DED)								JAN 302 9 M	- SEP 2025 ONTHS														
PROCUREMENT OF CIVIL WORKS						$\wedge$			0(7)	NI25 - JAN 202 A MONTHS	•												
CIVIL WORKS (2 YEARS)						ΙΓ	7					FEB 20 24	Nonths										
LONG TERM PERFORMANCE BASED MAINTENANCE (S YEARS)																				[	FEB 2026 - JAN 60 MONTH	NUSL	

Steps to ESMP Implementation:

- ES Risks/Impacts Assessments
- Mitigation Measures Formulation
- Mitigation Measures Implementation
- Mitigation Measures Monitoring and
  - Evaluation
- Stakeholders' Engagement

Figure ES-1: Project Schedule

#### **ES.11** Conclusions and Recommendations

In summary, the MTCIP represents a crucial investment in the future of Mindanao, laying the groundwork for sustainable development and prosperity. By adhering to rigorous environmental and social standards and placing a strong emphasis on inclusive growth, the project aims to leave a lasting positive impact on the region and its people.

Project Phase / Activities	Environmental Component(s)	Potential Impact(s) before Mitigation	Mitigating/Enhancement Measures
PRE-CONSTRUCTION AND CONSTRUCT	ON PHASE		
Acquisition of Applicable Permits and Licenses	People	(+) Disclosure of project information to stakeholders and concerned government authorities	Submit complete requirements for processing of permit application.
Land Acquisition for the RROW	People	(-) Displacement/ disturbance of settlers, properties, and livelihood	<ul> <li>Prepare and implement Resettlement Action Plan in accordance with the Resettlement Policy FrameworkCoordinate with the concerned city/municipal and barangay LGUs.</li> <li>Conduct audit and prepare Remedial/Corrective Action Plan as needed for prior incomplete land acquisition and compensation</li> </ul>
	People	(-) Involuntary resettlement of IP households	Prepare and implement of Indigenous     Peoples Plan (IPP)
Hiring of Workers	People	(+) Generation of employment opportunities	<ul> <li>Prioritize hiring of qualified workers within the host barangays.</li> <li>Coordinate with the PESO of concerned city/municipal LGUs and the barangays for posting of labor requirements.</li> </ul>
		(-) Possible SEA/SH	<ul> <li>Orientation of contractors/workers on this issue.</li> <li>Sensitize GRM to address SEA/SH concerns</li> <li>Implementation of the MTCIP Labor Management Procedures</li> </ul>
Site Preparation / Vegetation Clearing / Utilities Relocation	Land	(-) Loss of vegetation	<ul> <li>Limit vegetation clearing to the approved project development area.</li> <li>Apply for tree cutting permit, as necessary.</li> <li>Comply with the tree replacement guidelines as provided in JMC 2014-01 (i.e., 100 seedlings/ saplings/ propagules replacement for every tree cut).</li> </ul>

#### Table ES-2. Environmental and Social Management Plan for the MTCIP

Project Phase / Activities	Environmental Component(s)	Potential Impact(s) before Mitigation	Mitigating/Enhancement Measures
	Water	(-) Possible siltation of nearby water bodies	<ul> <li>Establish sediment traps, erosion barriers, and/or silt curtains as applicable.</li> <li>Ensure regular removal of silt and sediments.</li> </ul>
	People	(-) Threat to delivery of basic services	Coordinate with the concerned utility service providers and residents on the schedule of utilities relocation.
Construction of Temporary Facilities and Influx of Construction Workers	Land, Water, People	(-) Generation of domestic solid wastes	• Implement solid waste management plan in accordance with RA 9003.
	Land, Water, People	(-) Generation of domestic wastewater	Ensure provision of adequate sanitation facilities for the workers.
	People	(-) Community health and safety risks, including peace and order	<ul> <li>Coordinate with the host city/municipal and barangay LGUs and local PNP for maintaining peace and order for the duration of the construction activities.</li> <li>Ensure strict implementation of drug- and alcohol-free work environment.</li> </ul>
Civil Works for the Main Corridor and Link Roads Main Corridor (i.e., Road Widening, Repair of Damaged Road Sections, Implementation of Slope Protection Measures, Drainage Works, Installation of Road Safety Infrastructures)	Land	(-) Ground vibration from heavy equipment and vehicles	<ul> <li>Notify nearby residents in advance about the use of heavy equipment that may generate ground vibration.</li> <li>Apply non-vibration and/or vibration- avoiding techniques during construction, whenever possible.</li> <li>Ensure compliance of hauling trucks with road weight limits.</li> </ul>
Link Roads (i.e., Upgrading from Unpaved Roads to Concrete, Repair of Damaged	Land, Water, People	(-) Generation of construction spoils/debris and other solid wastes	Implement solid waste management plan in accordance with RA 9003.
Road Sections, Construction and Rehabilitation of Bridges, Implementation of Slope Protection Measures, Drainage Works, Installation of Road Safety Infrastructure)	Land, Water, People	(-) Generation of hazardous wastes	<ul> <li>Ensure proper onsite handling of hazardous waste in accordance with RA 6969.</li> <li>Ensure proper transport, treatment, storage, and disposal of hazardous waste by DENR-registered transporters and facilities.</li> </ul>

Project Phase / Activities	Environmental Component(s)	Potential Impact(s) before Mitigation	Mitigating/Enhancement Measures
	Water	(-) Possible siltation of nearby water bodies	<ul> <li>Apply erosion and sediment control measures to minimize runoff to nearby canals/waterways.</li> <li>Implement proper staging techniques to minimize spillage of paving materials to nearby canals/waterways.</li> </ul>
	Land, Water	(-) Potential contamination of soil/water from accidental oil spills/leaks from heavy equipment and vehicles	Implement oil spill management plan.
	Air, People	(-) Generation of dust	<ul> <li>Avoid dust-generating activities during windy days, if possible.</li> <li>Minimize unnecessary earth movement.</li> <li>Apply dust control measures, such as water spraying and use of canvas cover for soil piles.</li> <li>Ensure wearing of PPE by workers to protect from airborne dust.</li> </ul>
	Air, People	(-) Generation of air emissions and noise	<ul> <li>Ensure regular maintenance of heavy equipment and vehicles.</li> <li>Avoid performing noisy activities at nighttime.</li> <li>Locate noise-generating sources away from sensitive receptors (e.g., schools, hospitals, worship areas).</li> <li>Use noise control devices (e.g., temporary noise barriers/deflectors, mufflers), as necessary.</li> <li>Ensure wearing of PPE by workers to protect from excessive noise.</li> </ul>
	People	(-) Occupational health and safety risks	<ul> <li>Provide training on construction safety for workers.</li> <li>Ensure wearing or proper and complete PPE by construction workers.</li> <li>Ensure supervision of construction activities by trained professionals.</li> </ul>

Project Phase / Activities	Environmental Component(s)	Potential Impact(s) before Mitigation	Mitigating/Enhancement Measures
			Implement occupational health and safety policy.
	People	(-) Community health and safety risks, including road safety	<ul> <li>Install safety barriers to prevent unauthorized access to construction areas.</li> <li>Provide early warning devices and/or road safety signs.</li> </ul>
	People	(-) Threat to delivery of basic services/resource competition	<ul> <li>Coordinate with the concerned utility service providers and residents on the schedule of utilities relocation.</li> </ul>
	People	(-) Traffic congestion	Implement traffic management plan in coordination with the local authorities.
DEMOBILIZATION AND OPERATIONAL P	HASE		
Dismantling of Temporary Facilities and Clearance/Clearing of Construction	Land, Water	(-) Generation of debris and other solid wastes	• Implement solid waste management plan in accordance with RA 9003.
Debris and Waste	Air, People	(-) Generation of dust, air emissions, and noise	<ul> <li>Apply dust control measures, such as water spraying and use of canvas cover for soil piles.</li> <li>Ensure wearing of PPE by workers to protect from airborne dust and excessive noise.</li> <li>Ensure regular maintenance of heavy equipment and vehicles.</li> <li>Avoid performing noisy activities at nighttime.</li> <li>Use noise control devices (e.g., temporary noise barriers/deflectors, mufflers), as necessary.</li> </ul>
	People	(-) Occupational health and safety risks	<ul> <li>Provide training on construction safety for workers.</li> <li>Ensure wearing or proper and complete PPE by workers.</li> <li>Ensure supervision of construction activities by trained professionals.</li> </ul>

Project Phase / Activities	Environmental Component(s)	Potential Impact(s) before Mitigation	Mitigating/Enhancement Measures
			<ul> <li>Implement occupational health and safety policy.</li> </ul>
Road Operations and Long-Term Performance Based Maintenance	Water	(-) Increased rate of surface water runoff	<ul> <li>Implement stormwater management practices.</li> </ul>
(LTPBM)	People	(+) Enhancement of employment and livelihood opportunities	<ul> <li>Prioritize hiring of qualified workers within the host barangays.</li> <li>Coordinate with the PESO of concerned city/municipal LGUs and the barangays for posting of labor requirements.</li> </ul>
	People	(-) Generation of road traffic noise	<ul> <li>Install "No Blowing of Horn" signage at road sections adjacent to noise sensitive areas such as schools, hospitals, and worship places.</li> </ul>
	People	(-) Occupational health and safety risks	<ul> <li>Provide training on construction safety for workers.</li> <li>Ensure wearing or proper and complete PPE by maintenance workers.</li> <li>Ensure supervision of maintenance activities by trained professionals.</li> <li>Implement occupational health and safety policy.</li> </ul>
	People	(-) Traffic safety risks	<ul> <li>Install and maintain signs, signals, markings, and other devices that regulate traffic.</li> <li>Impose appropriate speed limits.</li> </ul>

## 1. INTRODUCTION

## 1.1 Project Background

The Proposed Mindanao Transport Connectivity Improvement Project (MTCIP) was conceptualized from the Technical Assistance: "Strengthening Road Connectivity to Support Agriculture and Regional Development in Mindanao" completed in March 2020 by the World Bank Group with the support of the Australian Government through the Australia-World Bank Philippines Development Trust Fund. The MTCIP focuses on road upgrading and improvement, incorporating climate resilience into road design and asset management, and the enhancement of road safety measures along the 421.12 km Cagayan de Oro-Davao-General Santos Road Corridor, as well as the new construction and upgrading of three local road sections connecting to the previously mentioned national road corridor.

The primary goal of the project is to support the agriculture sector of Mindanao by providing and enabling a more efficient movement of agriculture products from the hinterlands to markets and to make the mountainous and isolated rural areas more accessible so that they can be reached with ease, convenience, and safety.

The World Bank has expressed its continued support to DPWH in improving transport connectivity in Mindanao's agricultural hinterlands and main markets to deepen efforts in promoting inclusive growth and shared prosperity in the region. The MTCIP focuses on road upgrading and improvement, incorporating climate resilience into road design and asset management, and enhancing road safety measures along the four road types included in the project: national roads (Main Corridor) and three local roads (Link Roads).

The Environmental and Social Impact Assessment (ESIA) defines significant impacts through risks/impacts assessments for key resources and features associated with proposed activities. It presents recommendations and measures to prevent or mitigate recognized effects, formulates and arranges compensatory measures, and offers a monitoring plan with Environmental Quality Performance Levels (EQPLs). Correspondingly, it likewise lists key consultation and coordination activities and attendant issues and concerns that have been tackled during the assessment.

The ESIA aims to systematically analyze, evaluate, and manage all anticipated environmental and social impacts that the project may derive. It aims to strike a balance between development initiatives and environmental considerations. Ultimately, the assessment results will improve project design and implementation through measures aimed at minimizing, if not totally preventing, adverse social and environmental impacts.

## 1.2 Scope of the ESIA

This Draft ESIA Report is based on information available at the time of preparation, which includes environmental and social baseline data and preliminary design concepts. This report covers four main components (land, air, water and people) of the Main Corridor and three Link Roads. It is evident that as the project progresses, certain information may not be up-to-date due to changes in baseline conditions. This eventuality reinforces the need to constantly update the existing database to ensure that issues related to environmental and social concerns are appropriately addressed.

## **1.3 Approach and Methodology**

## 1.3.1 Land

The methodologies employed to obtain the primary data for the land component consist of:

- a. Review of available literature and studies
- b. Reconnaissance survey
- c. Geohazards and Geologic Mapping
- d. Rock sampling identification
- e. Soil sampling and analysis
- f. Flora assessment: transect method
- g. Fauna assessment: passive and active methods

This was supplemented by the requested secondary data from various authorities and sources, including DENR (Mines and Geosciences Bureau (MGB), EMB, and Biodiversity Management Bureau (BMB)), Philippine Institute for Volcanology and Seismology (PHIVOLCS), Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA), LGUs, and DPWH. For the secondary data, online sources of relevant information were also included in the review and analysis of project site environmental characterization.

#### 1.3.2 Water

A variety of methodologies were employed to determine the baseline environmental conditions of the water component. These include:

- a. Review of all available secondary information
- b. Detailed field investigations
- c. Water sampling

As part of this module, the quality of the rivers and creeks that pass under the MTCIP was sampled. The results of the water sampling were compared with the guideline values and standards based on DAO 2016-08 and 2021-19. This is being done to establish a baseline for the concerned bodies of water, as classified by EMB-DENR, and to ensure that the project does not significantly affect their quality. To address any water quality deterioration, various mitigation measures will be taken, including water sampling and monitoring of selected parameters at the affected river stations. These parameters are pH, temperature, dissolved oxygen (DO), total suspended solids (TSS), total dissolved solids (TDS), conductivity, maximum allowable limits. It should be noted, however, that the final scope of work within the main corridor will not include any bridgeworks that would significantly affect water quality in the area.

#### 1.3.3 Air

In order to assess the ambient air baseline conditions within the MTCIP, the following methods were used:

- Desktop review of available secondary data sourced from the Philippine Atmospheric, Geophysical, and Astronomical Services Administration (PAGASA);
- Desktop review of the DENR, DOH, and other international agencies on pertinent regulations and guidelines/standards on air quality.
- Reconnaissance survey and field investigation.

The air quality sampling results are limited to the following parameters relevant to a road

project based on RA 8749 (Clean Air Act): PM<sub>2.5</sub>, PM<sub>10</sub>, SO<sub>2</sub>, and NO<sub>2</sub>. Results from the air quality sampling were compared with the National Ambient Air Quality Guideline Values (NAAQGV) of the Implementing Rules and Regulations (IRR) of the Philippine Clean Air Act of 1999 (R.A. 8749), while the results from noise measurements were compared with National Pollution Control Commission (NPCC) Memorandum Circular No. 002 Series of the 1980 National Ambient Noise Standards and the 2007 Environmental, Health, and Safety (EHS) Guidelines of the IFC for Noise Management.

## 1.3.4 People

Estimating the project-affected population for the DDOA was done by counting the project-affected structures.

For the Main Corridor, an approximation of the affected structures was made using Google Earth and a count of the digitized structures within a 25-m RROW width. This methodology makes the assumption that 20% of the structures are used for residential purposes, while the rest are for commercial and other uses.

For the link roads, the project-affected population was estimated using an actual count of the structures within the 20-meter width of the road. The 20-m road right-of-way includes a 13.4-m carriageway (3.35 m x 4 lanes) and a 1.5-m paved shoulder. The survey included a count and a classification of the use of the structures. The actual count was validated by a GIS estimation of the digitized structures.

In the stakeholder identification and analysis, vulnerable groups were identified within the project area of influence. These vulnerable groups include indigenous peoples, women, solo parents, persons with disabilities, youth and children, and poor and informal settlers' families. These vulnerable groups were consulted and engaged during the formulation of the ESMP and will continue to be involved in the implementation of the ESMP.

The number of informal settler households among the project-affected population was estimated using secondary data from the barangay profiles of all barangays along the three link roads. The secondary information was corroborated with key informants, particularly through key informant interviews with barangay officials.

The identification of the social risks and impacts involved multiple MTCIP stakeholders at various levels of government as well as among sectoral representatives, particularly indigenous peoples, older persons, youth, women, and persons with disabilities.

## 1.4 ESIA Study Team

This Draft ESIA Report for the MTCIP has been prepared by Galerio Environmental Consultancy Inc. for the Department of Public Works and Highways (DPWH), the lead proponent for the said project. **Table 1-1** presents the ESIA study team.

Name	Role in the ESIA Study	Qualification
Leonila P. Galerio	Team Leader, Biologist	EIA Registration No. IPCO 021
		MSc in Environmental Resource and
		Management
		Master in Entrepreneurship
		B.S. in Biology
		18 years
Julia Echavez	Senior Environmental Specialist	MSc in Environmental Engineering
		MSc in Public Health Management

Table	1-1.	ESIA	Study	Team

Name	Role in the ESIA Study	Qualification
		BS in Chemical Engineering
		37 years
Carmeli Chavez	Senior Social Specialist	M.A in Urban and Regional Planning
	·	M.A. in Demography
		B.A. Honours in Sociology
		B.A in Philosophy
		20 years
Oda Beltran	Social Specialist	MSc Agronomy (Farming System)
		B.S. Agriculture (Weed Science)
		35 years
Vanessa Vianca S.	Conflict Specialist	B.S. in Arts in Organizational
Pallarco		Communication
		MS in International Studies
		13 years
Abigail June L. Agus	Geologist, Hydrologist, GIS	MSc in Geoinformation Science and
	Specialist	Earth Observation
		B.S. in Geology
		20 years
Jefferson Cruz	Forester	MSc in Urban and Regional Planning
		BS in Forestry
		18 years
Thelma D. Dela Cruz	ERA Specialist	Doctor of Philosophy in Environmental
		Science (candidate)
		Master of Occupational Health
		Master of Science (Environmental
		Science)
		Doctor of Veterinary Medicine
		24 years
Devaney Kreye G.	Assistant Geologist/Geophysics	B.S. in Geology
Ocampo		5 years
Hans Frederick B.	Assistant Geologist/Researcher	B.S in Geology
Quesada		1 year
Robeen John A.	Forester/Researcher	B.S. in Forestry
Gerodiaz		5 years
Maricel R. Dagooc	Forester / Project Coordinator	B.S. in Forestry
		5 years
Ariana Kissa G. Saro	Forester/Researcher	B.S in Forestry
		1 year
Sphen Tristan	Researcher	B.S in Environmental Science
Alberio		4 year
Jecar I. Dela Cerna	Researcher/Project Coordinator	B.S. in Agro-Forestry
		5 years
Darvin Louis L.	Air sampling technician	B.S. in Agro-Forestry
Cadungog		5 years

## 2. LEGAL AND INSTITUTIONAL FRAMEWORK

## 2.1 Philippine Environmental Laws & Regulations

Environmental law is the legal framework specifically addressing issues related to the protection and preservation of the environment. It is a set of legal rules that are specifically addressed to activities that may have potential impacts on the environment, both natural and man-made.

Under the Philippine setting, environmental law encompasses all the protections of the environment that emanate from the following to wit:

Constitution—the fundamentally highest law of the land.

Pertinent provisions of our Philippine Constitution relative to environmental protection:

a. 1987 Philippine Constitution, Article XII, Section 2

"All lands of the public domain, waters, minerals, coal, petroleum, and other mineral oils, all forces of potential energy, fisheries, forests or timber, wildlife, flora and fauna, and other natural resources are **owned by the State.** With the exception of agricultural lands, all other natural resources shall not be alienated."

The above constitutional provision is the embodiment of jura regalia, or the Regalian doctrine, which reserves to the State ownership of all natural resources. The Regalian doctrine is an exercise of the State's sovereign power as owner of lands in the public domain and of the patrimony (natural resources) of the nation.

- 1. International Laws
- 2. Laws and Regulations Promulgated by Regulatory Agencies or Implementing Rules and Regulations (IRR); and
- 3. Supreme Court Decisions interpreting these Laws & Regulations

The pertinent regulatory bodies, procedures, laws, and global environmental accords are listed below.

**Presidential Decree (PD) 1586** defines the Philippine Environmental Impact Statement System (PEISS), which is one of the main environmental laws in the Philippines that governs and safeguards the natural and social environments. An Environmental Impact Assessment (EIA) must be performed for any project or endeavor that has the potential to have a major negative impact on the environment. This requirement applies to all national government agencies and instrumentalities, including government-owned and controlled corporations. By enabling the government, decision-makers, project proponents, and impacted communities to manage adverse environmental effects or risks, the PEISS helps to achieve and maintain a reasonable and orderly balance between socioeconomic development and environmental protection. The following regulations are added to the PEISS:

- a. PD 1586: The Philippine Environmental Impact Statement System
- b. Republic Act (RA) 6969: Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990
- c. RA 8749: The Philippine Clean Air Act of 1999
- d. RA 9003: The Ecological Solid Waste Management Act of 2000
- e. RA 9275: The Philippine Clean Water Act of 2004 RA 9512: Environmental Awareness and Education Act of 2008

The **Environmental Compliance Certificate (ECC)** is issued to a project proponent after a thorough review of their EIA report. The ECC outlines the commitments of the proponent that are necessary for the project to comply with existing environmental regulations or to operate within best environmental practices. Moreover, the ECC contains specific measures and conditions that the proponent has to undertake before, during, and even after the operations phase to mitigate identified environmental impacts.

Various **Memorandum Circulars (MCs)** have also been issued to fill in the gaps of the IRR, along with other rules and regulations related to the PEISS (**Table 2-1**) and other relevant regulations.

Directive	Brief Description
Presidential Decree No. 1121 18 April 1977 Creation of the National Environmental Protection Council (NEPC)	One of the functions is to formulate policies and issue guidelines for the establishment of environmental quality standards and environmental impact assessments.
Presidential Decree No. 1151 06 June 1977 Philippine Environmental Policy	Provides the country's framework for environmental protection and management. The decree outlines the government's commitment to maintaining a balanced and healthful ecology while considering economic and social development.
Presidential Decree No. 1152 06 June 1977 Philippine Environmental Code	It serves as the comprehensive law that addresses environmental management and protection in the Philippines. It covers various aspects, including pollution control, natural resources management, and environmental impact assessments. The code outlines measures for pollution control, waste management, and protection of air and water quality.
Presidential Proclamation 2146 14 December 1981	Proclamation of certain areas and types of ECP and within scope of EIA
PD 1586 11 June 1978	The Philippine Environmental Impact Statement System (PEISS). It establishes an Environmental Impact Statement System including other environmental management related; introduced the concept of ECPs and ECAs
Administrative Order No. 42 02 November 2002	Rationalizing the implementation of the Philippine EIS System and delegation of the signing of ECCs for non-ECPs located in ECS to the EMB Regional Directors.
DENR Administrative Order No. 30 Series of 2003 (DAO 03-30) 30 June 2003	IRR for the Philippine EIS System (PD 1586) rationalizing and streamlining the implementation of the Philippine Environmental Impact Statement (EIS) System established under Presidential Decree (PD) No. 1586, Presidential Proclamation No. 2146 defining the scope of the EIS System and pursuant to Administrative Order No. 42 issued by the Office of the President on November 2, 2002.
EMB Memorandum Circular 2007-002 21 August 2007	Revised Procedural Manual for DAO 2003 – 30. It contains the various rules of procedures of the EIS System particularly in the conduct of the EIA process including fines and penalties for violations of PD 1586.
EMB MC No. 2011-005 Republic Act 10174 Amending the Climate Change Act of 2009	incorporation of DRR/CCA concerns in the EIA System [enhanced EIS Screening and IEE Checklist] An act establishing the people's survival fund to provide long-term finance streams to enable the government to effectively address the problem of climate change, amending for the purpose republic act no. 9729, otherwise known as the "climate change act of 2009", and for other

Table 2-1. The PEISS and Related Directives for Environmental Protection and Management

Directive	Brief Description
	purposes.
EMB Memorandum	Revised Guidelines for Coverage Screening and Standardized
Circular 2014-005	Requirements under the Philippine EIS System
DENR AO 2017-15	Guidelines on Public Participation under the Philippine EIS System
02 May 2017	
EMB Memorandum	Updated Guidelines in the Processing and Issuance of ECC for Category
Circular 2019-003	B Projects
DENR MO 2023-01	Guidelines on Project ECC Applications within or with Close Proximity to
	Protected Areas or RAMSAR Sites

## 2.1.1 Other Relevant Regulations

Other relevant regulations that need to be complied with or referred to in the preparation of environmental impact assessments required for development projects are shown in **Table 2-2**.

Regulation	Brief Description	Classification
Presidential Decree No. 984 18 August 1976 National Pollution Control Decree of 1976	This decree establishes policies and guidelines for the prevention, abatement, and control of environmental pollution. It provides legal framework for addressing various types of pollution, including air, water, and land pollution.	Environmental Protection and Management Pollution Control
Republic Act No. 6969 26 October 1990 Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 DAO No. 2013-22 04 December 2013	It establishes a framework for the management of toxic chemicals and hazardous wastes , ensuring their proper handling, disposal, and onitoring to orevent adverse impacts on human health and the environment.	Environmental Protection and Management
Republic Act No. 7586 01 June 1992 National Integrated Protected Areas System (NIPAS) Act of 1992 As Amended by Republic Act No. 11038 22 June 2018 Expanded National Integrated Protected Areas System Act of 2018	The law designates certain areas as protected areas to conserve and promote sustainable use of biological diversity and natural resources.	Biodiversity
Republic Act No. 8749 23 June 1999 Philippine Clean Air Act of 1999 DAO No. 2000-81 7 November 2000	The aw provides a comprehensive framework for air quality management, emission standards, and control measures to mitigate the adverse effects of air pollution on public health and the environment.	Environmental Protection and Management Pollution Control
Republic Act No. 9003 26 January 2001 Ecological Solid Waste Management Act of 2000 DAO 2001-34 20 December 2001	It addresses the issue of solid waste management. It outlines guidelines for the proper disposal, segregation, collection, recycling, and treatment of solid wastes. Implementing Rules and Regulation of RA No. 9003	Environmental Protection and Management Pollution Control
Republic Act No. 9275 22 March 2004 Philippine Clean Water Act of 2004	It establishes guidelines for the prevention, control, and abatement of pollution from water discharges. The law regulates activities that may lead to water pollution, sets water guality standards, and empowers	Environmental Protection and Management Pollution Control

 Table 2-2. Other Relevant Regulations

Regulation	Brief Description	Classification
	government agencies to monitor and enforce	
	compliance.	
DAO No. 2016-08	Water Quality Guidelines and General	Environmental
24 May 2016	Effluent Standards	Protection and
DAO No. 2021-19	Updated Water Quality Guidelines (WQG)	Management
30 June 2021	and General Effluent Standards (GES) for	Pollution Control
	Selected Parameters	Environmontol
23 June 2017		
Republic Act No 11285	Energy Efficiency and Conservation Act of	Energy Regulation
	2019	
Presidential Decree 856	Sanitation Code of the Philippines	Health and
		Sanitation
DENR AO 2003-24	Pursuant to RA 9175, Requiring the securing	Biodiversity
30 June 2003	of Chainsaw Permit for cutting/clearing of	
	Ifees from DENR	Environmentel
DENR AO 2003-27 August 2003		Protection and
August 2005		Management
DENR MC 2004-26 & 2007-	Requiring Permit to Operate Generator Sets	Environmental
03	· · · · · ··························	Protection and
		Management
		Pollution Control
DENR AO 2004-59	Forest Land use Agreement (FLAg)	Environmental
11 August 2004		Protection and
	Durauant to DA 7500 (4000) National	Management
25 July 2007	Pursuant to RA 7500, (1992), National	Protoction and
20 July 2007	and Regulations on Special use Agreement	Management
	within Protected Area (SAPA)	Management
DENR MO 2012-02	Uniform Seedling Replacement Ratio for Cut	Biodiversity
05 November 2012	Trees	-
RA 7942	Philippine Mining Act (RA 7942) requiring	Environmental
3 March 1995	Quarry Permit to be secured from the Local	Protection and
<b>D</b> • • • • •	Government	Management
RA 8048	Philippine Coconut Authority (PCA) Permit to	Biodiversity
	Special Tree Cutting Permit (STCP)	Biodiversity
AO 1988-86 DENR AO		Diodiversity
2000-21		
DENR AO 2016-23	Adoption of Euro4/IV Emission	Environmental
	Limits/Standards	Protection and
		Management
		Pollution Control
DENR AO 2020-14	Establishing Air Quality Index (AQI) for PM <sub>2.5</sub>	Environmental
21 October 2020	and amending the provisional short term	Protection and Management
		Pollution Control
DENR AO 2017-11	Updated National List of Threatened	Biodiversity
2017	Philippine Plants and their Categories	,
DENR AO 2019-09	Updated List of Threatened Philippine Fauna	Biodiversity
2019	and their Categories	
DENR AO 2000-08	Implementing Guidelines on Engineering	Environmental
	Geological and Geo-Hazard Assessment	Protection and
	(EGGA)	
	Supplemental Guidelines	
DPWH DO 2003-05	Stipulating the necessary auidelines for the	1

Regulation	Brief Description	Classification
	preparation of land acquisition and resettlement action plan for infrastructure projects	
DPWH DO 2017-65	Stipulating the scope and delegation of the ROW functions and creation and composition of ROW task forces	
DPWH DO 2019-142	Clearing of Structures/Improvements, Trees/Crops within ROW Limits of Projects	
DPWH DO 2022-159	Implementation of Social & Environmental Management System Operations Manual	
DPWH DO 2003-327	Guidelines for Land Acquisition and Resettlement Action Plans (LAPRAPs) for Infrastructure Projects	
NCIP AO 3 s 2012	Revised Guidelines on Free and Prior Informed Consent (FPIC) and Related Processes of 2012	
Occupational Safety and Health Standards 1989	Amended Philippine Occupational Safety and Health Standards	Health and Safety

## 2.1.2 Overview of the Philippine Environmental Impact Assessment Process

The Philippine EIA process consists of six sequential stages: 1) screening, 2) scoping, 3) EIA study and report preparation, 4) EIA review and evaluation, 5) decision-making (issuance or denial of ECC), and 6) post-ECC monitoring, validation, and evaluation/audit stage. **Figure 2-1** presents a summary flowchart of the EIA process and highlights stages that require public involvement.



Figure 2-1. Summary Flowchart of the EIA Process

## 2.1.2.1 Projects Requiring EIA

At the project screening, the type and location of the project become the basis for project categorization. More specifically, environmentally critical projects (ECPs) or those located in

environmentally critical areas (ECAs) and presumed to have significant impacts on the environment are subject to EIA. **Table 2-3** presents the four major categories based on EMB Memorandum Circular No. 2014-005, or the Revised Guidelines for Coverage Screening and Standardized Requirements.

Category	Type and Location of the Project
Category A Environmentally Critical Projects (ECPs)	Projects or undertakings that are classified as ECPs under the Presidential Proclamation No. 2146 (1981), Proclamation No. 803 (1996), and any other projects that may later be declared as such by the President of the Philippines. Proponents of these projects implemented from 1982 onward are required to secure an ECC.
Category B Non-Environmentally Critical Projects (NECP) but located in Environmentally Critical Areas (ECAs)	Projects or undertakings that are not classified as ECP under Category A but that are likewise deemed to significantly affect the quality of the environment by virtue of being located in ECA as declared under Proclamation 2146 and according to the parameters set forth in the succeeding sections. Proponents of these projects, implemented from 1982 onwards, are required to secure an ECC.
Category C Environmental Enhancement or Direct Mitigation Project	Projects or undertakings not falling under Category A or B that are intended to directly enhance the quality of the environment or directly address existing environmental problems.
Category D Non-Covered Project	Projects or undertakings that are deemed unlikely to cause a significant adverse impact on the quality of the environment according to the parameters set forth in the screening guidelines. These projects are not covered by the Philippine EIS system and are not required to secure an ECC. However, such non-coverage will not be construed as an exemption from compliance with other environmental laws and government permitting requirements.

## Table 2-3. Description of Project Categories for EIA under PEISS

## 2.1.2.2 Types of Reports Required for ECC

Projects covered under the EIA are required to submit documents for the application of either the ECC or the Certificate of Non-Coverage (CNC). **Table 2-4** shows a summary of the project groups, the documents to be complied with, and the deciding authority for each category based on EMB MC 2014-005.

Proj	ject Group	Project	Documents Required For ECC/CNC Application	Decision Document	Deciding Authority
Category A	A-1: New	Co-	PEIS	ECC	EMB Central
ECP		located			Office
		Single	EIS		
	A-2: Existing and to	Co-	PEPRMP in case		
	be expanded,	located	programmatic monitoring		
	modified and/or		data are available		
	rehabilitated.	Single	EPRMP in case monitoring		
	A-3: Operating		data is available.		
	without		EIS if no monitoring data is		
	ECC		available.		
Category B	B-1: New	Co-	PEIS	ECC	EMB Regional
NECP in		located			Office in the
FCA		Single	FIS IFFC	FCC	region where

#### Table 2-4. Summary of Documents Required for ECC or CNC Application

Proj	ect Group	Project	Documents Required For ECC/CNC Application	Decision Document	Deciding Authority
	B-2: Existing and to be expanded, modified and/or rehabilitated.	Single Co- located	EPRMP, EPRMP Checklist PEPRMP	ECC ECC	the project is located
Category C Environment al Enhancemen t or Direct Mitigation Project	B-3: Operating without ECC	Co- located/ single	Project Description (Part I and II) (to confirm non- coverage or further classify as either Category A or B)	CNC	EMB Regional Office in the region where the project is located
Category D Non-Covered Project			Project Description (Part 1 only) Project prior to 1982 – Proof of Project Implementation prior to 1982 without expansion/alteration/modific ation shall be submitted (if applying for CNC) to 1982 – Proof of Project Implementation prior to 1982 without expansion/alteration/modific ation shall be submitted (if applying for CNC)	CNC	EMB Regional Office in the region where the project is located

#### 2.1.3 Environmental Standards

#### 2.1.3.1 Surface Water Quality

DAO No. 2016-08 provides the Water Quality Guidelines (WQG) and General Effluent Standards (GES) for different classifications of water bodies. These are presented in **Table 2-5** and

**Table** 2-6. An updated WQG and GES for selected parameters were provided in DAO 2021–19.

Table 2-5. Classification of Water Body

Class	Description
Class AA	Public Water Supply Class I – Intended primarily for waters having watersheds, which are uninhabited and/or otherwise declared as protected areas, and which require only approved disinfection to meet the latest Philippine National Standards for Drinking Water (PNSDW)
Class A	Public Water Supply Class II – Intended as sources of water supply requiring conventional treatment (coagulation, sedimentation, filtration and disinfection) to meet the PNSDW
Class B	Recreational Water Class I – Intended for primary contact recreation (bathing, swimming, etc.)
Class C	Fishery Water for the propagation and growth of fish and other aquatic resources. Recreational Water Class II – for boating, fishing, or similar activities For agriculture, irrigation, and livestock watering
Class D	Navigable waters

#### Table 2-6. Surface Water Quality Standards

Parameter	Class A	Class B	Class C
Color	50	50	75 TCU
Temperature	26-30°C	26-30°C	25-31°C
pH (Range)	6.5-8.5	6.5-8.5	6.5-9.0
Dissolved Oxygen (DO)	5 mg/L	5 mg/L	5 mg/L
Biochemical Oxygen Demand (BOD)	3	5 mg/L	7 mg/L
Total Suspended Solids (TSS)	50 mg/L	65 mg/L	80 mg/L
Surfactants (MBAS)	0.2 mg/L	0.3 mg/L	1.5 mg/L
Oil and Grease (Petroleum Ether Extracts)	1 mg/L	1 mg/L	2 mg/L
Nitrate as Nitrogen	7 mg/L	7 mg/L	7 mg/L
Phosphate as Phosphorus	0.025 mg/L*	0.025 mg/L*	0.025 mg/L*
Phenolic Substances and Phenols	<0.001 mg/L	<0.001 mg/L	0.05 mg/L
Fecal Coliforms	50 MDN/100ml *	100	200
		MPN/100mL*	MPN/100mL*
Chloride as Cl	250	250	350 mg/L
Copper (Dissolved Copper)	0.2 mg/L*	0.2 mg/L*	0.2 mg/L*
Arsenic (As)	0.01 mg/L	0.01 mg/L	0.02 mg/L
Cadmium (Cd)	0.003 mg/L	0.003 mg/L	0.005 mg/L
Chromium (Hexavalent)	0.01 mg/L	0.01 mg/L	0.01 mg/L
Cyanide (CN-)	0.07 mg/L	0.07 mg/L	0.1 mg/L
Lead (Pb)	0.01 mg/L	0.01 mg/L	0.05 mg/L
Total Mercury (Hg)	0.001 mg/L	0.001 mg/L	0.002 mg/L
Organophosphate as Malathion	1 µg/L	1 µg/L	3 µg/L
Note: *DAO 2021-19 (Updated WQG and GE	S for Selected Parameter	ers)	

#### 2.1.3.2 Ambient Air Quality

DAO No. 2000-81, also known as the IRR of RA No. 8749 (Clean Air Act of 1999), sets the national ambient air quality standards (NAAQS) for criteria pollutants, while DAO No. 2013-13 provides for the provisional national ambient air quality guideline values for PM2.5. **Table 2-7** presents the applicable NAAQS.

Parameter	Unit of Measure	Averaging Time	Standard
Total suspended particulates	µg/normal cubic meter (Ncm)		230
PM <sub>10</sub>	µg/Ncm		150
PM <sub>2.5</sub>	µg/Ncm	24 hours	50
SO <sub>2</sub>	µg/Ncm	24-nours	180
NO <sub>2</sub>	µg/Ncm		150
Lead (Pb)	µg/Ncm		1.5
Carbon Monoxide (CO)	mg/Ncm	1 hour	35
Ozone (O <sub>3</sub> )	µg/Ncm	I-HOUI	140

#### Table 2-7. Applicable National Ambient Air Quality Standards

#### 2.1.3.3 Ambient Noise Level

Below are the relevant Philippine regulations and/or guidelines pertaining to noise.

- National Pollution Control Commission (NPCC), Section 78, Table 1
- NPCC Memorandum Circular 1980-002
- Noise-permissible limits in workplaces, as regulated by the DOLE

The first two regulations are directives from DENR on environmental or ambient noise standards generally aimed to protect the public or communities that reside adjacent to or outside an establishment or facility, while the third regulation is about workplace noise standards by the Department of Labor and Employment (DOLE) for workers who may be

exposed to unwanted sound (or noise) within their work areas.

The National Pollution Control Commission (NPCC) in 1976 developed ambient noise standards based on the land use of the area and the time of day. These criteria have not been amended or modified since 1980, and the DENR has adopted them to define the primary ambient noise standards as presented in **Table 2-8**.

Category	'Y Description		Maximum Allowable Noise Level, dB (A)		
of Area	Description	Daytime	Morning/Early Evening	Nighttime	
Class AA	Generally quiet areas such as areas within 100 meters from school sites, nursery schools, hospitals and special homes for the aged.	50	45	40	
Class A	Areas primarily used for residential purposes	55	50	45	
Class B	Areas zoned or used as commercial area	65	60	55	
Class C	Areas zoned or used as a light industrial area	70	65	60	
Class D	Areas zoned or used as a heavy industrial area	75	70	65	

Table 2-8. Standards for Ambient Noise

## 2.1.3.4 Permits for Project Construction and Operation

Prior to any construction work for the project, the permits listed in **Table 2-9** need to be secured from the appropriate government agencies and local government units.

	Priof Description
Name of Permit	Brief Description
Environmental Compliance	A document issued by the DENR/EMB after a positive review of an
Certificate (ECC)	ECC application certifies that the proponent has complied with all the
	requirements of the EIS System and has committed to implementing
	its approved Environmental Management Plan.
Certificate of No Overlap	A certificate issued by the National Commission on Indigenous
(CNO)	People (NCIP) stating that the project did not affect
Permit to Cut (Coconut)	A permit must first be secured and issued by the PCA prior to the
, , ,	cutting of coconut trees.
Tree Cutting Permit (TCP)	Inside resettlement areas, reservations, etc., and trees in public and
- 3 (- ,	private places that pose damage to human lives and/or properties as
	evaluated by DENR
Tree Cutting within	Naturally grown trees (non-premium and premium species)
Titled/Private Land	
Permit to Operate – Air	This permit must be secured for the project use of generators
Pollution Control	
Installation (PTO APSI)	
Cortification Procondition	This is issued by the National Commission on Indianneus Deeples
	(NCID) to contribute compliance of the project with the requirements
	(NCIP) to certify the compliance of the project with the requirements
<b>FOO ID 1</b>	of the Indigenous Peoples Rights Act (IPRA) of 1997.
ECC and Permit to	A document issued by the DENR-EMB certifying the project
Operate for Quary,	operations will not bring about unacceptable environmental impacts
Batching Plant and	and conditions, as well as environmental safeguards that the
Crusher Plant	proponents should comply with.
Pollution Control	Certifications issued by the DENR-EMB to personnel with appropriate
Accreditation Certification	training in accordance with the Philippine Clean Air Act, Clean Water
	Act, and other environmental laws.
Safety Officer Certification	Issued by the Occupational Safety and Health Standards (OSHS) of
	the Department of Labor and Employment (DOLE) for personnel

## Table 2-9. Relevant Permits Required for the Project

Name of Permit	Brief Description
	qualified to oversee safety and health programs.
Hazardous Waste	Issued by the DENR-EMB based on the provisions of Republic Act
Generator's ID	N0.6969 (Toxic Substances and Hazardous Materials) and the
	Nuclear Wastes Control Act of 1990.
Business Permit of	Issued by the head of the LGU where the main office of the
Contractors	contractor is located.
Electric and Water	Permits to be secured by the contractor from the local electric and
Connection Permits	water cooperatives.

## 2.1.4 Social

## 2.1.4.1 Land Acquisition and Resettlement

The regulatory framework pertinent to the social risk and impact assessment covers land acquisition and resettlement policies as well as regulations protecting the rights of indigenous peoples.

Land acquisition for MTCIP shall be in accordance with applicable Philippine laws and local ordinances, departments, and administrative orders of DPWH as the Implementing Agency, as well as the World Bank ESS5 principles as presented in **Table 2-10**.

Directive	Brief Description
1987 Constitution of the Republic of the Philippines	i. Article II, Section 10: The State shall promote social justice in all phases of development.
	ii. Article III, Section 9: Private property shall not be taken for public use without just compensation.
	iii. Article III, Section 11: Free access to the courts and quasi-judicial bodies and adequate legal assistance shall not be denied to any person by reason of poverty; and,
	iv. Article XIII, Section 10: Urban or rural poor dwellers shall not be evicted, nor their dwellings demolished, except in accordance with the law and in a just and humane manner. No resettlement of urban or rural dwellers shall be undertaken without adequate consultation with them and the communities where they are to be relocated.
Republic Act 7279 s.	Objective of UDHA:
1992 Urban Development	<ul> <li>Protects the right of the underprivileged and homeless to decent and affordable bousing</li> </ul>
and Housing Act of 1992	<ul> <li>Sets conditions for land acquisition that may pose a risk of displacement.</li> </ul>
	Policy and Collaboration:
	• State policy, in coordination with the private sector, aims to uplift conditions of underprivileged citizens.
	<ul> <li>Focus on providing decent housing, basic services, and</li> </ul>
	employment opportunities in urban and resettlement areas.
	<ul> <li>developers, and concerned agencies.</li> </ul>
	Criteria for Socialized Housing Sites (Section 6.3):
	Prefer new areas with employment opportunities.
	• Priority for areas with existing or easily introducible basic services.
	<ul> <li>Affordable transportation costs for target beneficiaries.</li> <li>Avoid excessive levelling cutting and filling</li> </ul>
	<ul> <li>Avoid excessive leveling, cutting, and ming.</li> <li>Avoid environmentally critical areas.</li> </ul>

Table	2-10.	Laws	on La	and A	cauisitio	n and	Resettl	ement
10010		Ea110	<b>UE</b>	ana / 1	oquiortio		1.000101	

Directive	Brief Description					
	Consider compatibility with existing zoning, financial feasibility, and land tenurial status.					
	<ul> <li>Responsibilities of LGUs (Section 8 and Annex A):</li> <li>Identify lands for socialized housing and resettlement in coordination with NHA, HLURB, NAMRIA, and DENR Land Management Bureau.</li> <li>Modes of land acquisition include community mortgage, land swapping, assembly, donation, joint-venture, negotiation, or expropriation as a last resort.</li> </ul>					
	<ul> <li>Location of Socialized Housing and Resettlement Projects (Section 22):</li> <li>Preferably near areas with accessible employment opportunities.</li> <li>Government agencies prioritize beneficiaries in designing livelihood programs and processing livelihood loans.</li> </ul>					
	<ul> <li>Stakeholder Engagement (Section 23):</li> <li>LGUs, in coordination with relevant agencies, must provide housing program beneficiaries with an opportunity for input and participation.</li> <li>Involves appropriate documentation and feedback mechanisms.</li> </ul>					
	<ul> <li>Evictions and Demolitions (Section 28b):</li> <li>Discouraged as a practice.</li> <li>Allowed for government infrastructure projects with available funding.</li> </ul>					
Republic Act 7160 s. 1991- Local Government Code	<ul> <li>Resettlement Housing Responsibility (Section 29):</li> <li>LGUs, in coordination with NHA, are responsible for relocating individuals in danger areas.</li> <li>Provision of relocation or resettlement sites with basic services, facilities, and access to employment and livelihood opportunities.</li> <li>Local Government Code and MTCIP Resettlement:</li> <li>Defines powers and responsibilities of provincial, city, municipal, and barangay governments in the Philippines.</li> <li>Crucial role of local government in the MTCIP resettlement.</li> </ul>					
	<ul> <li>Collaboration with DPWH UPMO:</li> <li>DPWH UPMO collaborates with provincial, city, municipal, and barangay LGUs in public consultations and community participation, especially in resettlement activities.</li> </ul>					
	<ul> <li>State Policy on Consultations (Section 2(c)):</li> <li>Policy for national agencies to conduct periodic consultations with local government units, NGOs, people's organizations, and concerned sectors before implementing projects or programs.</li> </ul>					
	<ul> <li>Powers and Responsibilities of LGUs (Section 17):</li> <li>LGUs exercise powers necessary for efficient provision of basic services and facilities.</li> <li>Provincial LGUs are mandated to provide basic services and facilities, except for certain housing projects funded by SSS, GSIS, and HDMF.</li> <li>Public works and infrastructure projects funded by the national government or foreign sources may not be covered, except when LGU is designated as the implementing access.</li> </ul>					
	Role in Land Use Planning (Section 20):					

Directive	Brief Description
	LGUs play a crucial role in land use planning.
	Reclassification of agricultural land, potentially for road or residential use, may require amendment of the zoning ordinance.
	<ul> <li>Reclassification of Agricultural Lands (Section 20(a)):</li> <li>A city or municipality may authorize reclassification through an ordinance after public hearings.</li> <li>Cases include when land ceases to be economically feasible for agriculture or has substantially greater economic value for residential, commercial, or industrial purposes.</li> </ul>
	<ul> <li>Comprehensive Land Use Plans (Section 20(c)):</li> <li>LGUs must prepare comprehensive land use plans through zoning ordinances.</li> <li>Plans consider requirements for food production, human settlements, and industrial expansion.</li> </ul>
	<ul> <li>Protection from Eviction (Section 27):</li> <li>No project or program implemented without compliance with consultations.</li> <li>Prior approval of Sanggunian required.</li> <li>Eviction not allowed unless appropriate relocation sites provided,</li> </ul>
Commonwealth Act 141 (Public Land Act)	following constitutional provisions. Land Acquisition under MTCIP in Bukidnon Province: • Some MTCIP areas in Bukidnon acquired through Commonwealth
	<ul> <li>Act 141 (Public Land Act).</li> <li>Reservation Strip under Commonwealth Act 141:</li> <li>Prescribes a 20-meter strip of land reserved by the government for public use.</li> <li>Damages paid only for improvements.</li> </ul>
	<ul> <li>Presidential Decree 635 Amendment:</li> <li>Amended Section 112 of Commonwealth Act 141.</li> <li>Increased the width of the reserved strip from 20 meters to 60 meters.</li> </ul>
	Impact on MTCIP Implementation (Section 7 of IRR RA 10752):
	If the government exercises the right to use the reserved strip within land acquired under CA No. 141: • The owner is required to execute a quit claim.
	Compensation limited to improvements only.
Republic Act 66859 (December 1988)	<ul> <li>Relevance of RA 66859 to MTCIP:</li> <li>Pertains to the hiring of qualified local labor in MTCIP projects.</li> </ul>
	<ul> <li>Labor Hiring Requirements (Section 1):</li> <li>Applies to national and local public works projects funded by national, local, or foreign sources.</li> <li>Mandates hiring at least 50% unskilled and 30% skilled labor from bona fide and actual residents in the province, city, and municipality.</li> <li>Eligible applicants are determined by the concerned governor, city or municipal mayor, who must be ready, willing, and able.</li> </ul>
	<ul> <li>Adjustments in Areas with Limited Resources:</li> <li>In areas with insufficient local resources, requirements are based on the maximum number of locally available labor resources.</li> </ul>
Directive	Brief Description
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	<ul> <li>Certification by the municipal, city, provincial, or district engineer ensures compliance with the labor requirements of the Act.</li> </ul>
DPWH Right-of-Way Acquisition Manual, December 2017	<ul> <li>DPWH Right-of-Way Acquisition Manual (DRAM):</li> <li>Essential reference for policies and procedures in the entire ROW acquisition process.</li> </ul>
	<ul> <li>Guidelines Covered by DRAM:</li> <li>Project Feasibility Study with Environmental Impact Assessment and preparation of Preliminary ROW Action Plan (RAP) with property appraisal.</li> <li>Inclusion of the Project in the Medium-Term Infrastructure Program.</li> <li>Provision of appropriations in the General Appropriations Act (GAA).</li> <li>Fund Release.</li> <li>Detailed Engineering Design (DED) including Parcellary Surveys and preparation of Final RAP.</li> <li>RAP Validation.</li> <li>Actual ROW Acquisition through Donation, Negotiation, Expropriation, and Other Modes.</li> <li>Payments.</li> <li>Transfer of Title to the Republic.</li> <li>Clearance of ROW.</li> <li>Management of ROW.</li> </ul> Users of DRAM: <ul> <li>Working guide for DPWH offices involved in ROW acquisition, including Unified Project Management Office (UPMO) Clusters, Public-Private Partnership Service (PPPS), Regional Offices (BOS) and District Engineering Offices (DEOS)</li> </ul>
	<ul> <li>(ROS), and District Engineering Offices (DEOS).</li> <li>Support offices such as Unified PMO ROW Task Force (URTF), Legal Service (LS), Planning Service (PS), Financial Service (FS), and Bureau of Design (BOD) in the Central Office and their counterparts at the ROs and DEOs.</li> </ul>
	Reference for Property Owners and PAPs:
	<ul> <li>Serves as a reference for property owners and Project-Affected Persons (PAPs) on rules and processes in ROW acquisition.</li> <li>Includes information on basic rights and obligations.</li> </ul>
Note: Detailed policies and Framework in the Append	d regulations on resettlement can be found in the MTCIP Resettlement Policy

## 2.1.4.2 Indigenous Peoples, Labor, and Cultural Heritage

The laws and policies applied to the indigenous peoples, labor and cultural heritage enumerated in **Table 2-11**, **Table 2-12**, **Table 2-13** comply with the GOP laws, DPWH's policies and guidelines, and the WB Environmental and Social Framework (ESF).

## Table 2-11. Laws on Indigenous Peoples

Directive	Brief Description
Philippine Constitution	Article II, Section 10: "The State shall promote justice in all phases of national development."
	Article III, Section 1: "No person shall be deprived of life, liberty, or property without due process of law, nor shall any person be denied the equal protection of the laws."
	Article III, Section 9: "Private property shall not be taken

Directive	Brief Description		
	for public use without just compensation."		
	Article XII, Section 5: "The Stateshall protect the rights of indigenous cultural communities to their ancestral lands to ensure their economic, social, and cultural well- being. By an act of Congress, customary laws governing property rights or relations can be applied in determining the ownership and extent of ancestral domains."		
	Article XIII, Section 10: "Urban or rural poor dwellers shall not be evicted, nor their dwelling demolished, except in accordance with law and in a just and humane manner. No resettlement of urban or rural dwellers shall be undertaken without adequate consultation with them and the communities where they are to be relocated."		
Republic Act 8371, The Indigenous People's Rights Act (IPRA) of 1997	This Act recognizes and promotes all the rights of Indigenous Cultural Communities (ICCs)/ Indigenous Peoples (IPs).		
The Land Acquisition, Resettlement, Rehabilitation, and Indigenous Peoples Policy (LARRP; 2007 3rd Edition) Framework	<ul> <li>Land Acquisition, Resettlement, Rehabilitation, and</li> <li>Indigenous Peoples Policy (LARRP): <ul> <li>3rd Edition established in 2007.</li> <li>Framework based on RA 8974 and</li> <li>Infrastructure Right-of-Way (IROW) Procedural</li> <li>Manual extracted from LARRP.</li> </ul> </li> </ul>		
	<ul> <li>Uniform Standards and Resettlement Planning:</li> <li>Aims to ensure uniformity of standards in Resettlement Planning.</li> <li>Incorporates DPWH's Indigenous Peoples Policy, based on the Indigenous Peoples' Rights Act (IPRA) and NCIP Administrative Order No. 1, series of 2006 (Free and Prior, Informed Consent Guidelines of 2012).</li> </ul>		
	<ul> <li>Guidance for Infrastructure Projects:</li> <li>LARRP provides guidance for preparing resettlement plans and safeguard instruments for Indigenous Peoples (IPs) affected by all types of DPWH infrastructure projects, whether foreign or locally funded.</li> </ul>		
	<ul> <li>Evolution of LARR Policy:</li> <li>First LARR Policy formulated in 1999 for the World Bank-assisted First National Road Improvement and Management Program (NRIMP).</li> <li>Adopted, with modifications, by other financing institutions like the Asian Development Bank (ADB) and the Japanese Bank International for</li> </ul>		
DPWH Right-of-Way Acquisition Manual (DRAM), December 2017	<ul> <li>Cooperation (JBIC) In their projects.</li> <li>ROW Manual and DRAM Update:</li> <li>ROW Manual, based on RA 10752 and other legal references, replaces the 2003 version.</li> </ul>		
	<ul> <li>Procedures for ROW Acquisition:</li> <li>Lists acquisition methods, including donation and negotiated sale.</li> </ul>		

Directive	Brief Description
	Coverage of DRAM in ROW Acquisition:
	Comprehensive coverage of the entire ROW
	acquisition process
	Includes steps such as Project Feasibility Study,
	Inclusion in the Medium-Term Infrastructure
	Program, appropriation in the General
	Engineering Design RAP preparation RAP
	Validation. ROW acquisition through various
	modes, payments, title transfer, clearance of
	ROW, and ROW management.
	Guide for GFIs and IPAs:
	Serves as a guide for Government Financial
	Appraisers (IPAs) in determining appropriate
	price offers to property owners affected by ROW
	acquisition.
DPWH Department Order No. 43,	Order Intent and Guidelines:
Series of 2020. Guidelines for Right-of-	Order aims to facilitate ROW claims involving
Appendix Acquisition and Payment of	ancestral domains owned by Indigenous
Implementation of National Government	Peoples (IPs), recognized under R A 8371
Infrastructure Projects.	Guidelines incorporated in the DPWH ROW
, ,	Acquisition Manual (DRAM).
	Section 2.16 A of DRAM addresses ROW
	acquisition involving minimal areas.
	ROW Acquisition by Easement of ROW (Ancestral
	Section 2.16 B of DRAM outlines the objective
	of acquiring Road Right-of-Way (RROW) on
	lands covered by Certificate of Ancestral
	Domain Title (CADT) or NCIP-confirmed
	Ancestral Domain.
	Procedure involves executing a ROW Easement     Agreement between NCIP Accredited or
	Certified Tribal Council and Implementing Office
	(IO).
	Agreement grants the IO absolute and
	unimpeded right to use the affected portion of
	the ancestral domain as RROW for as long as
	Public requirement subsists.     IPs/ICCs retain ownership of that portion of the
	land.
	Agreement follows the procedure and
	requirements outlined in Department Order No.
Note: Detailed discussion of policies and many	43, Series of 2020.
Policy Framework in the Appendix.	auons on irs can be iound in the Millor Indigenous Peoples

#### Table 2-12. Labor Management

Directive	Brief Description
1987 Philippine Constitution.	Guaranteed by the Labor Code of the Philippines (PD 442 / RA 6715).
	Provides comprehensive guidelines on employment relations, labor standards, and equal work opportunities.
	Regulates interactions between workers and employers.
The Labor Code of the Philippines (PD 442 / RA 6715)	Strengthens workers' constitutional rights to self-organization, collective bargaining, and concerted activities.
	Fosters industrial peace and harmony.
	Promotes voluntary modes for settling labor disputes.
	Reorganizes the National Labor Relations Commission.
	Specifies terms and conditions of employment, including working conditions, rest periods, wages, and benefits.
	Prohibits gender discrimination in promotion and training opportunities.
RA 11058 / Occupational Safety and Health Standards	RA 11058 strengthens compliance with occupational health standards.
	DOLE Department Order No. 198-2018 provides implementing rules and regulations.
	Ensures workers are informed about workplace hazards.
	Requires training in chemical safety, electrical safety, ergonomics, and other risks.
	Chapter III of DOLE Department Order No. 198-2018 mandates safety signage and devices in workplaces.
	RA 66859 and DPWH Department Order No. 51 Series of 1990 set requirements for hiring labor in public works projects.
RA 66859 and DPWH Department Order No. 51 Series of 1990	Contractor Employment Requirements mandate private contractors to hire a percentage of labor locally for public works projects.
	Specifies hiring quotas for unskilled (50%) and skilled (30%) labor from local residents.
	Determined by the governor, city mayor, or municipal mayor of the project area.

Directive	Brief Description
Republic Act 10066 - Cultural Heritage Act	Mandates reporting of chance finds of cultural or historical property to the Commission or relevant agency.
	Non-reporting activities considered as interventions on archaeological or historical sites, leading to penalties.
National Museum or National Historical Institute	Immediate suspension of activities affecting the site upon discovery.
	Prompt notification to the local government unit with jurisdiction.
	Activities can resume only with written authority from the National Museum or National Historical Institute.
	Resumption allowed only after systematic recovery of archaeological materials.

#### Table 2-13. Cultural Heritage and Chance Finds

# 2.2 International Conventions, Treaties and Protocols Ratified by the Philippines

The international conventions, treaties, and protocols (ICTPs) that the Philippines has ratified is presented in **Table 2-14**.

Table 2-14. Internation	onal Conventions, Treaties, and Protocols Ratified by the	Philippines
Category	Name of Treaty (Year Ratified)	Date Ratified
Biodiversity	<ul> <li>Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973</li> </ul>	November     1981
	<ul> <li>Convention on Biological Diversity, 1992</li> </ul>	<ul> <li>June 1992</li> </ul>
	<ul> <li>Convention on the Conservation of Migratory Species of Wild Animals, 1983 (1994, February)</li> </ul>	<ul> <li>February 1994</li> </ul>
	<ul> <li>Convention on Wetlands of International Importance, 1971 (1994, November)</li> </ul>	<ul> <li>November 1994</li> </ul>
	<ul> <li>Cartagena Protocol on Biosafety, 2000 (to the Convention on Biological Diversity (2006, October)</li> </ul>	October     2006
	<ul> <li>Nagoya Protocol on Access to Genetic Resources &amp; the Fair &amp; Equitable Sharing of Benefits Arising from their Utilization-Supplementary Agreement to the Convention of Biological Diversity</li> </ul>	• September 2015
Climate Change	<ul> <li>Vienna Convention for the Protection of the Ozone Layer, 1985</li> </ul>	<ul> <li>July 1991</li> </ul>
	<ul> <li>Montreal Protocol on Substances that Deplete the Ozone Layer, 1987</li> </ul>	<ul> <li>July 1991</li> </ul>
	London Amendment (to the Montreal Protocol), 1990	<ul> <li>August 1993</li> </ul>
	United Nations Framework Convention on Climate Change, 1994	November 2003
	<ul> <li>Kyoto Protocol to the United Nations Convention on Climate Change, 1998</li> </ul>	November 2003
	<ul> <li>Paris Agreement Adopted in the 21st Session of the Conference of Parties to the United Nations Framework Convention on Climate Change, 2015</li> </ul>	• December 2017
Pollution	<ul> <li>Basel Convention on the Control of Transboundary Movements of Hazardous wastes and their Disposal, 1992</li> </ul>	October     1993
Historical/Cultural Heritage	<ul> <li>UNESCO Convention Concerning the Protection of the World Cultural and National Heritage, 1972</li> </ul>	• May 1985

## 2.3 World Bank Frameworks, Policies, and Standards

## 2.3.1 World Bank Environmental and Social Framework (ESF)

The World Bank has several frameworks, policies, and standards that provide a comprehensive set of guidelines and requirements for the planning, implementation, and monitoring of road investment projects financed by the World Bank. They cover aspects such as environmental and social safeguards, procurement processes, financial management, and risk assessment. The Environmental and Social Framework (ESF) is a set of policies and standards established by the World Bank to address environmental and social risks and impacts associated with projects financed by the Bank. It aims to protect people and the environment from potential adverse impacts that could arise from World Bank-financed projects. It applies to all World Bank Investment Project Financing (IPF) on or after October 1, 2018. The ESF consists of the World Bank's Vision for Sustainable Development, the Environmental and Social Policy for Investment Project Financing, and the ten Environmental and Social Standards (ESSs). The ESSs set out the requirements for Borrowers relating to the identification, assessment, and mitigation of environmental and social (E&S) risks and impacts associated with projects financed by the Bank.

The 10 environment and social standards are as follows:

- ESS1: Assessment and Management of Environmental and Social Risks and Impacts
- ESS2: Labor and Working Conditions
- ESS3: Resource Efficiency and Pollution Prevention and Management
- ESS4: Community Health and Safety
- ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement
- ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
- ESS7: Indigenous Peoples/Sub-Saharan African Historically Underserved Traditional Local Communities
- ESS8: Cultural Heritage
- ESS9: Financial Intermediaries
- ESS10: Stakeholder Engagement and Information Disclosure

For road projects specifically, the ESF applies to IPF for road construction, maintenance, or improvement projects. The ESF requires the Borrowers to comply with the ESSs throughout the life of the project, which includes addressing direct and indirect linkages to climate change-related risks. The ESF also mandates the Borrowers to assess and manage environmental and social risks and impacts arising from road projects, including potential adverse impacts on communities from project-related activities. Additionally, the ESF requires the Borrowers to engage in meaningful consultation with stakeholders, identify appropriate methods and tools to assess and manage potential environmental and social risks, and monitor the environmental and social performance of road projects in accordance with the ESSs.

#### 2.3.2 World Bank Environmental, Health, and Safety (EHS) Guidelines for Road Projects

The Environmental, Health, and Safety (EHS) Guidelines are technical reference documents with general and industry-specific examples of Good International Industry Practice (GIIP). The General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines.

## 2.3.2.1 World Bank Group (WBG) General EHS Guidelines<sup>1</sup>

The General EHS Guidelines contain the following information:

- Environmental (Air Emissions and Ambient Air Quality, Energy Conservation, Wastewater and Ambient Water Quality, Water Conservation, Hazardous Materials Management, Waste Management, Noise, Contaminated Land)
- Occupational Health and Safety (General Facility Design and Operation, Communication and Training, Physical Hazards, Chemical Hazards, Biological Hazards, Radiological Hazards, Personal Protective Equipment, Special Hazard Environments, Monitoring)
- Community Health and Safety (Water Quality and Availability, Structural Safety of Project Infrastructure, Life and Fire Safety, Traffic Safety, Transport of Hazardous Materials, Disease Prevention, Emergency Preparedness and Response
- Construction and Decommissioning (Environment, Occupational Health and Safety, Community Health, and Safety)

# 2.4 Comparative/Gap Analysis between WB ESSs and the GOP laws and Regulations

**Table 2-15** presents the comparative/gap analysis between the WB ESSs and the GoP laws and regulations and the corresponding measures aimed at closing the gap.

<sup>&</sup>lt;sup>1</sup> Final - General EHS Guidelines\_APRIL 29.doc (ifc.org)

World Bank ESS	Counterpart Philippine Legislation	Comparative/Gap Analysis	Response Measures
ESS - Assessment and Management of Environmental and Social Risks and Impacts	PD 1586 (1987) – Philippine EIS System: DENR AO 2003-30: EMB MC No. 2007-002- Revised Procedural Manual of DAO 2003-30; EMB MC 2014- 005- Revised Guidelines for Coverage Screening and Standard Requirements. DPWH Social and Environmental Management Systems Manual of 2016	The WB ESS1, as well as the PEISS, applies to MTCIP. Considering the project component's location, nature and size, the project components are covered by the Philippine Environmental Impact Statement (EIS) System guidelines, thus will be required to secure an Environmental Compliance Certificate (ECC). Those sections which will not be covered will be issued with a Certificate of non-coverage (CNC). However, based on the screening process under DENR EMB MC No. 2014-005, MTCIP components, e.g. sections of the existing Main Corridor which will be repaired to address environmental related problems, e.g. slope protection, climate adaptation such as improvement of flood control structures, including installation of road safety barriers/signs components will not be covered by the PEISS, and issued with a Certificate of Non-Coverage (CNC). Furthermore, the type of EIA document needed to support the ECC application for MTCIP will depend on the scale/length of the road/bridge and on the presence/absence of critical slopes. Those sections of the Main Corridor which have been operating prior to 1982 and will undergo road widening within the existing RROW and the length of which is less than the threshold limit of 20 km or less than 10 km with critical (>50 degree) slopes, the supporting EIA document for ECC application will be IEE Checklist. Construction of the new link roads,	Under ESS1, An Environmental and Social Impact Assessment (ESIA) will be conducted and an ESMP including the additional necessary environmental instruments will be prepared for a selected Link Road project component. Likewise, under DENR EMB MC No. 2014-005, a link road and/or bridge, whether for upgrading or to be newly constructed, if the scale/length and presence of slopes is more than the threshold limits (see comparative/gap analysis column), then, an EIS (full EIA with EMP report) will be required. All MTCIP project components, either for construction of the new link Roads, or for the repair, rehab, widening or slope protection of the sections of the Main Corridor covered by the MTCIP, shall be secured with the appropriate environmental clearance certification- ECC or CNC, with the corresponding appropriate supporting EIA report. This draft ESIA also includes provision for the management of contractors to ensure contractor operations are consistent with the requirements of the ESS/GoP environmental regulations.

#### Table 2-15. Gap Analysis Between World Bank ESS and Relevant Philippine Laws and Regulations

World Bank ESS	Counterpart Philippine Legislation	Comparative/Gap Analysis	Response Measures
ESS2 - Labor and Working Conditions	RA 6715 – Labor Code of the Philippines RA 11058 - Occupational Safety and Health Standards Act and DOLE DO 198- 2018 Joint Memorandum Circular No. 1, series 2020 – Occupational Safety and Health Standards for the Public Sector RA 66859 – Private Contractors to whom national, provincial, city and municipal public works projects to hire at least 50 % of unskilled and at least 30% of skilled labor requirements to be taken from bonafide residents in the province and/or city where the project is located.	depending on the scale, i.e. If within the threshold limits, ECC application shall be likewise required to be supported with an IEE Checklist, otherwise, an EIS report shall be required. Whether the required EIA report will be an IEE Checklist or an EIS, data from the ESIA and the ESMP can be utilized or extracted either for the preparation of the IEE Checklist or for the EIS report. The Philippine labor laws and regulations contain the key elements of ESS2 that includes labor management procedures, terms and conditions of employment, rights of workers, occupational health and safety, non- discrimination and equal opportunity, prohibition on forced labor, and provisions on workers' organizations, grievance mechanism, and regulations for vulnerable workers, including child workers. However, the regulations are not clear on measures to prevent harassment, other than sexual and gender-based offenses, exploitation in the workplace, and on provision of social benefits and applicability of grievance mechanism to contract employees in the public sector.	Labor Management Procedures (LMP) will be prepared to fully align with the ESS2.
ESS3 - Resource Efficiency and Pollution Prevention and Management	RA 8749 – Philippine Clean Air Act of 1999 and DENR AO 2000- 81 RA 9275 – Philippine Clean Water Act of 2004 and DENR AO 2016-08 and 2021-19 RA 9003 – Ecological Solid Waste Management Act of 2000 and DENR AO 2001-34	Counterpart Philippine legislations conforms with the requirements of ESS3. Pertinent Philippine regulations/standards such as RA8749, RA9275, RA9003, and RA6969 will apply to road repair, rehabilitation, road widening including road/bridge construction activities which will create potential impacts related to air pollution from dust emission from site works	The Environmental and Social Management Plan (ESMP) will be developed to manage the anticipated environmental and social impacts of the Project. The ESMP shall form part of the bid document for project contractors' compliance.

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World Bank ESS	Counterpart Philippine Legislation	Comparative/Gap Analysis	Response Measures
	RA 6969 - Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 and DENR AO 2013-22 RA 11285 – Energy Efficiency and Conservation Act of 2019	and emission from equipment and construction vehicles used for construction; water pollution from runoff or soil erosion from stockpiled construction materials, wastewater from domestic sewage of construction workers, and accidental spillage of oil and other lubricants; noise from construction activities that may disturb nearby communities; generation of construction wastes and possibly hazardous materials such as used lead acid batteries, busted lamps, used oil, etc. Likewise, with ESS3 requirements, Quarry sites shall be secured with permits from the local	
ESS4 - Community Health and Safety	PD 1586 (1987) - Philippine EIS System and DENR AO 2003-30 Presidential Decree 856 – Sanitation Code of the Philippines RA 11058 - Occupational Safety and Health Standards DOLE Department Order 198- 2018	government. The ESS4 and pertinent GoP public health laws will apply to the Project. *** The repair/rehab/road widening works may be conducted near sensitive receptor premises such as school/clinics/other community service facilities, where civil works may pose hazards. There will be a number of vehicles transporting equipment and construction materials to the project site that may generate noise, dust, and temporary disturbance, and risk to vehicular accidents to staff and occupants of the school and health centers and to the nearby communities.	The Environmental and Social Management Plan (ESMP) will be developed to manage these anticipated environmental and social impacts of the Project.
ESS5 - Land Acquisition, Restrictions on Land Use and Involuntary Resettlement	RA 10752 – An Act facilitating the Acquisition or Right of Way, Site or Location for National Government Infrastructure Projects. RA No. 8974 - An Act to Facilitate the Acquisition of Right-of-Way, Site or Location	MTCIP project components will involve land acquisition or resettlement impacts. Temporary displacement or disruptions to household activities or farming operations are anticipated. Although the governing laws and policies in the country significantly meet the requirements of the international finance	A Resettlement Policy Framework will be prepared in conjunction with this draft ESIA.

World Bank ESS	Counterpart Philippine Legislation	Comparative/Gap Analysis	Response Measures
	for National Government Infrastructure Projects and for Other Purposes. Art. III, Sect. 9 of the 1987 Constitution - Private property shall not be taken for public use without just compensation. RA 7279 Urban Development and Housing Act of 1992	institutions like the WB, some gaps are still unavoidable. These gaps are addressed in the RAP documents as "gap filling measures".	
ESS6 - Biodiversity Conservation and Sustainable Management of Living Natural Resources	PD 705- Forestry Reform Code of the Philippines RA 9147- The Philippines' Wildlife Act RA 7586 and 11038 - National Integrated Protected Areas System DENR M.O. No. 2012-02- Uniform Replacement Ratio for Cut or Relocated Trees DENR AO No. 2017-11 (Threatened Flora) and 2019-09 (Threatened Fauna)	GoP's NIPAS, DENR's guidelines on uniform replacement of cut trees, and DPWH policies on minimizing cutting of trees and clearing of vegetation in road projects, are consistent with ESS6 requirements.	A site specific ESMP will be prepared to address the concern on protection of biodiversity conservation areas.
ESS 7 - Indigenous People/Sub- Saharan African Historically Underserved Traditional Local Communities	RA 8371 – Indigenous Peoples Rights Act (IPRA) DPWH DO No. 43, Series of 2020. Guidelines for Right-of- Way (ROW) Acquisition and Payment of Ancestral Domain Affected by the Implementation of National Government Infrastructure Projects	Some sections/components of MTCIP, particularly the new link roads, will traverse through identified ancestral domains of Indigenous Peoples (IPs). Engaging with IP communities is protected under NCIP Administrative Order No. 3 s. 2012 or the Revised Guidelines on FPIC of 2012. It is decisive and absolute in its procedures as implemented by NCIP. FPIC information requirements requiring validation are (i) FBI Report; (ii) Identity of the IP Elders and Leaders; (iii) IP Decision-making process; (iv) Census of IPs/migrant IPs:	An Indigenous Peoples Policy Framework will be developed for MTCIP.

World Bank ESS	Counterpart Philippine Legislation	Comparative/Gap Analysis	Response Measures
		<ul> <li>(v) Area affected;</li> <li>(vi) Existence of boundary conflict with other ancestral domains; (vii) Conflict resolution mechanism and facilitate the conduct of the same by the chosen/selected Elders/Leaders; and</li> <li>(viii) Proceedings towards IP community consensus building.</li> </ul>	
ESS8 - Cultural Heritage	RA 10066 – Philippine Cultural Heritage Act)	RA 10066 and ESS8 are applicable to this Project. Archaeological artifacts may be accidentally discovered during excavation or clearing activities for some road widening activities or for the new link roads.	A Chance Finds procedure will be developed and included in this draft ESIA based on the guidelines of the National Museum and the National Historical Institute.
ESS9 - Financial Intermediaries		ESS9 is not applicable to the Project. There are no Financial Intermediaries (FIs) or public and private financial services providers involved in the Project.	
ESS10 - Stakeholder Engagement and Information Disclosure	PD 1586 (1987) – Philippine EIS System DENR AO 2017-15 – guidelines on Public Participation under the Phil. EIS System Local Government Code of 1991 DPWH Social and Environmental Management Systems Manual of 2021	ESS10 applies to the Project. The public disclosure and consultations starting from the project preparation up to project implementation and operation, will enable stakeholders to give feedback on Project risks and impacts and that may help develop measures to address these issues. Key stakeholders of the Project include LGU officials, elders from the concerned IP, PAPs, and other interested parties.	The Stakeholder Engagement Framework (SEF) is developed to provide guidance in engaging stakeholders through open and participatory consultations with communities and affected persons.

## 3. DESCRIPTION OF THE PROJECT

## 3.1 Project Context

The Department of Public Works and Highways (DPWH) is in the process of securing a loan for the Mindanao Transport Connectivity Improvement Project (MTCIP) under the World Bank Group to strengthen road connectivity to support agriculture and regional development in Mindanao. The MTCIP is fully aligned with the Philippine Development Plan 2023-2028 as it supports the agricultural sector and contributes to the goal of expanding and upgrading infrastructure through the improvement of transport connectivity, embedding climate resilience in road design and asset management, and strengthening road safety measures along one of the important transport corridors, Cagayan de Oro-Davao-General Santos City Road.

The MTCIP aims to address the transportation and logistics challenges faced by the agricultural sector in Mindanao and increase the incomes of smallholder farmers. Its primary objective is to improve road connectivity, enhance climate resilience, and ensure road safety along the main national highways, including the 421.12 km Sayre Highway, Bukidnon-Davao Road, Digos-Makar Road, and Davao-Cotabato Road (Davao City-Junction Digos Section), which collectively form the Main Corridor (MC) passing through the cities of Cagayan de Oro (CDO), Davao, and General Santos. Additionally, the project plans to upgrade three local road sections with a total length of 129.86 kilometers connected to the Main Corridor. These local roads or Link Roads are Link Road 1 (Sayre Highway (Patulangan)-Cawayan-Kibenton Rd.-Intavas, La Fortuna-Sayre Highway), Link Road 2 (Fatima Malabog Rd.-Mahayahay-Polocon Rd.-Saloy Bantol Davao Bukidnon Rd. to Panabo City), and Link Road 3 (National Highway Jct Poblacion Malungon to Sta Maria Rd. Davao Occidental).

## 3.2 Proposed Project

## 3.2.1 Project Proponent

DPWH is the lead proponent for the Project as the Implementing Agency (IA), with the oversight of the Unified Project Management Office (UPMO)—Roads Management Cluster II (RMC II). The Project will be further complemented by the involvement of DPWH Region X, XI, and XII offices, alongside relevant district offices, ensuring comprehensive coverage and effective implementation across the targeted areas.

## 3.2.1 Project Objectives

The MTCIP's main goal is to improve transport infrastructure and accessibility across Mindanao to boost economic and social development needs. It will help farmers in remote areas by making transportation cheaper and easier. The Project also aims to enhance road users' safety along the Main Corridor and Link Roads with strategies geared towards protecting commuters, including drivers, passengers, pedestrians, and motorists, against accidents and crashes, as well as reducing the risks of such incidents occurring and minimizing their severity through different mitigation measures.

## 3.2.1 Project Location

The proposed MTCIP will improve the Main Corridor, connecting key areas across Mindanao, including six cities and 13 municipalities in eight provinces: Misamis Oriental, Bukidnon, Davao del Sur, Davao Occidental, Davao del Norte, Cotabato, Sarangani, and South Cotabato. These regions fall under the jurisdiction of Northern Mindanao (Region X), Davao Region (Region XI), and SOCCSKSARGEN (Region XII).

Starting from Cagayan de Oro in the north and ending in General Santos City in the south, the Main Corridor passes through various municipalities and cities, including Manolo Fortich, Sumilao, Impasug-ong, Malaybalay City, Valencia City, Maramag, Quezon, and Kitaotao in Bukidnon. It then moves through Arakan in North Cotabato before entering Davao City and continuing through Sta. Cruz, Digos City, Hagonoy, Padada, Sulop, and Malalag in Davao del Sur, finally reaching Malungon and General Santos City in South Cotabato Province.

Additionally, the three Link Roads branch off from the Main Corridor, located in the northern, central, and southern regions. Link Road 1 is entirely within Impasug-ong, Bukidnon, in Region X. Link Road 2 starts at Panabo City, Davao del Norte, extends into Davao City in Region XI, and terminates at the intersection with the Main Corridor of Bantol Road. Link Road 3 in the south connects Malungon and Sarangani of Region XII to Sta. Maria, Davao Oriental of Region XI. The entire MTCIP route, including the Main Corridor and three Link Roads, passes through a total of 186 barangays. The Main Corridor is accessible to private and passenger cars, motorcycles, tricycles, buses, goods utility vehicles, agricultural and construction vehicles, and specialized vehicles like rigid trucks and truck trailers. The Link Roads are accessed mainly via passenger cars, motorcycles, tricycles, tricycles, tricycles, jeepneys, agricultural vehicles, rigid and trailer trucks, and goods utility vehicles. **Figure 3-1** shows the location map of MTCIP.



Figure 3-1. Location Map of MTCIP

# 3.3 Project Components

The proposed MTCIP has five key components:

- **Connectivity**: (<u>Component 1: Improvements of selected local roads ("Link Roads"</u>)) upgrading 130 km of selected local roads to national road standards with climate resilience and road safety measures.
- Long-Term Road Asset Maintenance: (Component 2: Capacity, climate resilience and road safety enhancement of the CDO-Davao-GenSan Corridor ("Main Corridor"))
   Road safety improvement and climate resilience (whole 421.12 km) and rehabilitation (124 km of damaged sections), and an Output Performance-Based Road Contract (OPRC) of 5-7 years.
- **Capacity Building**: <u>(Component 3: Capacity building and Institutional Development)</u> capacity enhancement of DPWH and select LGUs (e.g., training, studies, knowledge exchange, among others).
- **Project Management**: <u>(Component 4: Project Management)</u> Support DPWH's UPMO-Road Management Cluster II in project implementation.
- Contingency Emergency Response Component (CERC): <u>(Component 5:</u> <u>Contingent Emergency Response Component (CERC) to support post-disaster</u> <u>recovery</u>) - a zero-dollar component within a project that allows for funds to be quickly reallocated to emergency recovery activities in the event of a disaster.

The MTCIP would entail rehabilitation and upgrading of the Main Corridor and the three Link Roads with various types of works at different sections of the alignment, such as road widening, reblocking, asphalt overlay, road strip widening, road paving, bridge construction and rehabilitation, drainage construction, slope protection, sidewalks, and road shoulders. The road works per type under the MTCIP are presented in the **Table 3-1**. The details of road works for the Main Corridor and Link Roads are provided in the **Annex 1-13**.

Туре	Road Works
Main Corridor	<ul> <li>421.12 km with road widening to 4 lanes</li> </ul>
Coordinates (WGS 84)	<ul> <li>Construction of roadside elements (slope protection, drainage/ditch_shoulders)</li> </ul>
8°30'3.21"N. 124°45'2.11"E	Reconstruction of distressed PCCP and ACP
to	Reconstruction of distressed recorrand Acr     Road safety mitigation works
6° 7'6.73"N, 125° 8'44.13"E	
Link Road 1	<ul> <li>9.0 km length to be paved with 28 cm thick PCCP</li> </ul>
	Earthworks: clearing and grubbing, embankment formation of
8°16'13 20"N 125°0'59 41"E	1.50 m thickness, subgrade and subbase works. PCCP with
to	both sides, cross drains every 300 m lateral drainnines at
8°11'48.10"N, 124°58'14.37"E	entrance/exit to plantations, covered lined ditch at urban areas.
	Outfalls for drainage to be excavated.
	<ul> <li>Asphalt overlay of existing pavement (4.9 km) and road strip</li> </ul>
	widening (4.9 km)
	<ul> <li>Bridge: Upgrading of existing spillway across Atugan River (loading to Intervas) to bridge</li> </ul>
Link Road 2	Construction of PCCP in uppayed sections (11.94 km) and
	road openings in the pre-determined alignments without roads
Coordinates (WGS 84)	from KM 42 to KM 56, construction of 3 bridges, 1 box culverts.
7°15'58.40"N, 125°19'50.39"E	Reblocking (1.5 km) of distressed pavements.
	Construction of paved shoulders and concrete-lined ditches
7°18'0.80"N, 125°40'49.71"E	(combination of covered (urban centers) and uncovered).
	<ul> <li>Slope protection works including concrete masonry and soil poiling with potting (2.1 km)</li> </ul>
Link Road 3	45.03 km following the alignment determined by the Feasibility
	Study from DPWH-XII with modifications: construction of

#### Table 3-1: Road Works Under the MTCIP

Туре	Road Works
Coordinates (WGS 84)	PCCP, 12 bridges, retain and rehabilitate 1 bridge, construction
6°22'42.41"N, 125°16'22.27"E	of additional cross-drains.
to	<ul> <li>Drainage concrete-lined ditches, paved shoulder, and slope</li></ul>
6°33'6.12"N, 125°28'21.03"E	protection work (masonry wall and soil nailing with netting).

## 3.4 Utility Requirements

#### 3.4.1 Water Requirements and Sources

The water will be mainly used during construction. An estimated 69,000 m<sup>3</sup> of water will be required by the Project during the construction phase. Initially, this water requirement will be sourced from a local water service provider near the project site and supplemented by auxiliary sources. This will need to be further studied during the DED stage.

## 3.4.2 Power Requirements and Sources

The electricity will be mainly used during construction. An estimated 495,600 kWh of electricity will be required by the Project during the construction phase. Initially, this power requirement will be sourced from a local electricity distributor in the region and supplemented by auxiliary sources. This will need to be further studied during the DED stage.

## 3.4.3 Other Support Facilities (Temporary)

## 3.4.3.1 General Works Areas

General Work Areas will be set up in specific segments of the Main Corridor and Link Roads. These areas will serve various purposes, including housing Contractor's offices, resident site staff offices, equipment, and machinery storage yards such as batching plant, crusher plant, asphalt plant, and quarry sites, as well as repair workshops, among other functions. The size and placement of these areas should be carefully evaluated, taking into account the extensive geographical span of the Main Corridor and Link Roads. It is expected that multiple work areas will be necessary to support construction activities effectively. Several work areas near the active construction sites may be needed for better logistics. This will be looked at more closely during the Detailed Engineering Design (DED) stage.

#### 3.4.3.2 Dumping Area

Concrete from road reblocking activities and other unsuitable materials, such as in boring activities and earth works spoils, can be disposed of at designated waste management facilities like landfills or recycling centers equipped to handle construction debris, ensuring compliance with regulations and minimizing environmental impact. Opting for a nearby dumping site reduces transportation costs and improves logistical efficiency. Contractors are required to have disposal facilities that are able to accommodate the estimated debris volume generated by the project. This will be looked at more closely during the Detailed Engineering Design (DED) stage.

#### 3.5 Construction Materials and Equipment

#### 3.5.1 Source of Construction Materials

The construction materials, such as cement, asphalt, aggregates, etc., will be locally sourced from government-recognized cement manufacturing, batching, asphalt, and quarry plants along the project alignment. Error! Reference source not found. presents the quarry sources o

f construction materials located near the Main Corridors and Link Roads.

able 3-2. Quarry Sources of Road Construction Materials Located Near the Main Corrido	ors
nd Link Roads	

Road Section	No. and Type of Quarries Nearby	Available Construction Materials	Potential Use (Purpose)
1.CDO - Bukidnon -Davao (Main Corridor) and Sayre Hwy- Cawayan-Kibenton Road (Link Road 1)	a. River Quarry – 26	a. River Quarry- Aggregates, Sand, Gravel, Boulders and Cobbles	River Aggregates Materials for; Item 200- Agg. Subbase Course Item 201-Agg Base Course Item 300-Agg Surface course Aggregates for Item 311-PCCP and Item 405-Structural concrete
			Boulders for; Item 505 -Riprap Item 506 -Stone masonry Item 507- Rubble Masonry Item 511- Gabions Item 516- Wet Stone Masonry
	D. Mountain Quarry - 10	b. Mountain Quarry- Limestone, Borrow Fill	Limestone (Mountain mix Materials) for Item 104- Embankment
2. Davao-Gen San (Main Corridor) and Two (2) Link Roads a. Fatima-Malabog- Rd-Saloy- Bantol-Davao-Bukidnon Road and b. Poblacion Sta Mari, Malungon Road	a. River Quarry- 95	a. River Quarry- Aggregates, Sand, Gravel, Boulders and Cobbles	River Aggregates Materials; Item 200- Agg. Subbase Course Item 201-Agg Base Course Item 300-Agg Surface course Aggregates for Item 311-PCCP and Item 405-Structural concrete Boulders for; Item 505 -Riprap Item 506 -Stone masonry Item 507- Rubble Masonry
			Item 511- Gabions Item 516- Wet Stone Masonry
	d. Mountain Quarry -12	b. Mountain Quarry- Earth fill	Earth fill (Mountain mix Materials) for Item 104- Embankment

Road Section	No. and Type of Quarries Nearby	Available Construction Materials	Potential Use (Purpose)
	c. Asphalt Batching Plants- 2	c. Asphalt mix	Asphalt mixes for Items 306,307, 310
	d. Concrete Batching Plants-16	d. Concrete mix	Concrete Mix for Items 311, 405, 407
	e. Concrete Products- 1	e. Concrete Products- RCPC and CHB	Item 500
	f. Crushing Plants- 5	crushed aggregates	Aggregates for Item 311-PCCP and Item 405-Structural concrete Crushed Aggregates for Item 202- Crushed Aggregate base course

## 3.5.2 List of Construction Materials and Equipment

The construction materials and equipment that will be used for the Project are presented in the following list.

## 3.5.2.1 Construction Materials

- A. Subbase
- B. Concrete:
  - a. Coarse Aggregate (Gravel)
  - b. Fine Aggregate (Sand)
  - c. Cement, 40 kg/bag
- C. Asphalt Concrete:
  - a. Hot Mixed Asphalt
  - b. Emulsified Asphalt/Tack Coat
- D. Bridge/Road/Rcbc:
  - a. Steel Casing
  - b. Reinforcing Steel
  - c. Structural steel, craneway
  - d. Form Lumber
- E. Stone Masonry/Riprap
  - a. Boulders
  - b. Sand
  - c. Cement
- F. RCPC
- G. Crash Barrier
- H. Guardrail
- 3.5.2.2 Equipment
  - A. Road Grader
  - B. Roal Roller Static

- C. Bulldozer
- D. Hydraulic Excavator
- E. Dump Truck
- F. Trailer Truck
- G. Payloader
- H. Water Truck
- I. Concrete Batch Plant
- J. Vibratory Roller
- K. Transit Mixer
- L. Asphalt Batch Plant
- M. Pneumatic Roller
- N. Crane
- O. Bored Piling Rig
- P. Vibratory Hammer
- Q. Pile Driving Rig
- R. Pile Hammer
- S. Welding Machine

#### 3.6 **Project Phases**

#### 3.6.1 Pre-Construction

The pre-construction phase involves procuring consultants, planning, obtaining permits and right-of-way (ROW), pre-qualifying contractors, and mobilizing for construction. These steps aid in developing detailed engineering designs, assisting project oversight, and providing project management expertise for efficient implementation and successful delivery.

#### 3.6.2 Construction

The construction phase will encompass civil works both on the Main Corridor and Link Roads. Civil works on the Main Corridor will involve tasks such as road widening, repairing damaged sections, implementing slope protection measures to safeguard against landslides, carrying out drainage works, and installing road safety infrastructure such as sidewalks, traffic signs, and traffic lights. Similarly, civil works on the Link Roads will entail upgrading from unpaved roads to concrete surfaces, repairing damaged sections, constructing and rehabilitating bridges, implementing slope protection measures, addressing drainage issues, and installing road safety infrastructure.

#### 3.6.3 Demobilization

The demobilization activities after construction will take place in the designated zones within the Main Corridor and Link Roads. This will include the dismantling of temporary accommodation, facilities, and structures, as well as retrieving all equipment. Construction areas will undergo clearance and cleaning to remove any debris or waste. Demobilization and restoration efforts will adhere to the established procedures and standards outlined in the approved civil works contract, in accordance with DPWH.

#### 3.6.4 Operational

During the operational phase, long-term performance-based maintenance (LTPBM) will entail continuous monitoring and upkeep. Employing the LTPBM contract model within the MTCIP aims to enhance the efficiency and efficacy of the road maintenance program which part of

Component 4: Project Management. This approach guarantees that the roads covered by the contract maintain satisfactory conditions for users, encompassing usability, structural integrity, drainage, safety, and user comfort, over the entire duration of the MTCIP agreement.

#### 3.7 Manpower

The estimated number of manpower needed throughout the various phases of the project is presented in **Table 3-3**.

Project Phase	No. of Manpower in Main Corridor	No. of Manpower in Link Roads
Pre-Construction Phase	100 -200	100 -200
Construction Phase	300 - 600	500 - 1000
Operation Phase	10 - 25	10 - 25

#### Table 3-3. Summary of Manpower

## 3.7.1 Pre-Construction

The pre-construction phase covers the Detailed Engineering Design (DED), which involves collaboration among the Project Proponent (DPWH), DED Consultant, Project Management Consultant (PMC), and Construction Supervision Consultant (CSC), all procured through a contract package managed by a consulting firm. The services provided will include developing comprehensive engineering design plans and specifications. It will assist the DPWH in project oversight from pre-construction to construction, offering specialized expertise in project management services encompassing planning, scheduling, and budgeting to ensure efficient implementation and successful project delivery. The estimated number of workers during construction will be finalized during the DED.

## 3.7.2 Construction

During construction, the labor force will include various professionals, such as engineers, project managers, surveyors, equipment operators, construction workers, traffic controllers, safety personnel, and quality inspectors. Determining the precise number of personnel for each role necessitates thorough project planning and assessment, accounting for variables such as work schedules, shifts, and productivity rates. An estimated 300 to 600 skilled and unskilled workers will be required for the Main Corridor, and 500 to 1,000 for the Link Roads.

## 3.7.3 Operation

During operation, an estimated 10 to 25 workers will be engaged to monitor road quality, ensure road safety, security, and passage, and conduct maintenance and repair work on the Main Corridor and Link Roads.

## 3.7.4 Equal Job Opportunity Policy

The project will enforce an equal job opportunity policy for employment, ensuring that all eligible candidates are given fair consideration for employment at all project phases, irrespective of their gender, age, or ethnicity. Contractors must comply with government laws pertaining to equal employment opportunity without any discrimination, such as the Labor Code of the Philippines (PD No. 442), Republic Act No. 6725, Republic Act No. 7277 (Magna Carta for Disabled Persons), Republic Act No. 10911 (Anti-Age Discrimination in Employment Act), and Republic Act No. 9710 (Magna Carta of Women).

## 3.8 **Project Schedule**

The project preparation, including the detailed engineering design (DED), will commence from 2024 to 2025. The start of civil works will be in 2026. The construction is projected to conclude by 2028. Additionally, long-term performance-based maintenance is scheduled to extend over a span of five years, from 2026 to 2030. **Figure 3-2** shows the project schedule.

# WORLD BANK

Proposed Timeline for the Mindanao Transport Connectivity Improvement Project (MTCIP)

	2024 2025			20	26		2027					2029	2030		20	31							
PROJECT	Q1	Q2	Q3	 ১ চ র জ	Q1	Q2	Q3	Q4 চ র খ	Q1	Q2	Q3	Q4	Q1	Q2	Q3	 চ ১ খ	bpppp	\$ <b>\$</b> \$	2 <b>12</b> 22	Q1	Q2	Q3	<b>Q4</b> চার খ
MINDANAO TRANSPORT CONNECTIVITY IMPROVEMENT	1 2 2	2 2	<u> </u>	x 0 2 0	2 2 2	2 2 3	1 1	0 2 0	2 2 2	2 2 2	<u> </u>	0 2 0	7 2 2	2 2 2	<u> </u>	0 2 0				4 4 8	<u> </u>	N N N	0 2 0
SUBMISSION OF PROJECT PROPOSAL TO NEDA-ICC		FEB 20 1 DA	24																				
NEDA-ICC TECHNICAL BOARD APPROVAL		FEB 2024 2 N	1 - MAR 2024 IONTHS	]																			
ICC CABINET COMMITTEE APPROVAL			APR 2024 - N 2 MON	1AY 2024 THS																			
APPRAISAL, PREPARATION, AND APPROVAL OF LOAN AGREEMENT				JUN 2024 - AL 6 MONT	IG 2024 HS																		
PROCUREMENT OF DED CONSULTANTS					SEP 2024 4 MC	- DEC 2024 DNTHS																	
DETAILED ENGINEERING DESIGN (DED)								JAN 2025 9 M	- SEP 2025 DNTHS														
PROCUREMENT OF CIVIL WORKS									OCT 2	2025 - JAN 203 4 MONTHS	26												
CIVIL WORKS (2 YEARS)												FEB 20 24	26 - JAN 2028 MONTHS	]									
LONG TERM PERFORMANCE BASED MAINTENANCE (5 YEARS)																				FI	EB 2026 - JAN 60 MONTH	2031 S	

Figure 3-2. Project Schedule

## 3.9 Project Cost

The estimated project cost is US \$572.00 million, jointly financed by WB and GoP, of which US\$407.00 is World Bank (International Bank for Reconstruction and Development or IBRD) financing.

The improvements of the Link Roads (Component 1) have a total budget of US\$138.00 million to upgrade 129.86 km of local roads to national road standards, incorporating climate resilience and road safety measures. The component includes detailed engineering design and construction supervision consultant services, with the government responsible for land acquisition and resettlement.

The capacity, climate resilience, and road safety enhancement of the Main Corridor (Component 2) has a total budget of US\$368 million for the rehabilitation of 126.67 km of road sections categorized as 'bad or poor'. The project will repair damaged sections and upgrade the carriageway, with a focus on climate resilience and road safety enhancements and introduce a new Road Asset Management regime post-improvement.

With a total budget of US\$18.00 million, capacity building and institutional development (Component 3) will support the capacity enhancement of DPWH and select LGUs in transport network planning and asset management. Activities include setting up transport asset management systems, institutional strengthening studies, climate resilience mainstreaming, training on OPRC concepts, and technical studies for priority interventions.

Project Management (Component 4) is allocated US\$47.00 million to support the DPWH's UPMO-Road Management Cluster-II and the PIU in project implementation. It finances training, technical advisors, and consultants for various aspects of project implementation, including road safety, climate resilience, and compliance with WB technical, fiduciary, and safeguards.

The proposed project includes a Contingent Emergency Response Component (Component 5) to provide a rapid, pre-approved source of funding to address emergency response needs following a natural disaster, crisis, or severe economic shock. The CERC allows for the quick reallocation of funds within the project or the mobilization of additional funds to support emergency response and recovery efforts. As a contingent fund, CERC has zero allocation in the initial project budget, meaning it is not allocated any funds unless an emergency occurs. It acts as a placeholder within the project that can be activated to provide immediate financial resources when needed.

## 3.9.1 Contract Packaging Options

The evaluation of contract packaging options for the MCIP has led to the recommendation of a multiple contract model, which divides the project into packages of approximately 52 km each for the MC and two packages each for the LRs. This model is chosen for its balance between administrative efficiency and the benefits of smaller contracts, such as local participation and competition. This offers manageable project sizes, reduces administrative burdens, encourages competition, and facilitates coordination across the project stretch. **Table 3-4** presents the contract options. **Figure 3-3** shows the map of district offices of DPWH. **Table 3-5** presents the proposed packages for main corridor and local link roads.

#### Table 3-4. Contract Option

Options	Pros	Cons
Single Large Contract (entire MC and LREs)	<ul> <li>Simpler administration</li> <li>Potentially lower overall cost due to economies of scale</li> </ul>	<ul> <li>Requires a very large contractor with significant resources</li> <li>Higher risk for the DPWH if the contractor fails to perform</li> <li>Less opportunity for local contractors to participate</li> </ul>
Multiple Contracts (each 50 km for MC and 25 km for LRs)	<ul> <li>More manageable project size for contractors</li> <li>Wider participation opportunity for local contractors</li> <li>Potentially fosters competition and innovation</li> </ul>	<ul> <li>Increased administrative complexity</li> <li>Potential for inconsistencies in service delivery across different packages</li> <li>Challenges in coordinating maintenance activities across the entire stretch</li> </ul>



Figure 3-3. Map of District Offices of DPWH

Package Number	Section Name	Length in km	Contract cost in million Pesos
Main Corridor (50 km)			
Package 1	S00577MN	50.575	PHP 4,451.22
_	S00621MN		
Package 2	S00639MN	48.287	PHP 805.97
Package 3	S00639MN	39.011	PHP 1,298.44
5	S00647MN		
Package 4	S00654MN	58.38	PHP 995.36
Package 5	S01406MN	50.2	PHP 455.86
Package 6	S01406MN	53.757	PHP 778.68
_	S01409MN		
	S00039MN		
	S00098MN		
Package 7	S00162MN	58.458	PHP 1,428.48
-	S00184MN		
	S00202MN		
Package 8	S00220MN	63.583	PHP 1,408.54
-	S00231MN		

## Table 3-5. Proposed Packages for Main Corridor (50 km) and Local Link Roads (20 km)

Package	District, Province/Region	District, vince/Region			
Local Link Roads (20 k	(m)				
Package 1 – LR1	Bukidnon 1st	25.03 km	PHP 1,315.85		
Package 2- LR2	Davao City, Davao City Sub	40.16 km	PHP 2,012.49		
Package 3 – LR2	Davao del Norte Sub DEO	19.24 km	PHP 487.00		
Package 4 -LR3	Davao Occ DEO	17.90 km	PHP 1,239.43		
Package 5- LR3	Sarangani DEO	27.13 km	PHP 1,138.91		

## 4. BASELINE DATA

## 4.1 **Project Influence Areas (PIAs)**

According to WB Operational Policy (OP) 4.01, the Project Influence Area (PIA) refers to the territory expected to be impacted by the project and its associated ancillary aspects. This includes infrastructure like power lines, pipelines, canals, access roads, and construction sites, as well as any unplanned changes brought about by the project, such as new settlements or logging along roads. Additionally, the PIA may encompass various zones like the project's watershed, affected estuaries and coastal regions, areas needed for resettlement, regions affected by air pollution, migratory routes of humans, wildlife, or fish, and areas used for livelihood activities or customary religious ceremonies.

A remote assessment using the World Bank Geospatial ESF Risk Assessment Toolkit indicated the following project features relevant to its area of influence:

- overlaps with urban settlements defined as areas with a population density of more than 1,000 people per square kilometer;
- within 10 kilometers of intact core forest landscapes, Key Biodiversity Areas (KBAs), and Protected Areas (PAs). IBAT analysis confirmed that there is no critical habitat within the 10 km buffer from the project sites;
- located in an area with recent deforestation of primary forest;
- contains a major river or is within 1 kilometer of a major river or inland water body, posing potential flooding risks and pollution impacts on downstream areas and communities; and
- within 25 kilometers of known indigenous territories.

Within the Main Corridor, numerous residential, agriculture farms, schools, parks, oval grounds, golf clubs, government offices, malls, commercial, and industrial facilities are directly affected, as are existing temporary facilities for construction, all situated along the access roads of the national highway that pass through 19 interconnected cities (Cagayan de Oro, Malaybalay, Valencia, Davao, Digos, and General Santos) and municipalities (Manolo Fortich, Sumilao, Impasug-ong, Maramag, Quezon, Kitaotao, Arakan, Sta. Cruz, Hagonoy, Padada, Sulop, Malalag, and Malungon).

In Link Road 1, the primary direct impact areas encompass residential zones, agriculture farms, commercial and agro-industrial establishments, a greenhouse facility, a primary school, a church, and local government offices. These are situated along the access roads that pass through the Municipality of Impasug-ong, covering five barangays (Capitan Bayong, Cawayan, Kibenton, La Fortuna, and Poblacion).

In Link Road 2, the direct impact areas are residential zones, agriculture farms, commercial and agri-industrial establishments, schools (primary, secondary, tertiary), churches, local government offices, and gasoline stations across the access roads traversing Panabo City, covering 10 barangays (New Pandan (Poblacion), Gredu (Poblacion), New Visayas, Datu Abdul Dadia, Little Panay, Katipunan, Cacao, Kauswagan, Consolacion, Malativas), and Davao City with 6 barangays (Mabuhay, Malabog, Paquibato (Poblacion), Bantol, Malamba, Salaysay).

In Link Road 3, the direct impact areas are residential zones, agriculture farms, minor commercial and agri-industrial establishments, schools (primary and secondary), churches, local government offices, gasoline stations across the access roads traversing Malungon,

covering five barangays (Poblacion, Upper Mainit, San Miguel, San Roque, Kinabalan), and Sta. Maria with five barangays (Datu Intan, San Antonio, Pongpong, San Isidro, and Poblacion).

#### 4.2 Land

## 4.2.1 Land Classification and Land Use

Within the stretch of the 40-m buffer zone (20 m each side) in the Main Corridor, the dominant land uses fall under the road and easement category with 32.26% of the overall percentage, followed by agricultural (23.45%), power, water, communication utilities (8.94%), residential (8.52%), and commercial (6.88%) uses.

In Link Road 1, the dominant land use within the 40-m buffer zone (20 m on each side) is for public roads and easements, mainly local roads (94.73%). While Link Roads 2 and 3 are dominated by forest (60.91%) and agricultural (87.64%) land use.

These data imply that the impact on the agricultural areas of the affected municipalities and cities in the Main Corridor and Link Road 1 is lesser compared to the cases of Link Road 2 and 3, since the existing land use in the Main Corridor and Link Road 1 is dominated by public roads and easements.

## 4.2.1.1 Main Corridor

The whole segment of the Main Corridor of the MTCIP covers a total of 1,508.59 ha of RROW land area. It is distributed into 19 land use classes, with the largest fraction falling within the land use zone of public roads and easements at 32.26% (486.60 ha). This is followed by agricultural land use with 23.45% (353.78 ha), utilities with 8.94% (134.81 ha), residential/settlement/resettlement/socialized housing with 8.52% (128.47 ha), and commercial with 6.88% (103.72 ha). Other land use classes are forest, mixed urban, tourism, water body/floodway, agro-forestry, agro-industrial, conservation area/greenbelt/green buffer, open space, institutional, parks/tree parks/recreation/playground, industrial, special use/planned unit development, quarry, and cemetery in decreasing order of land area (**Table 4-1**).

Category	Area, ha	Percentage
Residential/ settlement/ resettlement/ socialized housing	128.47	8.52%
Agricultural	353.78	23.45%
Agro-industrial	25.86	1.71%
Agro-forestry	33.63	2.23%
Commercial	103.72	6.88%
Mixed urban	39.32	2.61%
Public road/easement	486.60	32.26%
Forest	72.05	4.78%
Conservation area/ greenbelt/ green buffer	14.87	0.99%
Tourism	37.35	2.48%
Institutional	11.33	0.75%
Industrial	6.48	0.43%
Parks/ tree parks/ recreation/ playground	8.48	0.56%
Water body/ floodway	35.56	2.36%
Utilities	134.81	8.94%
Cemetery	0.21	0.01%
Open space	14.37	0.95%
Special use/ planned unit development	1.32	0.09%

## Table 4-1. Land Use within 40-Meter RROW of the Main Corridor

Category	Area, ha	Percentage
Quarry	0.38	0.03%
Total	1508.59	100%

Disaggregated into municipalities and cities, the land use that is predominant in the Main Corridor section falling within the jurisdiction of Cagayan de Oro City is urban, which accounts for 39.3 ha of the total 50.52 ha of RROW within the city. The other land use is agricultural, comprising the remaining 11.2 ha (**Table 4-2** and **Figure 4-1**).

Table 4-2. Land Use of the Main Corridor within Cagaya	an de Oro City, Misamis Oriental
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Category	Area within the 40m RROW, ha
Urban Land Use	39.32
Agricultural	11.20
Total	50.52



Figure 4-1. Land Use Map of MTCIP – Cagayan de Oro City, Misamis Oriental

In Manolo Fortich, the total RROW area is 115.185 hectares within the 40-meter RROW. The most prevalent land use has already been allocated for road use at 82.3 ha, followed by commercial land use at 9.66 ha. Production forests within this municipality that fall within the Main Corridor RROW are 4.06 ha, with residential zones accounting for 1.73 ha (**Table 4-3** and **Figure 4-2**).

#### Table 4-3. Land use of the Main Corridor within Manolo Fortich, Bukidnon

Category	Area within the 40m RROW, ha
Agri-Industrial (Non-Plantation)	0.34
Agro-Forestry	0.01
Buffer Zone	0.05
Commercial	0.11
Easement	0.13
Greenbelt Zone	0.37
Industrial	0.45
Inland Water	0.99
Institutional	0.99
Open Space	1.04
Production Agriculture	1.73
Production Forest	4.06
Residential	9.66
Road	12.96
Tourism	82.30
Total	115.19



Figure 4-2. Land Use Map of MTCIP – Manolo Fortich

In Sumilao, the total RROW area is about 42.13 ha, which is subdivided into infrastructural roads at 21.54 ha and parks and recreation at 7.37 ha. The residential land use classification only covers 6.06 ha of the total RROW area of the MTCIP in this municipality (Table 4-4 and Figure 4-3).

Category	Area within the 40m RROW, ha
Agri-Industrial	4.22
Commercial	0.77
General Institutional Zone	1.41
Industrial	0.76
Infra Roads	21.54
Parks and Recreation	7.37
Residential	6.06
Total	42.13

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Figure 4-3. Land Use Map of MTCIP – Sumilao

In Malaybalay City, the total RROW is 139.63 ha. The largest is utilized for roads at 130.54 ha, followed by commercial uses, which cover 5.65 ha (Table 4-5 and Figure 4-4).

Fable 4-5. Land use of the Main Corridor within Malaybalay, Bukidnon		
Category	Area within the 40m RROW, ha	
Agricultural Lands (Production)	0.48	
Cemetery	0.21	
Commercial	5.65	
Institutional	0.54	
Parks/Playground	0.72	
Proposed Road	0.51	
Residential (General)	0.35	

Category	Area within the 40m RROW, ha
River	0.36
Riverbank Allowance	0.05
Road	130.54
Special Institution	0.13
Utilities	0.08
Total	139.63



Figure 4-4. Land Use Map of MTCIP- Malaybalay City

In the City of Valencia, the whole RROW area, with a total of 57.55 ha, is already allocated for roads as its land use classification. No other classification falls within the 40-meter RROW zone. **Figure 4-5** shows the extent of the RROW classification within the jurisdiction of this city.



Figure 4-5. Land Use Map of MTCIP - Valencia City

In the Municipality of Maramag, the MTCIP RROW, with a total area of 102.12 ha, falls within 7 land use classifications. The majority is within Infrastructure/Utilities, Transportation, and Services (58.65 ha), followed by Settlement Area (24.77 ha), Agricultural Production (14.02 ha), Agricultural Protection (1.94 ha), Forest Production (1.45 ha), and Easement and Tourism with 0.589 and 0.681, respectively (Table 4-6 and **Figure 4-6**).

Category	Area within the 40m RROW, ha
Agricultural Production	14.02
Agricultural Protection	1.94
Easement	0.59
Forest Production	1.45
Infrastructure/Utilities, Transportation, and Services	58.65
Settlement	24.78
Tourism	0.68
Total	102.12

Fable 4-6. Land Use of Ma	n Corridor withir	Maramag,	Bukidnon
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Figure 4-6. Land Use Map of MTCIP - Maramag

Passing through Davao City, the MTCIP covers a total of 415.67 ha of RROW land. This is covered by a total of twenty three (23) land uses with the largest being major commercial use at 79.33 ha followed by tourism development use with 35.63 ha and floodway mitigation zone covering 34.66 ha (Table 4-7 and **Figure 4-5**).

Category	Area within the 40m RROW, ha
Agricultural non-Tillage	119.12
Agro-Industrial	0.29
Conservation	14.72
Floodway Mitigation	34.66
Heavy Industrial	0.42
High Density Residential	0.14
Infrastructure/Utilities	15.05
Institution	5.48
Landslide Mitigation	14.07
Light Industrial	3.02
Major Commercial	79.33
Marginal	21.11
Medium Density Residential	30.41
Medium Industrial	0.49
Minor Commercial	3.19
Open Space	0.24

Table 4-7. Land use of Main Corridor within Davao City, Davao del Sur

Category	Area within the 40m RROW, ha
Parks and Recreation	0.40
Planned Unit Development	0.07
Prime Agricultural	24.38
Rural Settlement Area	12.73
Socialized Housing	0.52
Special Use	0.21
Tourism Development	35.63
Total	415.67



Figure 4-7. Land Use Map of MTCIP - Davao City

In the Impasug-ong area, the RROW is composed mostly of infrastructure land use classification at 19.089 ha, followed by agri-industrial at 0.601 ha. The remaining land use out of the total 20.152 ha of RROW land area is distributed to forest and production forest, agricultural production, residential, commercial, and buffer land uses, in decreasing order (**Table 4-8** and **Figure 4-6**).

Table 4-0. Land Use of the Main Corndor Within Impasug-ong, Bukidhon	
Category	Area within the 40m RROW, ha
Buffer	0.002
Agriculture (Production)	0.149
Forest and Forest Land (Production)	0.294
Residential	0.016

Table 4-8. Land Use of the Main	Corridor within I	mpasug-ong, Bukidnon
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Category	Area within the 40m RROW, ha		
Agri-Industrial	0.601		
Commercial	0.001		
Infrastructure	19.089		
Total	20.152		



Figure 4-8. Land Use Map of MTCIP - Impasug-Ong

The total RROW area within the jurisdiction of Panabo City is 31.30 ha, which is classified into eleven (11) land classes. The largest of which is general commercial, followed by road and commercial - 2 (Table 4-9 and Figure 4-9).

Category	Area within the 40m RROW, ha	
Agri-Industrial Zone	0.03	
Buffer/Greenbelt Zone	0.01	
Commercial - 2 (C-2) Zone	3.28	
General Commercial Zone	15.12	
General Institutional Zone	0.48	
General Residential Zone	0.08	
Industrial - 1 (I-1) Zone	0.27	
Residential - 1 (R-1) Zone	0.05	
Rivers	0.04	
Road	11.80	

Table 4-9, Lan	nd Use of the	Main Corridor	within Panabo Ci	ty. Davao del Norte
				ty, Duruo uoi nonto
Category	Area within the 40m RROW, ha			
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Utilities, Transportation and Services Zone	0.14			
Total	31.30			



Figure 4-9. Land Use Map of MTCIP - Panabo City

Based on the existing Digos City Land Use Plan (2020), the RROW along the Main Corridor has been classified as primarily agricultural, followed by mostly residential lands at 17.99 ha and 10.38 ha, respectively, out of the total 38.02 ha of RROW land area (**Table 4-10** and **Figure 4-10**).

Category	Area within the 40m RROW, ha
Residential/ settlement/ resettlement/ socialized housing	10.38
Agricultural	17.99
Commercial	1.55
Tourism	1.57
Institutional	4.69
Grassland	1.84
TOTAL	38.02

Table 4-10. Land use of the Main Corridor within Digos City, Davao del Sur



Figure 4-10. Land Use Map of MTCIP - Digos City

The land use within the RROW area in the Municipality of Malungon is dominated by agricultural production. It spans up to 137.58 ha (**Table 4-11** and **Figure 4-11**)

Table 4-11. Land U	se of the Main Co	rridor within Malungon,	Sarangani

Category	Area within the 40 RROW (Ha.)
Production Agriculture	137.58
TOTAL	137.58





Figure 4-11. Land Use Map of MTCIP - Malungon

The extent of the 40-meter RROW in General Santos City has a total land area of 113.57 hectares. This is dominated by infrastructure and utilities at 76.07 ha, followed by the production forest at 18.59 ha. The residential, commercial, and agricultural categories follow the aforementioned categories, having 5.98 ha, 5.12 ha, and 3.08 ha, respectively (Table 4-12 and Figure 4-12).

Category	Area within the 40m Buffer Zone (Ha.)
Agricultural	3.08
Quarry	0.38
Commercial	5.12
Institutional	2.59
Infrastructure/Utilities	76.07
Residential	5.98
Production Forest (18-30% slope northern)	18.59
River & Creeks	0.11
Industrial	1.66
Total	113.57

Table 4-12, Land	use of the Main	Corridor within	General Santos	s City, Sarangani
			Schora Sanco	, only, our unguin





Figure 4-12. Land Use Map of MTCIP - General Santos City

## 4.2.1.2 <u>Link Roads</u>

The Link Roads' RROW was obtained within the 20-m RROW zone. In Link Road 1, a total of 20.15 ha comprises the RROW, with the largest already zoned as a public road or easement at 19.09 ha and the rest distributed to agro-industrial, agro-forestry, agricultural, conservation area, greenbelt, green buffer, commercial and residential, settlement, resettlement, and socialized housing in decreasing land area (**Table 4-13** and **Figure 4-6**).

Category	Area, ha	Percentage
Residential/ settlement/ resettlement/ socialized housing	0.02	0.08%
Agricultural	0.15	0.74%
Agro-industrial	0.60	2.98%
Agro-forestry	0.29	1.46%
Commercial	0.00	0.01%
Public road/easement	19.09	94.73%
Conservation area/ greenbelt/ green buffer	0.00	0.01%
Total	20.15	100.00%

#### Table 4-13. Land Use in Link Road 1

The RROW in Link Road 2 totals approximately 114.62 ha, with the dominant land use classification being agricultural, which covers more than 50%, followed by commercial at 16.05%. Other land classes within the RROW area are residential/settlement/resettlement/socialized housing, agro-industrial, water body/floodway, utilities, industrial, institutional, conservation area/greenbelt/green buffer, forest, and public road/easement, in increasing order (**Table 4-14**, **Figure 4-5**, and **Figure 4-9**)

#### Table 4-14. Land use in Link Road 2

Category	Area, ha	Percentage
Residential/ settlement/ resettlement/ socialized housing	10.55	9.21%
Agricultural	63.47	55.37%
Agro-industrial	0.03	0.02%
Commercial	18.40	16.05%
Public road/easement	11.80	10.30%
Forest	6.35	5.54%
Conservation area/ greenbelt/ green buffer	3.10	2.70%
Institutional	0.48	0.42%
Industrial	0.27	0.23%
Water body/ floodway	0.04	0.04%
Utilities	0.14	0.12%
Total	114.62	100.00%

The RROW in Link Road 3 has a total area of 62.7 hectares and is divided into eight (8) land use classes. The largest fraction is classified into forest land use with 28.16 ha which accounts for 44.91% of the total RROW area. This is followed by agricultural with 26.79 ha or 42.73% of the total RROW land. Details of the land use characteristics of Link Road 3 are presented in Table 4-15.

#### Table 4-15. Land us in RROW for Link Road 3

Category		Percentage
	ha	
Residential/ settlement/ resettlement/ socialized housing	0.02	0.04%
Agricultural	26.79	42.73%
Agro-forestry	3.33	5.30%
Commercial	1.05	1.68%
Forest	28.16	44.91%
Institutional	0.24	0.38%
Grassland	1.28	2.04%
Landfill, Dump Site, Recycling Site, Materials Recovery Facility	1.84	2.93%
Total	62.70	100.00%

### 4.2.2 Geology

The geology of the areas traversed by the MTCIP is underlain by variable lithologies that are predominantly igneous but also include a significant number of metamorphic rocks and sedimentary suites. The underlying geology along the alignment may influence the stability of the Project which may pose risks and impact the overall safety of the road. The occurrence of "weak", poorly consolidated, and/or significantly fractured and sheared lithologies may lead to landslides and rockfalls. The presence of limestones with significant dissolution features (karst) presents sinkhole hazards, which could potentially cause structural damage to the road infrastructure on the one hand and cause water quality problems on the other.

In Region X, the northern side of Sayre Highway mostly covers volcanic rocks, chiefly composed of pyroclastic eject and other materials found at the base of volcanic domes. This is similar to the middle portions of this highway. On the other hand, the southern side of this highway straddles numerous rocks, including dacite and andesite flows (**Plate 4-1**), marine and terrestrial sediments (**Plate 4-2**), which are sometimes associated with limestones, and a short extension towards the south covering rocks of shelf marine origins, mostly wackes, shales, and limestones. Link Road 1 runs through an area completely underlain by pyroclastics, like the northern Sayre Highway (**Figure 4-13**).



Plate 4-1. Sheared and Fractured Andesites KM 1460+255



Plate 4-2. Clastic Sedimentary Rocks KM 1468 +178



Figure 4-13. Geologic Map of Region X

In Region XI, the northern part of the alignment passes through a wide region of marine clastic rocks with some pyroclastic and tuffaceous sedimentary facies (**Figure 4-14**). This is within the Davao-Bukidnon Road. The southern extension of the latter runs through areas with chiefly volcanic and pyroclastic rocks sourced from the proximal Mt. Apo complex. Davao-Cotabato Road, which follows the coastal region, is covered with recent Quaternary alluvial deposits, the same as the northern part of Digos-Makar Road.



Figure 4-14. Geologic Map of Region XI



Plate 4-3. Tuffaceous Sandstone on Link Road 2



Plate 4-4. Andesites with Characteristic Spheroidal Weathering at KM 1648

Link Road 3 covers areas with gravel deposits, marine clastics, and tuffaceous sediments (**Plate 4-5**), wackes and shales with some limestone, a short stretch underlain by volcanic flows of andesites and basalts, and finally Quaternary alluvial deposits at their terminus along the coastal plains (**Plate 4-6**).

The southern portion of the Digos-Makar Road of the Main Corridor within Region XII lies on top of rock units that are mostly Quaternary alluvial deposits on its southern extension. However, upland areas along this segment are underlain by marine and terrestrial sedimentary rock, which includes limestones and reworked tuff (**Figure 4-15**).



Plate 4-5. Tuff Overlain by Terrace Gravel Deposits at KK 1635



Plate 4-6. Quaternary Alluvial Deposits Along Flood Plain Near KM 1613



Figure 4-15. Geologic Map of Region XII

## 4.2.3 Terrain/Topography

The terrain along the Main Corridor and the Link Roads is presented herewith in reference to the topography of Regions X, XI, and XII. The topographic characteristics of the Project alignment will impact road safety conditions, as high or steep slope gradients may pose challenges to vehicles, affecting driver control and stability, which can be aggravated by inclement weather. The terrain is also a significant factor in designing bends and curves on roads, where sharp curves will reduce driver visibility and reaction times. In addition, surface drainage is greatly controlled by relative elevation, where depressed areas may accumulate water that may lead to hydroplaning, thereby reducing vehicular wheel traction. Furthermore, mountainous areas may require significant earth movement in order to attain acceptable road gradients, which will result in significant environmental impacts.

Geologically, Region X is a combination of plains, rolling hills, and mountains. Elevation along Sayre Highway, which starts at Puerto, Cagayan de Oro City, ranges from 142 m to 251 m and rises up to 622 m in Malaybalay City. About 60% of the city's area has above 30% slope, characterized by steep hills, mountains, and cliff-like streamside. About 25% are level, gently sloping, and undulating. While Valencia is 0-3% level to nearly level, Manolo Fortich has steep to very steep slopes, particularly at Brgy. San Vicente (**Figure 4-16**).

At Link Road 1, terrain at Brgy. Kapitan Bayong is level to nearly level, gently sloping to undulating at Brgy. Cawayan, then finally undulating to rolling at Brgy. Kibenton as it approaches the sloping upward entrance road to Mt. Kitanglad (**Plate 4-7**).



Plate 4-7. Road on the Right Side Leads to the Mt. Kitanglad Range Natural Park



Figure 4-16. Terrain Map of Region X

The terrain of Region XI consists of flat, rolling, hilly, and mountainous portions, which are evenly distributed throughout the area. Davao City, which is traversed by the Main Corridor and where part of Link Road 2 is located, is hilly in the west (the Marilog district) and slopes down to the southeastern shore. Mount Apo, the highest peak in the Philippines, is located at the city's southwestern tip. The topography of Link Road 2, starting at the Marilog district, is rolling to moderately steep to very steep. Whereas from Davao City to Panabo City, it is gently sloping to level to nearly level (**Figure 4-17**).



Figure 4-17. Terrain Map of Region XI

Region XII's terrain varies from flat, fertile plains to an irregular landscape of wide valleys, scattered hills, and extensive mountain ranges.

Mountains and rolling hills dominate the landscape of Link Road 3 and the Main Corridor, passing through the municipalities of Sta. Maria in Davao Occidental and Malungon in Sarangani Province. Both provinces' topographic characteristics are attributed to the presence of the Alip Range, Daguma Range, Mt. Parker, and Mt. Matutum (**Figure 4-18**). The geology of the areas traversed by the MTCIP is underlain by variable lithologies from predominantly igneous but also include a significant number of metamorphic rocks and sedimentary suites as discussed in Section 4.2.2.





Figure 4-18. Terrain Map of Region XII

# 4.2.4 Pedology

The MTCIP passes through the whole length of Mindanao Island from north to south. It runs through areas of different types of underlying soil. The type of soil along the alignment will have a significant impact, depending on its different physical characteristics. It can influence foundation stability where soils with very high clay content can experience swelling during wet conditions and shrinking on dry spells, which may lead to road cracking and deformation. Drainage may also be affected by the type of underlying soil, as the permeability of this layer influences how well-drained the soils are in the road section, reducing the risk of hydroplaning. Also, the type of soil will influence the soil erosion potential of the area, which can lead to increased sediment content in the surrounding surface waters.

In Region X, the northern Sayre Highway of the Main Corridor mostly overlays clay soils, with a short portion along the northern edge falling within clay loam and complex soil areas. While the middle and southern Sayre Highways also lie above undifferentiated soils. Link Road 1 is



#### initially underlain by clay soils but then enters a section of loamy soils (Figure 4-19).

Figure 4-19. Soil Map of Region X

In Region XI, the MTCIP crosses areas with undifferentiated soils and clay along Davao-Bukidnon Road, then eventually enters an area with silty clay loam soils and clay loams in Davao-Cotabato Road and Northern Digos-Makar Road, in Region XII. Meanwhile, southern Digos-Makar Road passes through regions of loam and clay loam soils. For Link Road 2, it is underlain by at least five types of soils, including undifferentiated soil, sandy clay loam, clay loam, and silty clay loam soils. Whereas Link Road 3 falls within clay loam, silty clay loam, and loam soils (**Figure 4-20** and **Figure 4-21**).



Figure 4-20. Soil Map of Region XI



Figure 4-21. Soil Map of Region XII

## 4.2.5 Natural Hazards

#### 4.2.5.1 Seismic Hazards

The Philippines is a country situated in a seismically active region where several plate boundaries converge, including the Philippine Sea Plate, Philippine Mobile Belt, Sunda Plate, and the Eurasian Plate. Tectonic readjustment along these areas results in minor as well as major seismic activities that result in devastation, particularly to rigid infrastructure.

Seismic hazards for highways include the risks and potential damage to the actual road network as well as associated facilities such as drainages, flood control, and slope protection structures. The chief seismic hazards that may affect the MTCIP are ground shaking and ground rupture, considering the different fault systems that transect Regions X, XI, and XII.

The alignment of the MTCIP traverses a few active and potentially active faults within Region X, specifically the Sayre Highway of the Main Corridor (**Figure 4-22**). Along the northern Sayre Highway, it crosses the approximate trace of the potentially active Dicklum Fault within the Municipality of Manolo Fortich in the vicinity of KM 1444. Middle Sayre Highway also transects another potentially active fault, the Valencia Fault, around the areas of KM 1504 and KM 1548 within the vicinity of Barangay Sumpong and Barangay Casisang. The southern extension of this segment is also cut by the active South Bukidnon Fault at approximately KM 1560. Moreover, the southern Sayre Highway runs through another splay of the aforementioned fault system within the area of KM 1564.

Within Region XI, Davao-Bukidnon Road, Davao-Cotabato Road, and Digos-Makar Road of the Main Corridor, as well as Link Roads 2 and 3, cross PHIVOLCS-identified fault traces (Figure 4-23). Along the Main Corridor, Davao-Bukidnon Road passes through approximate traces of the Central Davao Fault System at KM 1673 (Tamugan Fault), KM 1673 (Lacson Fault), KM 1683, KM 1687-1688, and KM 1692. Davao-Cotabato Road follows the approximate trace of the Lacson Fault from KM 1528 to KM 1535. The municipalities of Malalag and Sta. Maria is cut by the northwest-southeast trending Tangbulan Fault, which also intersects northern Digos-Makar Road at KM 1588.

On the other hand, Link Road 2 passes through an approximate trace of the active Central Davao Fault System at KM 1514+644 and KM 1513+131. The southern extension of the Tangbulan Fault is also transected by Link Road 3 around the geographic coordinates 6.4768697°N, 125.4553106°E.

The MTCIP extension within Region XII consists of a portion of Link Road 3 and the southern Dikos-Makar of the Main Corridor (**Figure 4-24**). Based on the alignments, Southern Digos-Makar Road will cross the Makilala-Malungon Fault of the Cotabato Fault System at KM 1619. While the western side of Link Road 3 will not be susceptible to ground rupture.



Figure 4-22. Active Faults Map of Region X



Figure 4-23. Active Faults Map of Region XI



Figure 4-24. Active Faults Map of Region XII

#### Ground Shaking/Earthquake

Another critical risk posed by faults in infrastructure is ground shaking/earthquake. Events such as earthquakes that originate due to kinematic readjustment along these fault lines result in the massive release of seismic energy that results in extreme vibrations within rigid concrete structures and others. Should the vibrations exceed the capacity of these stiff structures, cracks and other structural failures may occur, which may eventually lead to unsafe conditions or collapse.

Based on the peak ground acceleration map published by PHIVOLCS, the MTCIP will likely experience shaking ranging from 0.3g to 0.5g where the foundations are anchored on rock sites (**Figure 4-25**). While sections of the highway and bridges founded on stiff soils will likely experience ground shaking ranging from 0.3g to 0.5g at different parts of the alignment (**Figure 4-26**). In general, the southern extension of the MTCIP experiences worse ground shaking compared to the northern part.

In addition, ground shaking scenario maps have been generated by PHIVOLCS to simulate the horizontal ground motion that will be experienced given a simulated earthquake scenario. Earthquake scenarios for the most probable generator within the central Mindanao region include the Central Mindanao Fault, Davao River Fault, Lanao Fault System, and Mindanao Fault, which were modeled with their design magnitudes of M7.6, M7.1, M6.9, and M7.3, respectively (*see* DDOA-MTCIP Comprehensive Data Collection Report, *Appendix 24: Earthquake Scenarios for the Most Probable Generator within Central Mindanao*). Based on these scenario maps, sections of the MTCIP within Region X will likely experience earthquake intensities of 5–6 during an event in the Lanao Fault and Mindanao Fault, while they will have higher intensities of 6–8 if the event occurs at the Davao River Fault or the Central Mindanao

#### Fault.

Within Region XI, the MTCIP alignment will be subjected to earthquakes of 7-8 intensity based on the PHIVOLCS Earthquake Intensity Scale (PEIS) should the modeled event occur along the Davao River Fault or the Central Mindanao Fault. If the event is in the Lanao Fault System or Mindanao Fault, the intensities to be expected range from 3 to 4. Meanwhile, the extension of the MTCIP alignment within Region XII will experience intensities ranging from 3 to 4 in the event that any of the design earthquakes occur on any of the four fault systems.



Figure 4-25. Peak Ground Acceleration Map on Rock Sites



Figure 4-26. Peak Ground Acceleration Map on Stiff Soils

## 4.2.5.2 Sinkhole Collapse

Field inspection has identified a section of the MC in Kitaotao, Bukidnon (7°33'10.64"N, 125°13'14.44"E) that is underlain by limestone and exhibits ground subsidence leading to cracks and uneven surface on this road segment. This may be due to the existence of sinkholes in the area as the surrounding exposures shows apparent solution cavities and minor caves. Examination of the surface runoff flow path shows that the waterflow leads into the base of the road segment. Sinkhole collapse pose significant risk in road projects which may lead to structural damage and instability under roads and bridges. Seismic events may trigger collapse of the roof of existing solution cavity resulting to sinkhole formation.

## 4.2.5.3 Liquefaction

The presence of numerous faults crisscrossing the MTCIP makes it prone to liquefaction in some sections of the highway. This phenomenon occurs due to the presence of significant soil moisture and pore spaces within granular soils, which results in a loss of strength and stiffness during significant shaking, such as an earthquake event.

Based on the liquefaction susceptibility map of the Philippines published by PHIVOLCS, the MTCIP runs across several areas that are prone to liquefaction. In Region X, the northernmost tip of the MTCIP is prone to liquefaction, as is the middle portion within the Municipality of Maramag, Bukidnon, at around KM 1525 and KM 1542+560 until KM 1544. In the southern part, another portion of the highway lies above liquefiable soils from KM 1616 until KM 1620. Link Road 1 does not intersect any areas that might be prone to liquefaction (**Figure 4-27**).

Within Region XI, there is a significant portion of the highway that runs through liquefactionprone areas. This is primarily due to the geomorphological and geological characteristics of the coastal plains that comprise most of the areas where the alignment passes through in this region. A portion of Davao-Bukidnon Road from KM 1682 +600 until KM 1694 lies on ground that is highly susceptible to liquefaction. Another long section that is within a liquefiable area is from KM 1511 to KM 1587, almost the whole of Davao-Cotabato Road. This is a relatively long section of the road that roughly follows the coastline of southern Mindanao. These conditions are similar to the eastern terminus of Link Road 2, which is also prone to liquefaction from geographic coordinates 125.6386866°E 7.2996421°N until its end. Link Road 3 does not cross any area that may have liquefaction (**Figure 4-28**).

The extension of the highway into the jurisdiction of Region XI runs through mostly liquefaction-safe areas except towards the southernmost portion of the highway, Southern Digos-Makar Road. From KM 1639 +118 until the end at KM 1655, this section of the alignment is prone to liquefaction. It can be noted that this section is near the coast and within the southern extension of the Cotabato Basin, which is mostly underlain by ash deposits (**Figure 4-29**).



Figure 4-27. Liquefaction Susceptibility Map for Region X



Figure 4-28. Liquefaction Susceptibility Map for Region XI



Figure 4-29. Liquefaction Susceptibility Map of Region XII

### 4.2.5.4 Tsunami Hazard

Tsunamis are triggered by submarine earthquakes and landslides that result in a series of large waves. These waves, when reaching the shoreline, can cause devastating effects on coastal communities and infrastructure, especially along shallow coastlines.

The coastal areas of the Philippines are prone to tsunamis from various sources, and the MTCIP alignment that runs within this near-coast region will likely be affected by such events. This includes the Northern Sayre Highway, Davao-Cotabato Road, and Southern Digos-Makar Road of the Main Corridor (**Figure 4-30**, **Figure 4-31**, and **Figure 4-32**). Tsunamis generated from trench-related local events, submarine landslides, offshore faults, and distant tsunamis can affect this section.



Figure 4-30. Tsunami Prone Areas in Region X



Figure 4-31. Tsunami Prone Areas in Region XI



Figure 4-32. Tsunami Prone Areas in Region XII

#### 4.2.5.5 Volcanic Hazard

There are two active volcanoes and one potentially active volcanic center proximal to the alignment of the MTCIP. These are Mt. Calayo (Musuan) in Bukidnon and Mt. Matutum in General Santos City. The potentially active center of Mt. Apo is located on the western side of Davao City. Of the three, the closest to MTCIP is Mt. Calayo, which is less than 1 km from the road along MTCIP Middle Sayre Highway (**Figure 4-33**). This volcanic center has no recorded eruption; however, anecdotal accounts report a phreatic eruption around 1886–87, and there was a recorded earthquake swarm in 1976. Mt. Apo is approximately 22.4 km from the closest segment of the MTCIP, Davao-Cotabato Road, and is believed to be potentially active, although there is no eruption on record (**Figure 4-34**). The third volcanic center is the active Mt. Matutum, which is about 22 km from the closest Southern Digos-Makar Road. The last known eruption of this volcanic center was on March 7, 1911 (**Figure 4-35**).

Based on the distance of the MTCIP from these volcanic centers in conjunction with the level of activity in the volcanoes, the primary hazard that poses risks to the project is ashfall from Mt. Matutum and Mt. Apo.



Figure 4-33. Active Volcanic Centers in Region X



Figure 4-34. Potentially Active Volcanic Centers in Region XI



Figure 4-35. Active Volcanic Centers in Region XII

### 4.2.5.6 Storm Surge

Storm surges are sudden rises in sea level due to severe weather events like typhoons and very strong storms. This often poses very dangerous risks to areas along the coast, which may cause coastal and inland flooding as well as coastal erosion, infrastructure damage, and loss of life.

Storm surge-prone areas along the MTCIP alignment are found along the middle part of Davao-Cotabato Road of the Main Corridor. This section of the alignment is found very close to the coastline, starting from KM 1540 until KM 1548 within the Municipality of Sta. Cruz, Davao del Sur (**Figure 4-36**).



Figure 4-36. Storm Surge Prone Areas Along the MTCIP

## 4.2.5.7 <u>Flooding</u>

Flooding is a hazard that affects most of the Philippines and is one that Philippine highway are commonly subjected to. This is because of the relatively high rainfall rate within the country, the topographic configuration of the terrain, which concentrates storm runoff into highway routes, the size and characteristics of natural drainage channels like creeks and rivers that cross the highways, and other factors that are related to anthropogenic activities such as land use, infrastructure development, etc.

The MTCIP runs through the length of Mindanao Island, crossing highly variable terrain and inevitably through areas that are prone to water accumulation, ponding, and overflow. In addition, sections of the highway that are proximal to the coastline may experience inundation due to rising sea levels brought about by climate change. In this context, improving the resilience of this road network against the adverse effects of changing climate, such as shifting precipitation patterns, more frequent and increasing intensity storms, and rising sea levels, is

#### a priority.

Within Region X, there are a few sections of the highway that are identified as susceptible to flooding. These include the start of the Northern Sayre Highway, part of the Middle Sayre Highway, and portions of the Southern Sayre Highway (**Figure 4-37**). Floods within KM 1425 until KM 1425+900 are primarily caused by drainage overflow. This region is at the coast, and the drainage line discharges into the sea. During high tides, the outward flow of the canals and culverts is not as effective. The Middle Sayre Highway, from KM 1524 to KM 1526, is highly prone to flooding due to the overflow of the Manupali River. However, field validation shows that the grade of the highway is significantly higher than the surrounding areas and is not reached by flood waters. Along the Southern Sayre Highway, flood-prone areas are at KM 1531 and KM 1537. Stream and river crossings along the alignment are also susceptible to flooding, but floodwaters do not reach the road grade. Several areas are also flooded due to the blockage of existing drainage ditches with debris, eroded sediments, vegetation carried by runoff, and anthropogenic waste.

Flooding in Region XI along the MTCIP occurs in areas near the coastal flats of Sta. Cruz, Digos City, Padada, Hagonoy, and Sulop. These areas are along Davao-Cotabato Road and Northern Digos-Makar Road. Although some portions of Davao-Bukidnon Road fall within areas mapped as flood-prone, field confirmation reveals that the flooding does not reach the highway level. Reported flooding in Tugbok, Davao City, has been resolved after the construction of levees and dikes along the riverbanks.

Flooding along Davao-Cotabato Road of the Main Corridor is due to various conditions, including lack of or insufficient drainage, blocked or clogged drainage, naturally lower elevation road grade, overflow of surrounding rivers, and an extreme volume of unchanneled surface runoff upslope of the alignment (Figure 4-38). Flooding within the Cebulan River at KM 1537, which reached the road grade but did not overtop the bridge, was caused by extreme discharge together with high debris and sediment loads, which significantly reduced the efficiency of the main channel. This condition led to an overflow of water along the riverbanks. Another flooded portion was identified at KM 1544 due to the lowered road elevation and the lack of cross drains that will allow stormwater to flow across opposing lanes that are divided by a concrete island in the middle. In the central area of Sta. Cruz, from KM 1548 until KM 1552, the municipality is particularly susceptible to flooding. This is mainly due to the numerous natural surface drainages that flow downslope in a parallel linear configuration from the foot slopes of Mt. Apo. This natural flow direction is transected by the alignment at almost 90° angles, and the road grade abruptly cuts off the natural flow, resulting in higher flood heights on the upslope side of the highway. At KM 1549 +500, a box culvert regularly overflows due to insufficient size as well as the configuration of the channel leading to it. The abruptly curving channel shape does not encourage uninterrupted flow into the box culvert crossing the highway (Plate 4-8).

The northern part of Southern Digos-Makar Road from KM 1565 until KM 1585 also falls within the flood-prone zone. This is primarily due to the general topography of the region. However, the highway grade is significantly higher than the surrounding area and is not overtopped by floodwaters. For Link Road 2, flooding is confined within the low coastal flats of the western extension of Panabo City. This greater region of Panabo and its adjacent municipalities cover the floodplain of the Lasang River, the Likanan River, and others, which makes it highly susceptible to flooding. Link Road 3, on the other hand, does not fall within a well-defined flood-prone area, but field inspection shows that the segment of the road is within the lower elevation plains of Sta. Maria closely parallels the shallow channel of surface drainage. This results in frequent diversion of surface runoff into the current road alignment (**Plate 4-9**).

In Region XII, a portion of Southern Digos-Makar Road falls within a flood susceptibility area, but based on the field inspection, flood levels do not reach the level of the road pavement (**Figure 4-39**). Flood susceptibility ratings for these sections are mostly low, which implies expected flood heights of less than 0.5 m.



Plate 4-8. Regularly Flooded Portion of Davao-Cotabato Road Main Corridor at KM 1549



Plate 4-9. Portion of Link Road 3 in Sta. Maria, Davao del Sur (surface runoff is regularly diverted into the roadway)



Figure 4-37. Flood Susceptibility Map of Region X



Figure 4-38. Flood Susceptibility Map of Region XI



Figure 4-39. Flood Susceptibility Map of Region XII

As a summary, the following table presents the total length of the MTCIP that is likely to be affected by flooding based on the DENR-MBG data and as confirmed by field inspections. Based on this, Davao-Cotabato Road has the longest area that is susceptible to flooding, while Segment 2 will not likely be affected by severe floods (**Table 4-16**).

MTCIP	Length, km
Northern Sayre Highway	2.3
Segment 2	0.0
Middle Sayre Highway	8.2
Southern Sayre Highway	3.9
Davao-Bukidnon Road	5.8
Davao-Cotabato Road	10.8
Northern Digos-Makar Road	8.8
Southern Digos-Makar Road	4.8
Link Road 2	4.8
Link Road 3	4.5

Table 4-16.	Length of MTCI	P Within Flood	Prone Areas

Another type of flooding that may affect the MTCIP is inundation due to sea level rise brought about by climate change. The Philippines in general, as an archipelago, is very susceptible to the dangers posed by the increasingly higher levels of the oceans around it. Sections of the MTCIP that are proximal to the coastline are especially vulnerable to these hazards (**Figure 4-40**, **Figure 4-41**, and **Figure 4-42**). These include parts of the Main Corridor like the Northern Sayre Highway, Davao-Cotabato Road, and Northern Digos-Makar Road, which can be reached by ocean waters up to 0.1m during a 0.5m sea level rise. Although this may not seem

to be very critical at the moment, if this trend continues, excessive rises in sea level will eventually affect the MTCIP. Thus, it is prudent to prepare for worsening conditions within the alignment due to climate change. The affected sections of the MTCIP include KM 1425 and KM 1520 to KM 1579.



Figure 4-40. Sea Level Rise Susceptibility Map X



Figure 4-41. Sea Level Rise Susceptibility Map XI



Figure 4-42. Sea Level Rise Susceptibility Map XII

#### 4.2.5.8 Landslides

The Philippines, being an archipelagic country, is very vulnerable to the various impacts brought about by climate change. Considering the geology, topography, and climate of the country, the interaction between these three factors creates extreme conditions that will result in disastrous events. Although landslides are not directly affected by climate change, there is a growing number of studies that correlate changes brought about by the phenomenon, especially weather cycles, to the rising frequency and magnitude of landslides. This is mostly due to changes, oftentimes an increase, in rainfall linked to climate change, where the added moisture saturates slopes, leading to the rise of landslide risks and/or occurrences. Extreme weather conditions also aggravate the unstable conditions of the ground, triggering catastrophic mass movement.

The MTCIP alignment runs through areas with variable terrain, some stable and others very unstable. Based on the geohazard mapping undertaken by the Mines and Geosciences Bureau and confirmed by field inspections, several sections of the MTCIP fall within zones that are highly susceptible to landslides both for rain-induced and earthquake triggered landslide. In fact, field inspection reveals several occurrences of slope failure along the alignment as well as current activities by the DPWH to stabilize large landslide incidents.

Within Region X, the majority of the alignment falls within stable ground; however, several sections are also located within very high to highly susceptible areas to failure (**Figure 4-43**). Although some portions already have slope protections in place and others are currently under ongoing construction, there are some that are yet to be addressed. Along the Northern Sayre Highway, long stretches of road highly susceptible to landslides are found in KM 1441–1442, KM 1450–1454, KM 1457–1462, and KM 1464–1464 +700. The steep flanks of river crossings are also very prone to landslides.

This is the case for most river or stream crossings, especially those that have deeply incised channels. The same case can be seen in Segment 2 of the Main Corridor. The Middle Sayre Highway runs through mostly level to undulating terrain that is not very susceptible to failure. The Southern Sayre Highway is very similar except towards the southern end, starting from KM 1596, where the highway transects mountainous terrain that is high to very high risk for landslides. Several large active slope failures were noted along this section of the Southern Sayre Highway. Link Road 2 traverses relatively leveled terrain that is not prone to landslides or mass wasting. The only issue identified during the field inspection is that the lack of proper drainage and outfall results in accelerated erosion within the thick soil underlying the roads.


Figure 4-43. Landslide Susceptibility Map of Region X.



Plate 4-10. Drone Shot of Ongoing Works Along a Large Unstable Slope in KM 1453



Plate 4-11. Active Landslide Along a Winding Section Near KM 1598 +525



Plate 4-12. Beddings that are Daylighting with Respect to the Orientation of the Roadcut in KM 1592

In Region 11, the northern extensions of Davao-Bukidnon Road and Southern Digos-Makar Road fall within highly susceptible landslide areas, from KM 1621 to KM 1652 and from KM 1588, respectively. This is primarily due to the mountainous terrain that exhibits steep slopes as well as the sometimes fragmented and weathered nature of the underlying rocks (**Figure 4-44**). In some instances, roadcuts are oriented parallel to the bedding plane or fracture orientations of the bedrock, which pose high risks of failure from planar landslides. The southern portion of Davao-Bukidnon Road, the whole of Davao-Cotabato Road, and Northern

Digos-Makar Road fall largely within areas that are relatively safe from slope failure. For Link Road 2, the western half of the alignment runs through rough terrain that is underlain by sedimentary and tuffaceous deposits that are prone to failure. Most of Link Road 3 passes through highly rugged topography, with several landslide occurrences observed during the field inspection. The northeastern end section ultimately falls within the coastal areas of Sta. Maria, which is not susceptible to mass wasting.



Figure 4-44. Landslide Susceptibility Map of Region XI



Plate 4-13. Landslide Affecting the Road in Link Road 2 (125.3401021°E 7.2909774°N)



Plate 4-14. Landslide in Link Road 3 which Covered the Existing Logging Road (125.3710217°E 6.4231535°N)

The extension of Southern Digos-Makar Road within the area of Region XII passes through rolling terrain that eventually grades to the valley of General Santos City. Except for isolated sections on the western side, this segment is not as susceptible to mass wasting or landslides as the others (**Figure 4-45**).



Figure 4-45. Landslide Susceptibility Map of Region XII

In summary, **Table 4-17** presents the length of road sections within the different segments of the MTCIP. Davao-Bukidnon Road runs through the most landslide-prone areas, while

Segments 2 and 6 have the shortest landslide-prone alignment. Both Link Roads 2 and 3 have significant portions that are landslide-prone, while Link Road 1 does not cross areas that are high-risk for landslides.

MTCIP	Length, km
Northern Sayre Highway	15.9
Segment 2	0.1
Middle Sayre Highway	1.9
Southern Sayre Highway	19.2
Davao-Bukidnon Road	27.7
Davao-Cotabato Road	0.8
Northern Digos-Makar Road	4.1
Southern Digos-Makar Road	11.6
Link Road 2	26.4
Link Road 3	35.6

Table 4-17	Portion of	of MTCIP	that are	Prone to	l andslides
			that are		Lanasnacs

## 4.2.6 Terrestrial Ecology

### 4.2.6.1 Flora Assessment

Floral assessment includes identification and monitoring of ecosystems and habitats and inventory, identification, assessment, and monitoring of flora species in an area. The methodology used in the flora assessment is based on the Terrestrial Ecosystems Biodiversity and Assessment Monitoring Manual (DENR-BMB, 2017). The flora assessment locations are shown from **Figure 4-46** to **Figure 4-49**. The detailed methodology of flora assessment is provided in **Annex 14**.



Figure 4-46. Transect Map of Flora Assessment of Main Corridor



Figure 4-47. Transect map of Flora Assessment of Link Road 1





Figure 4-48. Transect map of Flora Assessment of Link Road 2



Figure 4-49. Transect map of Flora Assessment of Link Road 3

## Protected Area (PA) and Key Biodiversity Area (KBA)

Based on the Key Biodiversity Areas (KBA) of the DENR-BMB (2024), there are 13 key biodiversity areas within the 50-km buffer. **Figure 4-50** shows the map of the KBAs, particularly in Mindanao. Protected areas near the Main Corridor are Mt. Kalauayan-Mt. Kalauayan Complex, which is 20 km east; Mt. Kitanglad Range, which is 3 km of Link Road 1, Mt. Kalauayan-Mt. Kinabalian Complex is 20 km east of Main Corridor, Apo Natural Park is 16.1 km west in Sta Cruz, and 17.1 km west of Main Corridor is where the Mt. Kalatungan Mountains Range Park is located. Talicud Island and Mt. Sinaka are 13.1 km southeast and 3.7 km southwest of Davao City, respectively. In Santa Maria, along Link Road 3, 3.7 km north is where the Malalag Bay is situated, and 17 km southeast is where the Mt. Latian Complex is located. Along the Main Corridor, 14 km west of Malungon is Mt. Matutum Protected Landscape, while 18 km west of General Santos City is Mt. Busa-Kiamba. **Annex 14** presents that the link roads do not fall within the boundary of the Mt. Kitanglad Range Protected Area.



Figure 4-50. Biodiversity Area

## **Plant Diversity Assessment**

An assessment was conducted on the project area, and a total of 273 species were identified, belonging to 116 families of flora. The data shows that Link Road 1 has 1,521 individuals, Link Road 2 has 5,522 individuals, Link Road 3 has 2,178 individuals, and Main Corridor has 1,037 individuals.

In the Main Corridor, the most abundant species found was Yemane (*Gmelina arborea*), with 201 individuals, followed by Coconut (*Cocos nucifera*), with 110 individuals. The third most abundant species was Mahogany (*Sweitenia macrophylla*), with 103 individuals.

Link Road 1 had the highest number of Lanzones (*Lansium domesticum*) with 270 individuals, followed by Yemane (*Gmelina arborea*) with 263 individuals and Kupang (*Parkia timoriana*) with 169 individuals.

Link Road 2, which connects Panabo City, has a diverse range of species, including trees, grass, shrubs, and palms. The most common species in this area were Coconut (*Cocos nucifera*) with 611 individuals and Yemane (*Gmelina arborea*) with 524 individuals. Mahogany (*Sweitenia macrophylla*) was the third most abundant species, with 524 individuals.

Link Road 3, located in Sta. Maria, Davao Occidental – Malungon, Sarangani Province, had a total of 2,176 individuals. Mahogany (*Sweitenia macrophylla*) was the most abundant species, followed by Coconut (*Cocos nucifera*) and Yemane (*Gmelina arborea*), with the same number of individuals. The fourth most abundant species was Ipil-ipil, which is considered a pioneer species in the area.

#### Table 4-18. Summary Results for Plant Diversity Assessment

Parameters	Main Corridor	Link Road 1	Link Road 2	Link Road 3
Number of Species	52	53	99	69
Species Richness	0.12	1.53	1.67	2.08
Number of Families	23	25	39	29
Diversity Index (H')	2.96	0.947	0.689	0.423
Evenness Index	0.801	0.862	0.354	0.611

#### **Diversity and Evenness**

An effective way to measure the diversity of a species is by using the Shannon Diversity Index, which considers the frequency and rarity of the species within a community. The data collected based on the classification scheme developed by Fernando et al. (1998) indicates that the alignment falls between the categories of very low and highly diverse. To determine the importance of the plant community, diversity and evenness are being utilized. Diversity measures the abundance of the number of individuals, whereas species evenness measures the intensity of the closeness of the species in the area. As per the results, the Main Corridor shows the highest diversity index with H'=2.96 (moderate), whereas the link roads 1, 2, and 3 have a "very low" diversity with the values of H'= 0.947, H'= 0.689, H'= 0.423, and H'= 2.96. **Figure 4-51** shows the flora diversity and species richness and evenness.



Figure 4-51. Flora Diversity and Species Richness and Evenness

### **Density and Species Richness**

The term "species density" refers to the number of individuals from a specific area in a forest stand. On the other hand, "species richness" is the quantity of different species known for a particular group of organisms over a given period. Based on the data, it is evident that Link Road 2 has the highest abundance and richness of species. This is attributable to the fact that some parts of the area are still vegetated and considered secondary forests in the selected areas. The complete exposure of the canopy to sunlight allows for the permeation of the forest floor, thereby encouraging the growth of wildlings.

## Plant Form

The flora assessment of the project comprises palms, grass, shrubs, and trees, which help in identifying the structure of the whole flora community. As the table shows, the highest number of species is classified under trees with 99%, followed by palm, grass, and shrubs with a percentage of 0.13%, 0.03%, and 0.01%, respectively.

This trend often indicates that the areas assessed are commonly open and utilized, either for cultivation or roadside maintenance. It also indicates that the ecological succession of the area is at its earliest stages, viz., nudation to invasion. These stages are the points in ecological succession where aggregation and ecesis occur, leading to an increase in the number of species, given the prevailing conditions of the area. **Table 4-19** presents the plant forms in MTCIP.

#### Table 4-19. Plant Forms in MTCIP

Plant Form	Percentage
Trees	99.81
Shrubs	0.02
Grass	0.04
Palm	0.14

### **Threatened Species**

Based on the survey conducted in Link Road 1 (Bukidnon Province), it was found that Narra, with 50 individuals, is considered "Endangered". Bagras (*Eucalyptus deglupta*) has 16 individuals under the category of "Vulnerable".

Link Road 2, located in Davao City, Narra (*Pterocarpus indicus*) is second on the list with 69 individuals, and Marang-banchan (*Artocarpus odoratissimus*), under the family of Moraceae and known for its edible fruit, has 46 individuals. The aforementioned species were "Endangered" and "Vulnerable," respectively. Moreover, Yakal (*Shorea astylosa*) is considered "Endangered, and Nato (*Palaquium luzoniense*) is "Vulnerable."

In Link Road 3, 113 individuals from Narra were found to be considered "Endangered" and Bakan (*Litsea philippinensis*), with 20 individuals falling under the category of "Nearly Threatened.".

Along the Main Corridor, the species under the category of "Endangered" is Narra, with 20 individuals as presented in IUCN conservation status in **Table 4-20**.

Location	Common Name	Scientific Name	Species Abundance	IUCN Status
Link Road 1	Narra	Syzygium aqueum	50	Endangered
(Bukidnon Province)	Bagras	Eucalyptus deglupta	17	Vulnerable
Link Road 2	Bagras	Eucalyptus deglupta	5	Vulnerable
(Davao City)	Bakan	Litsea philippinensis	3	Near
				Threatened
	Marang-	Artrocarpus	46	Near
	banguhan	odoratissimus		Threatened
	Nato	Palaquium luzoniense	1	Vulnerable
	Narra	Pterocarpus indicus	69	Endangered
	Yakal	Shorea astylosa	2	Endangered
Link Road 3	Bakan	Litsea philippinensis	20	Near
				Threatened

#### Table 4-20. IUCN Conservation Status

(Sta. Maria and Malungon)	Narra	Pterocarpus indicus	113	Endangered
Main Corridor	Narra	Pterocarpus indicus	25	Endangered

#### **Sensitivity Indices**

The index was developed based on the context of the roads as the areas of research (The Energy and Biodiversity Initiative: Biodiversity Indicators for Monitoring Impacts and Conservation Actions). The sensitivity was based on the approximate nature of the natural environment and human-altered environments along the road, which may be affected at any point during the construction or rehabilitation phase.

Five categories were assigned after getting data on the actual situation of the roadsides and alignment:

- Sensitivity Index # 1 was assigned to areas with 60%–100% human settlements or man-made structures along the road that may harbor common non-endemic species. These areas include those with houses and other built structures, at least on one side of the road, and the aggregation of houses into villages.
- Sensitivity Index # 2 was assigned to areas with at least 80% used for agriculture and may have intermittent human structures. These areas may have been developed, but the degree of man-made disturbance is relatively low compared to the first index; these could be the agricultural plots that have the tendency to support a few (about 10%) endemic species.
- Sensitivity index #3 was assigned to sites that were primarily agricultural areas but with around 20% volunteer wildlings or endemic flora that may support some wildlife.
- Sensitivity Index #4 was assigned to areas that were mostly abandoned or uncultivated agricultural lands. These areas include those recovering from recent human intervention and slowly growing back their native vegetation. The crops and introduced plants were limited, approximately, to not more than 30% of the total floral structure. These may be feeding and nesting areas for birds.
- Sensitivity Index #5 was assigned to dominantly wild vegetation with less than 20% non-endemic species; these areas could be candidate habitat for wildlife. These areas could be forest or marshland with a minimum of introduced species and not be used for agriculture or grazing.

The sensitivity index was based on the context of the road. The categories were limited to the immediate roadside (approximately 20 meters) from the middle of the road, with little consideration given to the areas behind human structures, unless the ecosystem type is largely pronounced, like a wide pooling area, streams, wetlands, or patches of forests.

It should also be noted that there are portions of the road network that are wider compared with other segments, depending on their classification or type. As such, it affects the 20-meter distance from the middle of the road. Adjustments to about 25 meters were made, whenever applicable, to minimize bias in the data gathering and analysis.

#### Main Corridor

The Cagayan de Oro-Bukidnon-Davao Road connector is about 277.4 km long, starting from the road near TH Cagayan Mall in Cagayan de Oro City in the Province of Misamis Oriental, passing the plateau area of the Province of Bukidnon, and ending in Ulas, Davao City. It follows a south-southeast direction, connecting two bays in Mindanao: Macajalar Bay in

Cagayan de Oro and Talomo Bay in Davao City.

The road is paved and widened in certain areas, zigzagging and rising from 7 masl in Cagayan de Oro to about 1230 masl in the Marilog District, Bukidnon. It is a very busy highway, being the main arterial road of Regions X (Northern Mindanao) and XI (Davao Region). Although most areas are highly developed by human activities (e.g., houses, urban centers), they also have vast arable and agricultural lands. These areas are planted with rice, maize, sugar, coffee, rubber, pineapple, banana, tomato, flowers, cassava, oil palm, fruit and timber trees, and vegetables.

The sensitivity of the road is mostly low to medium as the road traverses urban centers and a large extent of agricultural areas. There are some notable areas where sensitivity is high, like the mountainous portions in Impasug-ong to Marilog. Also, a tourist destination, the Blue Water Cave in the Pulangi River in the Municipality of Quezon is near the road system. **Figure 4-52** and **Figure 4-53** show the sensitivity of Main Corridor.



Figure 4-52. Sensitivity of Main Corridor (Cagayan de Oro-Bukidnon-Davao)

The Davao-General Santos segment is about 143.2 kilometers, starting from the Andres Bonifacio roundabout in Davao City and ending in General Santos City, marked by Hadano Park. The road is mostly situated in urban areas and has long stretches of straight sections; the most notable is the Digos-Hagonoy-Padada-Sulop stretch. It follows a south-southwesterly direction and, at one point, touches the coastline in Tagabuli Bay.

Human settlements and commercial areas lined up the roadsides, although there are large swaths of cultivated land and pioneer vegetation behind these structures in some stretches of the road. Shanties of food stalls and fruit stands are common in some portions. There are also largely vegetated areas, but they are within property fences, ridges, and gullies in the elevated portions of the road. Agriculture areas are mostly plantations of banana, timber species, palm oil, pineapple, and other cash crops.



Figure 4-53. Sensitivity of Main Corridor (Davao – General Santos)

Generally, this road connection has low sensitivity as it is a wholly concrete-paved road with some segments already widened. However, one of the areas with high sensitivity is the portion in Tagabuli. It is along the coast with mangroves, behind the houses along the road. This segment also has a locally managed critical habitat for waterbirds like herons and egrets. The presence of the roosting area was also noted during the study for the Mindanao Railway Project in 2018.

### Link Road 1

The road option Link Road 1 is a loop starting from the intersection of Intavas Road and Sayre Highway, going to La Fortuna towards Intavas, Kibenton, and Cawayan, and exiting again on Sayre Highway, covering about 25.43 kilometers. It is mostly an agricultural area, near the foothills of the Mt. Kitanglad Range Natural Park, a protected area under the NIPAS Act. The elevation of the road ranges from 710 masl to as high as 1273 masl in Brgy. Intavas.

Human structures can be found in clusters for the entirety of the road. The clusters are usually the sitios or barangay proper, but there are also sporadic structures lining the road. Agriculture areas are mostly plantations of cut flowers, timber species, palm oil, pineapple, and cash crops. Natural or native vegetation is mostly concentrated along creeks and rivers.

The sensitivity of the road is mostly low, attributed to the high human influence in the area. However, there are some portions with high sensitivity, especially the upland roads. Given the vastness of cultivated land and sporadic human structures, the degree of disturbance in these areas in terms of wildlife may still be low. Natural vegetation, especially along the waterways, can also act as "highways" for wildlife movement. **Figure 4-54** show the sensitivity of Link Road 1.



Figure 4-54. Sensitivity of Link Road 1

# <u>Link Road 2</u>

The road option Link Road 2 is almost 59.4 kilometers, starting from Cabaluna St.-Daang Maharlika in Panabo City and exiting to the Davao-Bukidnon Highway in Malamba, Marilog District, in a westerly direction. Most of the road is around 100–400 masl, with the highest at around 720 masl. It is mostly paved, some relatively newly constructed. However, there are stretches of land that are graveled and unpaved.

Human structures are mostly clustered for the entirety of the road. These are usually the sitios or barangay proper, although there are also sporadic structures lining the road outside the clustered areas. Agriculture areas are planted with rice, corn, pineapple, mango, coconut, and banana. There are also some areas with timber species like mahogany and gmelina. Natural vegetation is usually clustered in gullies and near rivers. The vegetation in such areas may act as "highways" for any wildlife thriving there.

The sensitivity of the roadsides for Link Road 2 is fairly low since most portions have human intervention. However, the portion for construction is situated in Brgy. Bantol-Lumiad is a sensitive area, as it crosses two rivers and will be clearing a second-growth forest with a rolling to steep contour. Although fairly vegetated, there are also patches of cultivation in the vicinity of the area. Such a state may allow the area to still harbor wildlife, as there seems to be little motorized vehicular traffic in the area. **Figure 4-55** show the sensitivity of Link Road 2.



Figure 4-55. Sensitivity of Link Road 2

# Link Road 3

The road option Link Road 3 is around 45.03 km, starting from Panabo City, Davao Region, to Malungon, in Sarangani Province. It ranges from around 20 masl to 750 masl and follows a southwesterly direction, passing through mountain ranges. Most of the roads, especially in the

uplands, are unpaved, and in some areas, they can be considered trails. The road alignment showed that there are portions to be rehabilitated, upgraded, or constructed.

As is common in rural and upland areas, houses are concentrated on a certain portion of the road, forming the sitios, purok, or barangay proper. Sporadic structures are in farmlands, which are usually huts and sheds, although there are bigger structures, especially in the lower elevation, near the urban areas.

Although there are patches of cultivation in the upland areas, the natural vegetation is low to fair owing to the slash-and-burn method of farming and plantation establishments. As such, a large portion of the mountainous areas where the road is aligned may still harbor wildlife, as there seems to be little to no motorized vehicular traffic in the area. **Figure 4-56** shows the sensitivity of Link Road 3.



Figure 4-56. Sensitivity of Link Road 3

## 4.2.6.2 Fauna Assessment

The wildlife assessment was undertaken at predefined sampling sites along the Main Corridor and Link Roads. The fauna assessment was conducted using the guidelines laid out in the Terrestrial Ecosystems Biodiversity and Assessment Monitoring Manual (DENR-BMB, 2017). All relevant secondary data for the area was thoroughly examined to identify potential species of concern. Additionally, key informant interviews were conducted to complement the survey data and enrich the assessment process. The methodology outlines limitations on the number and size of sampling plots (quadrats) and the length of transects. Consequently, biodiversity indices merely signify biodiversity levels based on species within the quadrats and along the transects. The recorded checklist of faunal species encompasses those encountered during the transects walk. The detailed methodology for fauna assessment is provided in **Annex 15**. **Plate 4-15** shows the photographs of the fauna assessment.





Plate 4-15. Photograph of Fauna Assessment

#### Main Corridor

The assessment was conducted using the described methodology, and 45 species were evaluated, with 31 and 14 species observed for avifauna and herps, respectively. During the assessment, 16 species were seen and heard for avifauna, while 8 species were observed for herps. The data indicates that avifauna has moderate diversity but high species evenness, with values of 2.59 and 0.934. On the other hand, herpetofauna has H'=1.91, indicating very low diversity but high species evenness, with values of J'=0.918.

The predominant reptile species in the area are the Philippine cobra (*Naja philippinensis*), Barred Philippine False Coral Snake (*Hemibungarus calligaster*), and King cobra (*Ophiophagus hannah*), as identified in the Key Informant Interview. **Figure 4-57** shows the transect map of fauna assessment in Main Corridor.



Figure 4-57. Transect Map of Fauna Assessment in Main Corridor

#### <u>Avifauna</u>

It was found that the large-billed crow is the most abundant bird species in the proposed area,

with a relative frequency of 13.69 and 0.2, respectively. The majority of the species were identified through interviews with the residents in the area, who either saw or heard them. Other birds were found perched on the canopy or flying within the vicinity of the area. The Philippine Eagle (*Pithecophaga jeffryi*) is classified as "Critically Endangered," the Rofous Hornbill (*Buceros hydrocorax*) is classified as "Vulnerable," the Philippine Hawk Eagle (*Nisaetus philippensis*) is classified as "Endangered," and the Mindanao Highland scops owl (*Otus mirus*) is classified as "Near Threatened." All these species were found in the alignment along the Davao Occidental and Malungon, Sarangani province areas.

#### <u>Mammals</u>

Most species found in the area are the Great Musky Fruit Bat (*Ptenochirus jagori*), considered the least concerned species (left), and Geoffroy's Rousettes (*Rousettus amplexicaudatus*). To study these bats and their feeding behavior, researchers established mist nets in areas where the bats fly and where they can find food, such as rice field rats (*Rattus argentiventer*). These areas are also home to residential areas and plantations of banana, coconut, and fruit trees. One of the locations where rice field rats were found is in Alignment 1, Capitan Bayong, Impasug-ong, near the Adlai rice plantation.

#### Herpetofauna

Based on the status of the species in the area, the King Cobra (*Ophiophagus hannah*) was found to have the highest population, followed by the Philippine Cobra (*Naja philippinensis*). Both of these species are considered vulnerable and near threatened. On the other hand, the Reticulated Python (*Malayopython reticulatus*) was found to be under the least concern status. It was noted that the agricultural and residential areas in the assessed region had a significant impact on the habitat and reproductive cycle of these reptiles. The King Cobra was the most abundant species, with a population of 15, followed by the Philippine Cobra with 12 individuals, and the Reticulated Python with 7 individuals.

#### Link Roads

**Habitat Description**. The presence of fauna in an area has a significant impact on the food and habitat available in that area. There is a road project underway that includes three proposed link roads. These roads will pass through areas that are predominantly agricultural, including mixed plantations, residential areas, and secondary-growth forests. The areas along Sta. Maria, Davao Occidental (Malungon), and Bantol, Davao City (Panabo City), are primarily agricultural, with banana and pineapple plantations being prevalent in the La Fortuna, Impasug-ong area. Secondary growth forests have also been identified in Link Roads 2, 3, and the main corridor.

#### Link Road 1 (Impasug-ong, Bukidnon Province)

A survey has been conducted in this area, which has identified a total of 48 species of animals. Among these, 16 are birds, 9 are mammals, 13 belong to the category of herpetofauna, and 8 are aquatic species. During the establishment of the mist net and trapping device, there was an off-set of 55 meters on station C in the original alignment and 102.54 meters on the net station due to the residential area. The transect line is presented in **Figure 4-58**.

According to the findings, the Shannon diversity index for avifauna in the Shannon area is 2.52, indicating moderate diversity with a high level of evenness at 0.977. This means that a moderate number of bird species are evenly distributed throughout the region. Herpetofauna, on the other hand, has a diversity index of 1.83, which is interpreted as very low, but with a

very high level of evenness at 0.958. The diversity of mammals is also very low, with a diversity index of 1.15 and a high level of evenness at 0.829. Furthermore, aquatic animals have a very low diversity index of 1.56, but high species evenness at 0.967.

The species that are most prevalent in the area are Asian Palm Civet (*Paradoxurus hermaphroditus*), Philippine Cobra (*Ophiophagus hannah*), and Paitan (*Barbodes montanoi*).



Figure 4-58. Transect Map of Fauna Assessment in Link Road 1

## Link Road 2 (Davao City- Panabo City)

In the surveyed area, a total of 159 individuals were found along the transect line from Davao City to Panabo Link Road 2. **Figure 4-59** shows the transect tread during the assessment. The avifauna group had the highest abundance, while mammals had the lowest abundance. The data interpreted from the survey shows that the avifauna group has moderate diversity (2.74), with a very high evenness index (0.901). On the other hand, mammals, herpetofauna, and aquatic animals have very low diversity, with indices of 1.21, 1.82, and 1.66, respectively. However, their species evenness falls under the "very high" index. The species richness of the animal classification was 21 for birds, two for mammals, and seven and six for herpetofauna and aquatic animals, respectively. It was found out that the most rampant species in the area are Asian Palm Civet (*Paradoxurus hermaphroditus*) of Viverridae, giant mottled eel (*Anguilla marmorata*) of Anguillidae, and Paitan (*Barbodes montanoi*) of the family Cyprinidae.



Figure 4-59. Transect Map of Fauna Assessment in Link Road 2

## Link Road 3 (Malungon – Sta. Maria, Davao Occidental)

During the assessment of Link Road 3 (transect shown in **Figure 4-60**), a total of 108 animals were counted. Of these, 56 were birds, 6 were mammals, 24 were herps (reptiles and amphibians), and 22 were aquatic animals. Due to the presence of residential areas, the stations along Brgy. San Antonio and Brgy. Poblacion, Malungon, and Sarangani Province were affected.

The proposed link road has moderate diversity for avifauna, with a species evenness index of H'=2.84 and J'=0.923. As for herpetofauna, the diversity was very low, but it had a high evenness index with values of H'=1.75 and 0.841. The result showed that mammals had low diversity but a high evenness index, with H'=1.1 and J'=1. For aquatic animals, the diversity is low with an H'=1.58, but the species evenness is high with a value of 0.88. King cobra (*Ophiophagus hannah*), Paitan (*Barbodes montanoi*), and Giant mottled eel (*Anguilla mamorata*) have dominated the area.

During the fauna assessment, it was found that a total of 365 individuals were present in the entire project area. Avifauna were the most commonly found species, followed by herpetofauna, mammals, and aquatic animals. Unfortunately, several species were discovered to be threatened due to continuous land cultivation, which negatively affects their reproduction in the area. The Philippine Warty Pig (*Sus philippinensis*), Philippine Deer (*Rusa mariana*), Eurasian carp (*Cyprinus carpio*), King cobra (*Ophiophagus hannah*), and Chinese softshell turtle (*Pelodiscus sinensis*) were all classified as "Vulnerable". Other species, such as the Philippine cobra (*Naja philippinensis*) and Philippine long-tailed macaque (*Macaca fascicularis philippinensis*), were classified as "Near Threatened".

 Table 4-21 presents the list of fauna species and IUCN conservation status.

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Figure 4-60. Transect Map of Fauna Assessment in Link Road 3

No	Taxonomic	Name of	<b>IUCN Conservation</b>					
NO.	Class	Scientific Name	Common Name	Status				
Main	Main Corridor							
1	Avifauna	Pithecophaga jefferyi	Philippine Eagle	Critically Endangered				
2		Buceros hydrocorax	Rofous Hornbill	Vulnerable				
3		Nisaetus philippensis	Philippine Hawk Eagle	Endangered				
4		Otus mirus	Mindanao Highland Scops Owl	Near Threatened				
5	Mammals	Ptenochirus jagori	Great Musky Bat	Least Concerned				
6		Rousettus amplexicaudatus	Geoffroy's Rousettes	Least Concerned				
7		Rattus argentiventer	Rice Field Rats					
8		Sus philippensis	Philippine warty pig	Vulnerable				
9	Herpetofauna	Ophiophagus hannah	Kind Cobra	Vulnerable				
10		Naja philippinensis	Philippine Cobra	Near Threatened				
11		Malayopython reticulatus	Reticulated Python	Lease Concerned				
12		Hemibungarus calligaster	Barred Philippine False Coral Snake	Least Concern				
13		Trimeresurus flavomaculatus	Philippine Pit Viper	Least Concern				
14		Hydrosaurus pustulatus	Philippine sailfin lizard	Least Concern				
15		Cerberus rynchops	Dog-faced water snake	Least Concern				
16		Philautus acutirostris	Pointed-snouted Tree Frog	Least Concern				
Link	Road 1							
1	Avifauna	Phapitreron leucotis	White-eared brown dove	Least Concern				

# Table 4-21. List of Fauna Species and IUCN Conservation Status

	Taxonomic	Name of	IUCN Conservation	
NO.	Class	Scientific Name	Common Name	Status
2		Haliastur indus	Brahminy Kite	Least Concern
3		Passer montanus	Eurasian tree sparrow	Least Concern
4		Columba livia	Common pigeon	Least Concern
5		Agapornis	Lovebirds	Least Concern
6		Loriculus philippensis	Philippine hanging parrot	Least Concern
7		Rhipidura nigritorguis	Philippine pied fantail	Least Concern
8		Leptocoma sperata	Purple-throated sunbird	Least Concern
9		Gallirallus torquatus	Barred rail	Least Concern
10		Todiramphus winchelli	Collared kingfisher	Least Concern
11		Spilopelia chinensis	Spotted dove	Least Concern
12		Corvus macrorhynchos	Large-billed crow	Least Concern
13	Mammals	Sus philippensis	Philippine warty pig	Vulnerable
14		Paradoxurus hermaphroditus	Asian palm civet	Least Concern
15		Macaca fascicularis philippensis	Philippine long-tailed macaque	Near Threatened
16		Rusa marianna	Philippine Deer	Vulnerable
17	Herpetofauna	Hydrosaurus pustulatus	Philippine sailfin lizard	Least Concern
18		Naja philippinensis	Philippine cobra	Near Threatened
19		Naja philippinensis	Philippine cobra	Near Threatened
20		Cerberus rynchops	Dog-faced water snake	Least Concern
21		Anguilla marmorata	Giant mottled eel	Least Concern
22		Philautus acutirostris	Pointed-snouted Tree Frog	Least Concern
23		Rhinella marina	Cane Toad	Least Concern
24		Varanus cumingi	Yellow-headed water monitor	Least Concern
Link	Road 2			
1	Avifauna	Phapitreron leucotis	White-eared brown dove	Least Concern
2		Ducula poliocephala	Pink-bellied imperial	Least Concern
			pigeon	
3		Haliastur indus	Brahminy Kite	Least Concern
4		Aplonis panayensis	Asian glossy starling	Least Concern
5		Passer Montanus	Eurasian tree sparrow	Least Concern
6		Aplonis panayensis	Asian glossy starling	Least Concern
7		Columba livia	Common pigeon	Least Concern
8		Buceros hydrocorax	Philippine Hornbill	Least Concern
9		Iodiramphus chloris	Collared kingfisher	Least Concern
10		Surniculus velutinus	Philippine drongo- cuckoo	Least Concern
11		Geopelia striata	∠ebra dove	Least Concern
12		Loriculus philippensis	Philippine hanging parrot	Least Concern
13		Passer Montanus	Eurasian tree sparrow	Least Concern
14		Ardea sumatrana	Great-billed heron	Least Concern
15		Chalcophaps Indica	Common emerald dove	Least Concern
16		Lepidotnrix suavissima	Francisco fra	Least Concern
1/		Passer montanus	Eurasian tree sparrow	Least Concern
18		Corvus macrornynchos	Large-billed crow	Least Concern
19		Transportus golavier	reliow-vented bulbul	Least Concern
20			Pink-necked Green- Pigeon	
21		Sarcops calvus	Coleto	Least Concern
22		Collocalia esculenta	Glossy swittlet	Least Concern
23		Cinnyris jugularis	Olive-backed sunbird	Least Concern
24		Gallirallus torquatus	Barred rail	Least Concern
25		Iodiramphus chloris	Collared kingfisher	Least Concern

NI -	Taxonomic	Name of Species		IUCN Conservation
NO.	Class	Scientific Name	Common Name	Status
26		Spilopelia chinensis	Spotted dove	Least Concern
27		Egretta garzetta	Little egret	Least Concern
28		Corvus macrorhynchos	Large-billed crow	Least Concern
29	Mammals	Paradoxurus	Asian palm civet	Least Concern
20		Suc philippopoio	Philipping worth pig	Vulnorabla
30		Sus prilippensis	Philippine warty pig	
31		Rusa mananna	Philippine Deer	
32		philippensis	macaque	Near Inreatened
33	Herpetofauna	Varanus cumingi	Yellow-headed water monitor	Least Concern
34		Ophiophagus hannah	King cobra	Vulnerable
35		Malayopython	Reticulated python	Least Concern
36		Anguilla marmorata	Giant mottled eel	Least Concern
37		Naja philippinensis	Philippine cobra	Near Threatened
38		Hemibungarus	Barred Philippine False	Least Concern
00		calligaster	Coral Snake	
39		Dryophiops philippina	Philippine Keel-bellied Whin Snake	Data Deficient
40		Gekko Gecko	Tokay Gecko	Least Concern
Link	Road 3			Louor Concom
1	Avifauna	Phapitreron leucotis	White-eared brown dove	Least Concern
2		Oriolus steerii	Philippine oriole	Least Concern
3		Haliastur indus	Brahminy Kite	Least Concern
4		Naia philippinensis	Philippine cobra	Least Concern
5		Pithecophaga jeffervi	Philippine eagle	Critically
Ŭ		n nnooopnaga jonoryn		Endangered
6		Aplonis panayensis	Asian glossy starling	Least Concern
7		Passer Montanus	Eurasian tree sparrow	Least Concern
8		Columba livia	Common pigeon	Least Concern
9		Buceros hydrocorax	Rufous hornbill	Vulnerable
10		Gracula religiosa	Common hill myna	Least Concern
11		Loriculus philippensis	Philippine hanging parrot	Least Concern
12	1	Geopelia striata	Zebra dove	Least Concern
13	1	Loriculus philippensis	Philippine hanging parrot	Least Concern
14		Nisaetus philippensis	Philippine hawk-eagle	Endangered
15	1	Chalcophaps indica	Common emerald dove	Least Concern
16		Passer montanus	Eurasian tree sparrow	Least Concern
17		Otus mirus	Mindanao highland	Near Threatened
18	1	Loriculus philippensis	Philippine hanging parrot	Least Concern
19	•	Pycnonotus goiavier	Yellow-vented bulbul	Least Concern
20		Pithecophaga jefferyi	Philippine hawk-eagle	Critically
21		Treron vernans	Pink-necked Green-	Least Concern
22	4	Sarcons coluus		Loost Concorn
20	-	Collocalia esculanta	Glossy swiftlat	Least Concorn
24	1		Closey swittlet	Least Concorn
20	4		Little ograt	
20	{			
21	4		Darrey rail	
20			Spolled dove	
29	•	Molonorpoo corolinus		
30		weianerpes carolinus	Rat Snakes	

No	Taxonomic	Name o	IUCN Conservation	
NO.	Class	Scientific Name	Common Name	Status
31		Corvus macrorhynchos	Large-billed crow	Least Concern
32	Mammals	Paradoxurus	Asian palm civet	Least Concern
		hermaphroditus		
33		Sus philippensis	Philippine warty pig	Vulnerable
34		Macaca fascicularis	Philippine long-tailed	Near Threatened
		philippensis	macaque	
35		Rousettus	Geoffroy's rousette	Least Concern
		amplexicaudatus		
36	Herpetofauna	Varanus cumingi	Yellow-headed water	Least Concern
			monitor	
37		Ophiophagus hannah	King cobra	Vulnerable
38		Malayopython	Reticulated python	Least Concern
		reticulatus		
39		Anguilla marmorata	Giant mottled eel	Least Concern
40		Naja philippinensis	Philippine cobra	Near Threatened
41		Rhinella marina	Cane Toad	Least Concern
42		Lamprolepis	Emerald Tree Skink	Least Concern
		smaragdina		

#### 4.3 Water

This section discusses pertinent baseline data on the hydrology, surface water, and freshwater ecology along and near the vicinities of the MTCIP. For this report, the section on marine ecology is not applicable since the alignment will not traverse marine waters and is nowhere near marine water bodies.

## 4.3.1 Hydrology

The MTCIP runs through a wide area in the middle of Mindanao, which is characterized by variable terrain and many different drainage basins. The whole project crosses at least seven major river basins, including the Tagoloan River, the Rio Grande de Mindanao, the Davao River, the Lasang River, the Padada-Mainit River, the Malungon River, and the Makar River.

Within Region X (**Figure 4-61**), the northern segment of the Main Corridor and Link Road 1 fall within the watershed of the Tagoloan River System. This drainage system intersects the highway at around KM 1441 and ends at KM 1494. The Tagoloan River system is considered the 13<sup>th</sup> largest in the country and has an estimated drainage area of 1,704 km<sup>2</sup> with a total length of 106 km. It discharges into the Macalajar Bay along the shores of Cagayan de Oro City.

The middle portions of Sayre Highway run through the watershed of the Rio Grande de Mindanao. This fluvial network covers a large area of Mindanao Island and is considered the second-largest river system in the country. It drains an area of 23,169 km<sup>2</sup>, which stretches from the northern part of the island until the southern region, stretching a length of approximately 373 km. It discharges into Illana Bay along the Moro Gulf west of Mindanao Island. This watershed intersects the MTCIP at about KM 1494 until KM 1640.

Field assessment shows that within Region X, the Main Corridor of the MTCIP crosses at least nine rivers and 18 creeks. Link Road 1 does not traverse any natural drainage channels.

In Region XI (**Figure 4-62**) the project crosses at least four drainage basins, including the Davao River, Lasang River, Malungon River, and Padada-Mainit River. The northernmost portion of Davao-Bukidnon Road falls within the region of the Davao River Watershed. This is

the 3<sup>rd</sup> largest watershed in Mindanao and covers an area of 1,700 km<sup>2</sup> with an approximate length of 170 km. The alignment enters the watershed at around KM 1640 until KM 1685. The rest of this highway goes through the smaller watersheds of the Matina River and the Talomo River. All of these river systems discharge into the Davao Gulf, located further south along the coast of Davao City.

A portion of Davao-Cotabato Road crosses the smaller watersheds of the Lipadas River and Sibulan River, as well as minor parallel river systems that flow from the slopes of Mt. Apo down to the coast of the Davao Gulf. It also crosses the watershed of the Padada-Mainit River system, which lowers from the higher elevation into the coastal flats of the Municipality of Padada and Hagonoy. The main channel of this system is at KM 1572+68, and since the surrounding areas are relatively flat, the waterflow direction is not very distinct, and man-made drainages dictate the major direction of the waterflow. This river network has a drainage area of approximately 1,303 km<sup>2</sup>.

The initial portion of Digos-Makar Road from KM 1593 until KM 1640 falls within the watershed of the Malungon River, also known as the Buayan-Malungon River system, which is a relatively small watershed with a drainage basin of approximately 1,506 km<sup>2</sup> and deposits its load into the Saranggani Bay (**Figure 4-63**). A portion of Link Road 3 also falls within this watershed.

Link Road 2 traverses two (2) watersheds, including the Davao River Watershed on the western side and the Lasang River Watershed on the eastern side. The Lasang River has a drainage area of about 467 km<sup>2</sup> and discharges into the Davao Gulf.

Field assessment results indicate that the MTCIP has at least 14 river crossings and 62 creek crossings within Region XI. Link Road 2 crosses at least 4 river crossings and 7 creeks. While Link Road 3 crosses a single river channel multiple times at different locations.

In Region XII, the alignment traverses a portion of the Malungon River Watershed as well as the Makar River Watershed. The latter drains into the Saranggani Bay and intersects the alignment at KM 1653+720. The Malungon River basin covers Digos-Makar Road until KM 1640 within this region. Field assessment determined that the MTCIP crosses two rivers in this region.



Figure 4-61. River Systems in Region X



Figure 4-62. River Systems in Region XI



Figure 4-63. River systems in Region XII

## 4.3.2 Drainage System

In the Main Corridor, there are various types of drainage systems in the MTCIP, such as concrete trapezoidal or rectangular ditches and earth canals or ditches, prevalent in different areas. While most drainage ditches are clear and working properly, some portions are affected by blockage due to debris, garbage, and soil, leading to diminished hydraulic capacity, overflow, and low-level flooding within the highway. Prior to blockage, the drainage systems were effective in conveying surface runoff away from the highway.

In Link Road 1, the only concrete ditch identified was towards the end of the alignment, while most of the ditches were shallow earth ditches frequently filled with sediment and rubble carried from higher elevations.

Some areas on Link Road 2 lack proper drainage. The concrete ditches observed were those adjacent to an existing paved concrete roadway, with the majority of the ditches being shallow earth ditches prone to the accumulation of sediment and debris.

In Link Road 3, proper roadside drainage is yet to be established, with only the road leading to the barangay hall of Brgy. San Miguel exhibits an open concrete rectangular ditch. Community centers along the alignment have dug minor earth canals that serve to divert the runoff away from roads but are mostly sporadic and discontinuous.

## 4.3.3 Water Quality

In-situ surface water quality measurements using Horiba U53 were used. The sampling was made on October 10–13, 2023. There were 26 stations selected on Link Roads 2 and 3. There

will be no bridgework or river crossing activities along the Main Corridor and Link Road 1. **Plate 4-16** shows a photograph of water sampling activity. **Table 4-22** presents the water sampling stations and schedules. **Figure 4-64** and **Figure 4-65** show the locations of water sampling stations.



Plate 4-16. Water Sampling in New Diclum Bridge, Bukidnon Province

Date	Time	Station Site Name		
10/10/2023	11:41:49	Upper Mainit Bridge		
10/10/2023	14:51:13	Kityan Bridge		
10/10/2023	15:19:10	Kityan (Box culvert)		
10/11/2023	12:34:04	Intan 7 Sta. Maria		
10/11/2023	11:59:32	Intan 6 Sta. Maria		
10/11/2023	13:27:31	Intan 5 Sta. Maria		
10/11/2023	13:46:33	Intan 4 Sta. Maria		
10/11/2023	14:01:21	Intan 3 Sta. Maria		
10/11/2023	14:19:17	Intan 2 Sta. Maria		
10/11/2023	14:32:33	Intan 1 Sta. Maria		
10/11/2023	15:11:04	Sitio Lais Creek		
10/12/2023	08:28:15	Sitio Libug Creek 1		
10/12/2023	08:45:32	Sitio Libug Creek 2		
10/12/2023	09:03:01	Paluhan Creek 1		
10/12/2023	09:14:25	Paluhan Creek 2		
10/12/2023	09:23:53	Lumabat Creek		
10/12/2023	09:38:59	Paluhan Creek 3		
10/12/2023	09:59:06	Panamin Bridge		
10/12/2023	11:00:32	Mamulawan Bridge		
10/12/2023	15:18:19	Bantol Bridge		
10/12/2023	15:35:08	Banuayan Creek		
10/13/2023	11:03:39	Siao River		
10/13/2023	12:39:19	Malabog Bridge 1		
10/13/2023	12:59:54	Malabog Bridge 2		
10/13/2023	13:45:57	Katipunan Bridge		
10/13/2023	14:19:00	Lasang Bridge		

Table 4-22.	Water	Quality	Sampling	Stations	and Schedules
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Figure 4-64. Water Sampling Stations along Link Road 2



Figure 4-65. Water Sampling Stations along Link Road 3

The results of the laboratory tests for TSS, DO, BOD, COD, pH, and oil and grease were compared with WQG based on DAO 2016-08 and DAO 2021-19. The results for TDS, total, and fecal coliform were compared with the Philippine National Standard for Drinking Water (PNSDW 2017). Standards used for salinity in both freshwaters were adapted from the Environment Protection Authority of South Australia's (EPA SA) inland waters and drinking water guidelines.

The pH, temperature, and dissolved oxygen values of the rivers and creeks in Link Roads 2 and 3 are within the water quality criteria set by the DENR. However, the Upper Mainit Bridge, Mamulawan Bridge, and Bantol Bridge station sites have exceeded the DENR's water quality criteria for total suspended solids.

The Kityan Bridge, Kityan Box Culvert, Malabog Bridge 2, Katipunan Bridge, and Lasang Bridge station sites along Link Roads 2 and 3 have water that exceeds the WHO's recommended guideline values for conductivity. Similarly, the Kityan Box Culvert, Banuayan Creek, Malabog Bridge 2, and Katipunan Bridge station sites along the Link Roads 2 and 3 also exceed the WHO's recommended guidelines for total dissolved solids in the water.

Silway Bridge and Tinagakan Bridge stations along the main corridor exceeded WHO guidelines for conductivity and total dissolved solids.

It appears that the quality of water in the bodies of water along the proposed road is being impacted by suspended solids. This is indicated by the high values in TSS, conductivity, and TDS. The suspended solids could be attributed to foreign materials such as sand, sediment, solid wastes, and/or plankton that are present in the water. **Table 4-23** presents the result of laboratory analysis for surface water quality.

Station Site pH		Temperature (°C)		DO (mg/l)		TSS (mg/l)		Conductivity (µS/cm)		TDS (mg/l)		
Name	Actual	Remarks	Actual	Remarks	Actual	Remarks	Actual	Remarks	Actual	Remarks	Actual	Remarks
Upper Mainit Bridge	8.76	Passed	30.77	Passed	8.89	Passed	145.35	Failed	311	Passed	202	Passed
Kityan Bridge	8.38		30.56		9		43.47	Passed	451	Failed	293	1 43504
Kityan (Box Culvert)	8.33		27.53		7.47		85.5		602	Taned	385	Failed
Intan 7 - Sta. Maria	8.79		27.87		10.37		87.75		259	Passed	168	Passed
Intan 6 - Sta. Maria	8.78		28.21		9.84 10.03		8.78		255		165	
Intan 5 - Sta. Maria	8.81		27.8				41.27		260		169	
Intan 4 - Sta. Maria	8.82		27.62		9.3		35.96		253		169	
Intan 3 - Sta. Maria	8.77		27.09		9.31		24.62		259		169	
Intan 2 - Sta. Maria	8.7		26.79		9.07		10.76		261		170	
Intan 1 - Sta. Maria	8.6		26.12		9.31		9.31		253		164	
Sitio Lais Creek	8.49	Passed	25.31	Passed	9.02	Passed	9.02	Passed	225	Passed	146	Passed
Sitio Libug Creek 1	8.19		24.91		7.72		7.72		181		118	
Sitio Libug Creek 2	8.5		24.59		9.88		9.88		275		179	
Paluhan Creek 1	8.39		25.93		8.02		8.02		198		129	
Paluhan Creek 2	8.15		24.87		9.3		9.3		273		177	
Lumabat Creek	8.47		25.37		8.77		8.77		254		165	
Paluhan Creek 3	8.15		25.61		7.93		7.93		247		16	

#### Table 4-23. Result of Laboratory Analysis for Surface Water Quality

Station Site	рН		Temperature (°C)		DO (mg/l)		TSS (mg/l)		Conductivity (µS/cm)		TDS (mg/l)	
Name	Actual	Remarks	Actual	Remarks	Actual	Remarks	Actual	Remarks	Actual	Remarks	Actual	Remarks
Panamin Bridge	7.98	Passed	26.22	Passed	6.51	Passed	6.51	Passed	247	Passed	161	Passed
Mamulawan Bridge	8.64		31.17		9.64		9.64		511		327	Passed
Bantol Bridge	8.65		28.16		8.61		8.61	Failed	281		183	1 83500
Banuayan Creek	8.88		29.21		7.7		7.7	Failed	65		416	Failed
Siao River	8.96		26.34		9.9		9.9		368		239	
Malabog Bridge 1	8.77		25.66		9.74		9.74		355		231	Passed
Malabog Bridge 2	8.42		26.61		9.2		9.2	Passed	509		326	Failed
Katipunan Bridge	8.51		28.12		6.91		6.91		847	Failed	542	Falleu
Lasang Bridge	8.79		28.81		9.38		9.38		418		271	Passed

#### 4.4 Air and Noise

The air quality samplings and on-site noise measurements were conducted on August 1-4, 2023; on August 8–11, 2023; and on August 16–17, 2023. Ambient air particulate sampler BGI PQI 200 and gas sampler JCG Tri-gas sampler were used to collect air particulate samples for PM10 and PM2.5 and for gas samples for SO2 and NO2 lab analysis. Unfortunately, samples for photochemical oxidants such as ozone and carbon monoxide were not collected due to technical problems with the sampling equipment.

## 4.4.1 Air Quality

MTCIP traverse Regions X, XI, and XII of Mindanao. The distance, travel time, and the presence of sensitive receptors to air quality impacts and noise were factors considered in the selection of locations for sampling stations.

The sampling stations were located at the starting and terminal points of the Main Corridor and those of the Link Roads, where there may be sensitive receptors. The 11 sampling stations are enumerated in Table 4-24 and Figure 4-66.

Table 4-24. All Quality and Noise Level Sampling Locations						
Main Corridor	Link Road 1					
<ul> <li>Brgy. Puerto, Cagayan de Oro</li> </ul>	<ul> <li>Brgy Kibenton, Impasugong</li> </ul>					
<ul> <li>Brgy. Talomo, Ulas, Davao City</li> </ul>	<ul> <li>Brgy. Capitan Bayong,</li> </ul>					
<ul> <li>Brgy. Lagao, Gen. Santos City</li> </ul>	Impasug-ong					
Link Road 2	Link Road 3					
<ul> <li>Brgy Malabog, Davao City</li> </ul>	<ul> <li>Brgy. Poblacion, Sta. Maria</li> </ul>					
<ul> <li>Brgy Bantol, Davao City</li> </ul>	<ul> <li>Brgy. San Antonio, Sta. Maria</li> </ul>					
<ul> <li>Brgy. New Visayas, Panabo</li> </ul>	<ul> <li>Brgy. Poblacion, Malungon</li> </ul>					
City						

Table 4-24 Air Quality and Noise Level Sampling Locations

Parameters monitored as part of the ESIA included particulate matter PM<sub>10</sub>, PM2.5, sulfur dioxide (SO2), and nitrogen dioxide (NO<sub>2</sub>). Each sampling station was monitored for one hour. The samples were transported and analyzed at ELARSI, Inc., Quezon Ave., Quezon City, a Department of Environment and Natural Resources (DENR)-accredited laboratory. The ambient air quality sampling methodology is provided in the Annex 16.

The result of laboratory analysis for air quality are summarized below and presented in Table 4-25.

- Main Corridor: The Ambient Air Quality Sampling and Measurement results for the Main Corridor Sampling Stations were found to be within the DENR standards
- Link Road 1: SO<sub>2</sub> and NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> levels in Link Road 1 Sampling Stations are all within the DENR standards
- Link Road 2: SO<sub>2</sub> and NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> levels in Link Road 2 Sampling Stations are all within the DENR standards
- Link Road 3: SO<sub>2</sub> and NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub> levels in Link Road 3 Sampling Stations are all within the DENR standards



Figure 4-66. Air Quality and Noise Level Sampling Locations
#### Table 4-25. MTCIP Air Quality Sampling Results

Samplin g Station	Location	Geographica (Latitude ar	al Coordinates nd Longitude)	PM 10 (ug/Nm3)	PM 2.5 (ug/Nm3)	SO2 (ug/Nm3)	NO2 (ug/Nm3)	Site Description
AAS 01	Brgy Malabog, Davao City <b>(Link Road 2)</b>	7°19'20.86" N	125°27'50.68" E	1.07	1.07	0.672	0.382	Inside San Roque Church, 10m away from Link Road 2, residential and commercial area
AAS 02	Brgy Bantol, Davao City <b>(Link Road 2)</b>	7°16'38.86" N	125°20'5.49" E	1.08	1.08	1.38	0.326	Beside barangay road, Passing trucks and Motorcycles make noise. Barangay clinic and daycare approx. 50 m away
AAS 03	Brgy New Visayas, Panabo City <b>(Link Road 2)</b>	7°18'1.92"N	125°40'18.88 "E	1.03	1.03	0.849	0.239	Inside boundary of sand and gravel store, Beside Link Road 2, Commercial and Residential area.
AAS 04	Brgy Talomo, Ulas, Davao City <b>(Main Corridor)</b>	7° 3'18.76"N	125°32'42.08 "E	2.06	1.03	0.778	0.377	Beside National Road (Bukidnon Road), under construction road, A lot of vehicles passing by, Commercial Area.
AAS 05	Brgy Poblacion, Sta. Maria <b>(Link Road 3)</b>	6°33'4.54"N	125°28'22.28 "E	1.05	1.05	0.955	0.217	Beside national road going to Malita, Commercial area, vehicles like SUV's, Trucks, and Motorcylcle passing by the road.
AAS 06	Brgy San Antonio, Sta. Maria <b>(Link Road 3)</b>	6°28'22.53" N	125°16'32.05 "E	10.89	1.09	0.849	0.289	Motorcycle and Cars passsing, nearby house under construction, Crowd talking. Residential houses, Barangay clinic, and gym just beside the barangay hall.
AAS 07	Brgy Poblacion, Malungon (Link Road 3)	6°22'35.69" N	125°16'32.05 "E	1.01	1.04	1.1	0.468	Inside Barangay Poblacion, Malungon Boundary, Vehicle pass ingby, On going SK chairman program (Sports Fest). Residential Area
AAS 08	Brgy Lagao, Gen. Santos City <b>(Main Corridor)</b>	6° 7'51.11"N	125°11'56.07 "E	2.07	1.02	1.1	0.264	Beside main corridor at General Santos. City. Open Space, Nearby Commercial lots Public Market, and Coco Lumbers store). a lot of vehicles are

Samplin g Station	Location	Geographica (Latitude ar	al Coordinates nd Longitude)	PM 10 (ug/Nm3)	PM 2.5 (ug/Nm3)	SO2 (ug/Nm3)	NO2 (ug/Nm3)	Site Description
								passing by (SUV's, Motorcycle, and Trucks)
AAS 09	Brgy Kibenton, Impasug- ong (Link Road 1)	8°12'9.81"N	124°58'28.67 "E	4.55	1.14	1.38	0.201	Inside Barangay Hall Boundary, Residential Area, Minimal Vehicle passing by. School about 100-150 m away.
AAS 10	Brgy Capitan Bayong, Impasug-ong <b>(Link Road 1)</b>	8°16'11.43" N	125° 0'58.71"E	1.09	1.1	1.1	0.121	Near national road going Cagayan de oro, near DOLE office a lot vehicle pass by the national road and minimal to the barangay road. rough road going barangay Kibenton and barangay Cawayan.
AAS 11	Brgy Puerto, Cagayan De Oro (Main Corridor)	8°29'57.98" N	124°45'8.23" E	17.51	10.31	1.38	0.239	At least 10m away from the corridor, commercial area, All types of land vehicle pass the area (trucks, SUV's and motorcycle)
DENR Star DAO No. 2	ndard (Table 1 of DAO No. 2 013-13 (Guideline Values for	2000-81 (IRR fo r PM <sub>2.5</sub> ))	or RA 8749) and	150	50	180	150	

## 4.4.2 Noise Level

Table **4-26** indicates the noise permissible limits in workplaces, as regulated by the DOLE. The noise limits are set at various averaging times, from 0.25 to 8 hours. Exposures to impulsive or impact noise shall not exceed 140 dB.

Duration per Day, hours	Sound Levels, dBA, Slow Response
8.00	90
6.00	92
4.00	95
3.00	97
2.00	100
1.50	102
1.00	105
0.50	110
0.25	115
Source: DOLE 1990	

### Table 4-26. Permissible Noise Exposure

Field surveys were undertaken and noise measurements were conducted on the same dates (August 1-4, 8-11, and 16-17, 2023) and locations of the Air Quality Monitoring stations identified in Figure 4-70. The selection of the noise measurement stations considered the area of influence that could be affected by noise emissions during the construction and operational phases of MTCIP. Noise-sensitive receptors such as daycare centers, clinics, schools, churches, and residential areas were noted in proximity to the noise measurement locations.

 Table 4-27 presents the noise sampling locations and site descriptions.

**Table 4-28** presents the results of noise measurements. The noise measurements were made in the morning (5 AM to 9 AM), during the day (9 AM to 6 PM), and in the evening (6 PM to 10 PM). Measurements were not undertaken at night (10 PM to 5 AM) due to the distance and remoteness of the noise measurement locations from the lodging place of the environmental survey team.

Maximum allowable noise levels for categories A and B were used to assess the results. Except for the site at Brgy. Bantol, Davao City, which is quite rural and an interior part of the city, and all other sites hardly passed and even exceeded the maximum allowable noise levels for Category A areas in most of the time periods of the day. However, if the sites are to be considered Category B areas, then it is only the site at Brgy. Puerto in Cagayan de Oro City exceeded the maximum allowable noise levels during the daytime. This is because the area is highly urbanized and also a traffic-congested area. It is anticipated that during construction and eventually during the operational phase, noise levels at the locations of the noise measurement sites will increase.

Station	Loostion	Geographica	al Coordinates	Date of	Site
Station	Location	Latitude	Longitude	Sampling	Classification
AAS 01	Brgy. Malabog, Davao City (Link Road 2)	7°19'20.86"N	125°27'50.68"E	Aug. 01, 2023	В
AAS 02	Brgy. Bantol, Davao City	7°16'38.86"N	125°20'5.49"E	Aug. 02, 2023	А

#### Table 4-27. Noise Sampling Locations and Site Descriptions

Station	Location	Geographic	al Coordinates	Date of	Site
Station	LOCATION	Latitude	Longitude	Sampling	Classification
	(Link Road 2)				
AAS 03	Brgy. New Visayas, Panabo City (Link Road 2)	7°18'1.92"N	125°40'18.88"E	Aug. 03, 2023	В
AAS 04	Brgy. Talomo, Ulas, Davao City (Main Corridor)	7° 3'18.76"N	125°32'42.08"E	Aug. 04, 2023	В
AAS 05	Brgy Poblacion, Sta. Maria (Link Road 3)	6°33'4.54"N	125°28'22.28"E	Aug. 08, 2023	В
AAS 06	Brgy San Antonio, Sta. Maria (Link Road 3)	6°28'22.53"N	125°26'8.69"E	Aug. 09, 2023	А
AAS 07	Brgy Poblacion, Malungon (Link Road 3)	6°22'35.69"N	125°16'32.05"E	Aug. 10, 2023	В
AAS 08	Brgy Lagao, General Santos City (Main Corridor)	6° 7'51.11"N	125°11'56.07"E	Aug. 11, 2023	В
AAS 09	Brgy Kibenton, Impasug-ong (Link Road 1)	8°12'9.81"N	124°58'28.67"E	Aug. 16, 2023	A
AAS 10	Brgy Capt. Bayong, Impasug-ong (Link Road 1)	8°16'11.43"N	125° 0'58.71"E	Aug.16, 2023	В
AAS 11	Brgy Puerto, Cagayan De Oro (Main Corridor)	8°29'57.98"N	124°45'8.23"E	Aug. 17, 2023	В

## Table 4-28. Noise Measurement Results

				Time	
Station	Location	Site Classification	Morning 5AM – 9AM (dB(A))	Daytime 9AM – 6PM (dB(A))	Evening 6PM – 9PM (dB(A))
AAS 01	Brgy Malabog, Davao City (Link Road 2)	В	44.3	56	55.4
AAS 02	Brgy Bantol, Davao City (Link Road 2)	A	41.5	42.4	43.2
AAS 03	Brgy New Visayas, Panabo City (Link Road 2,)	В	58.7	60.5	59.1
AAS 04	Brgy Talomo, Ulas, Davao City (Main Corridor))	В	57	54.2	-
AAS 05	Brgy Poblacion, Sta. Maria (Link Road 3)	В	49.1	55.1	59.1
AAS 06	Brgy San Antonio, Sta. Maria (Link Road 3)	A	51.1	51.1	52.2
AAS 07	Brgy Poblacion, Malungon (Link Road 3)	В	52.3	53.7	53.2
AAS 08	Brgy Lagao, General Santos City	В	-	60.1	-

				Time	
Station	Location	Site Classification	Morning 5AM – 9AM (dB(A))	Daytime 9AM – 6PM (dB(A))	Evening 6PM – 9PM (dB(A))
	(Main Corridor)				
AAS 09	Brgy Kibenton, Impasug- ong (Link Road 1)	А	56.9	57.4	48.3
AAS 10	Brgy Capt. Bayong, Impasug-ong (Link Road 1)	В	49.8	59.1	48
AAS 11	Brgy Puerto, Cagayan De Oro (Main Corridor)	В	-	67.2	-
NPCC C	ategory A Max. Allowable No	ise Level (dBA)	50	55	50
NPCC (	Category B Max. Allowable N	oise Level (dBA)	60	65	60
Notes: 1.	Values in red font exceeded the Ca	at. A or B Maximum Al	lowable Noise Lev	el.	

2. "-" not measured due to constraints in travel time.

**Main Corridor:** In the three (3) sampling sites at the Main Corridor, the site at Brgy. Puerto exceeded the noise limit for the Category B area. Noise generated in the area is due to traffic convergence and the presence of nearby malls.

**Link Road 1:** Between the two sampling sites in Link Road 1, the sampling site at Brgy. Kibenton exceeded the noise limit for Category A. The noise is due to the ongoing sports activity during the noise measurement, which also coincided with the passing of vehicles along Link Road 2.

**Link Road 2:** The noise levels at the three (3) sampling sites along Link Road 2, two as Category B areas and the other as Category A areas, were all within the noise limits of both categories.

**Link Road 3:** The noise level at the Category A sampling site in Link Road 3 exceeded the noise limit for the assessed category, while the noise levels at the two other sites were assessed as Category B. are within the noise limits for that category. The exceedance in noise for the category A area is attributed to the ongoing house construction and passing vehicles during the noise measurement activity.

In summary, noise levels in most sampling sites are within the noise standards for their respective area categories; however, some sampling sites already exceed the noise standards, and it is expected that noise levels are bound to increase during construction and even continue during the operations phase of MTCIP, so measures have to mitigate noise so as not to impact community health.

## 4.5 Historical Climate and Projected Climate Change

## 4.5.1 Historical Climate

**Figure 4-67** shows that the climate in Mindanao's Regions X, XI, and XII is Type 4 based on the Modified Corona's Climate Classification, i.e., rain is evenly distributed throughout the year. It has no dry season. Due to its proximity to the area covered by a Type II climate, Cagayan de Oro City has experienced rainfall during the months of November to January.



Figure 4-67. Climate Map of the Philippines, PAGASA 2007



Figure 4-68. Tropical Cyclones Incidence, Map of the Philippines

In terms of tropical cyclones, the Philippines is a typhoon-prone country, with approximately 20 typhoons entering its area of responsibility each year. Locally known generally as *bagyo*, typhoons regularly form in the Philippine Sea and less regularly in the South China Sea, with the months of June to September being the most active and August being the month with the most activity. As shown in **Figure 4-68**, Region X has a low incidence of typhoon hits, and Regions XI and XII even have a very low incidence of annual typhoon hits.

### **Rainfall and Temperature**

The tabulations on the climatological normals and extremes of PAGASA are provided in the **Annex 17**. It presents the 30-year record (1991–2020) of the climatological normals and extremes of PAGASA synoptic stations at Lumbia Airport in Cagayan de Oro City, Malaybalay City, Davao City, and Gen. Santos City. The tabulations on climatological normals contain, among others, information on wind direction, wind speed, minimum sea level pressure (MSLP), and the number of days with thunderstorms and lightning. The tabulations on climatological extremes contain information such as the dates of occurrences of the extreme temperature, greatest daily rainfall, strongest winds, and sea level pressures. The wettest time of the year averages from June to September, with an average maximum rainfall of 247.3 mm recorded at Lumbia Airport, 319.5 mm from June to August at Malaybalay, 194.8 mm from May to October at Davao City, and 101.9 mm in June, which then diminishes to 99.6 mm in October in Gen. Santos City. The number of rainy days per year in the respective area covered by each synoptic station ranges from 120 to 50 days. **Figure 4-69** and **Figure 4-70** show the average rainfall and maximum and minimum temperature along MTCIP.



Figure 4-69. Average Rainfall along MTCIP



Figure 4-70. Maximum and Minimum Temperature along MTCIP

**Main Corridor:** For the Main Corridor Sections from Sayre Highway to Atugan Bridge, months of June–September are wettest with a maximum rainfall of 220.8 mm, the hottest months are April–May at 33 °C, and the coolest time of the year falls in January at 29.8 °C. An extreme temperature of 36.4 °C was recorded on April 15, 2016.

From Atugan Bridge to the junction of Sayre Highway and Bukidnon-Davao Highway, average rainfall is high during the months of June to August, with maximum rainfall at 319.5mm, while high temperatures (30.7–31.6 °C) prevail during the months of March to May.

For the MC Sections in Region XI, the average rainfall amount from May to October ranges from 166.2 mm to 194.8 mm. The highest temperature during the month of April is 33.1 °C, and the coolest month, which is December, has a temperature of 23.7 °C.

Meanwhile, for MC Sections in Region XII, average rainfall is at a maximum of 101.9 in June and diminishes to 99.6 in October, while the high temperature in April is at 34.3 °C and the lowest temperature in January is at 22.8 °C. The greatest rainfall event recorded was on September 8, 1977, at 189.5 mm, and the hottest temperature recorded was 39.4 °C on April 16, 2016.

**Link Road 1:** Rainfall at Link Road 1, as per the PAGASA Malaybalay Station records, is high during the months of June to August, with maximum rainfall at 319.5mm, while high temperatures (30.7–31.6 °C) prevail during the months of March to May.

**Link Road 2:** Based on PAGASA Davao Synoptic Station records from 1991–2020, the average rainfall amount from May to October covering the area of Link Road 2 ranges from 166.2 mm to 194.8 mm. Extreme rainfall at 242.6 mm was recorded on August 2, 1902. Meanwhile, the highest temperature during the month of April is 33.1 °C, and the coolest month of the year, December, has a temperature of 23.7 °C.

**Link Road 3:** PAGASA Gen. Santos City Synoptic Station Climatological records reflect that for the area of influence covered by Link Road 3, average rainfall is at a maximum of 101.9 mm in June and diminishes to 99.6 mm in October, while the high temperature in April is at 34.3 °C and the lowest temperature in January is at 22.8 °C. The greatest rainfall event recorded was 189.5 mm on September 8, 1977.

## 4.5.2 Projected Climate Change

A 2023 PAGASA Technical Bulletin on Climate Change states that climate change is already being experienced in the Philippines and that heavy daily rainfall will continue to become more frequent. Extreme rainfall is projected to increase in Luzon and the Visayas only, but the number of dry days is expected to increase in all parts of the country in 2020 and 2050.

## 4.5.2.1 Temperature Increase

Observed changes in temperature by DOST-PAGASA indicate an increase of 0.68 °C in the historical (1951–2015) annual mean temperature. Projected changes in temperature indicate continuous warming and an increase by as much as 0.9 °C to 1.9 °C in the country-averaged mean temperature for the moderate emission scenario (RCP4.5) and from 1.2 °C to 2.3 °C for the high emission scenario (RCP 8.5) in the mid-21st century (2036-2065). By the end of the 21st century (2070–2099), temperature change is projected to increase from 1.3 °C to 2.5 °C (RCP 4.5) to as much as 2.5 °C to 4.1 °C (RCP 8.5) in mean temperature relative to the baseline climate.

Figure 4-71 shows the seasonal temperature increase in 2020 and 2050 under medium-range

## emission scenario in Regions 10, 11 and 12.

Table a: Seasonal temperature	increases (in °C) in 2020 and 205	50 under medium-range emission	scenario in provinces in Region 10
	A REAL PROPERTY AND		

	OBSE	RVED BAS	LINE (19	71-2000)	CHAI	VGE in 202	0 (2006	-2035)	CHANGE in 2050 (2036-2065)			
	DJF	MAM	ALL	SON	DJF	MAM	ALL	SON	DJF	MAM	ALL	SON
Region 10												
BUKIDNON	25.1	26.5	25.8	25.7	1.0	1.2	1.2	1.0	1.9	2.3	2.4	2.1
LANAO DEL NORTE	24.4	25.5	25.4	25.2	1.0	1.1	1.0	1.0	1.9	2.2	2.1	1.9
MISAMIS OCCIDENTAL	25.6	26.7	26.6	26.4	1.0	1.1	1.1	1.0	1.9	2.2	2.2	1.9
MISAMIS ORIENTAL	25.4	26.8	26.9	26.5	1.0	1.2	1.2	1.0	1.9	2.3	2.4	2.0
Table a: Seasonal temperatu	re increas	es (in °C) ir	2020 an	d 2050 un	der me	dium-rang	e emis	ion scen	ario in p	provinces i	in Regio	n 11
PROVINCES	OBS	ERVED BA	SELINE (1	971-2000)	СНА	ANGE in 20	20 (200	06-2035)	СНА	NGE in 205	50 (2030	5-2065)
THOUS CONTRACTS	DJ	F MAN	ALL N	SON	DJF	MAM	JJA	SON	DJF	MAM	JJA	SON
Region 11	2.5		<i>a.</i> :	12	~	172	141	10			50	10 <sup>-</sup>
COMPOSTELA VALLEY	26.	7 27.8	27.	6 27.6	0.9	1.1	1.2	1.1	1.9	2.3	2.4	2.1
DAVAO DEL NORTE	26.	7 27.8	27.	4 27.4	0.9	1.1	1.2	1.1	1.9	2.3	2.5	2.1
DAVAO DEL SUR	26.	9 27.8	26.	9 27.1	0.9	1.1	1.1	1.0	1.9	2.2	2.3	2.0
DAVAO ORIENTAL	26.	8 27.8	27.	5 27.6	0.9	1.0	1.1	1.0	1.8	2.0	2.4	2.0
Table a: Seasonal temperatu	re increas	es (in °C) ir	2020 an	d 2050 un	der me	dium-rang	e emis	ion scen	ario in j	orovinces i	in Regio	on 12
	OBSERV	ED BASELI	VE (1971-	2000)	CHANC	GE in 2020	(2006-2	2035)	CHAN	GE in 2050	0 (2036-	2065)
	DJF	MAM	ALL	SON	DJF	MAM	ALL	SON	DJF	MAM	ALL	SON
Region 12	1											
NORTH COTABATO	26.8	27.9	27.0	27.1	1.0	1.3	1.2	1.1	2.1	2.5	2.4	2.1
SARANGANI	27.7	28.4	27.3	27.6	0.9	1.2	1.1	1.0	1.9	2.4	2.2	2.0
SOUTH COTABATO	27.7	28.5	27.4	27.7	1.0	1.2	1.1	1.1	2.0	2.3	2.2	2.1
SULTAN KUDARAT	27.8	28.6	27.6	27.8	1.0	1.2	1.1	1.0	2.0	2.2	2.2	2.0

### Figure 4-71. Seasonal Temperature Increase in 2020 and 2050 under Medium Range Emission Scenario in Regions 10, 11 and 12.

## 4.5.2.2 Rainfall Change

There is an increase in the observed annual and seasonal rainfall associated with extreme rainfall events in many parts of the country. The annual total rainfall (1951–2010) over Central and Western Mindanao has declined, while increasing trends have been observed in other areas, notably the northeastern and southwestern sections of Mindanao, at a rate ranging from 10 mm per decade to as much as 40 mm per decade. Such trends in annual total rainfall are associated with extreme rainfall events.

DOST-PAGASA (2018) projections of changes in rainfall suggest a wide range of future changes. For the RCP 8.5 (high emission) scenario, the driest possible rainfall change could reach beyond 40% reduction in many areas, particularly Mindanao, by the mid-21st century. The wettest possible change could exceed 40% in rainfall, particularly over Luzon, western sections of Visayas, and some parts of Mindanao.

Figure 4-72 and Figure 4-73 show the projected increase in the number of dry days (with dry days defined as those with rainfall less than or equal to 2.5 mm) and the increase in the number of days with extreme rainfall( defined as daily rainfall exceeding 300mm) compared with the observed (baseline) values, respectively.

The MTCIP project sites will be mostly spared from extreme rainfall events, but the surrounding areas near Cagayan de Oro, Davao City, and Gen. Santos City will most likely have an increase in dry spells in the coming years.



Figure 4-72. Current and Projected Number of Dry Days in the Philippines in 2020 and 2050



Figure 4-73. Current and Projected Extreme Rainfall in the Philippines in 2020 and 2050

**Figure 4-74** shows the seasonal rainfall change in 2020 and 2050 under medium-range emission scenario in Regions 10, 11 and 12.

	OBSER	OBSERVED BASELINE (1971-2000)				NGE in 202	20 (2006	-2035)	CHANGE in 2050 (2036-2065)			
	DJF	MAM	JJA	SON	DJF	MAM	ALL	SON	DJF	MAM	JJA	SON
Region 10	12						~	201				0
BUKIDNON	329.7	335.6	653.8	559.5	2.9	-10.3	-4.4	-0.3	-5.1	-13.0	-9.7	-5.8
LANAO DEL NORTE	337.5	350.3	662.5	621.1	9.6	-0.6	-2.2	6.9	2.5	-1.9	1.4	7.1
MISAMIS OCCIDENTAL	392.1	323.4	633.1	728.3	9.1	1.4	-6.1	6.1	5.2	0.3	- <mark>5.1</mark>	4.6
MISAMIS ORIENTAL	442.5	296.0	615.7	581.1	4.6	-10.4	-3.7	2.9	1.8	-17.8	-5.2	-0.1

Table b: Seasonal rainfall change (in %) in 2020 and 2050 under medium-range emission scenario in provinces in Region 10

Table b: Seasonal rainfall change (in %) in 2020 and 2050 under medium-range emission scenario in provinces in Region 11

DROWINCES	OBSER	OBSERVED BASELINE (1971-2000)				GE in 2020	0 (2006	2035)	CHANGE in 2050 (2036-2065)			
PROVINCES	DJF	MAM	JJA	SON	DJF	MAM	ALL	SON	DJF	MAM	ALL	SON
Region 11	14		20	20			19 3	() () () () () () () () () () () () () (			70 S	0
COMPOSTELA VALLEY	748.1	559.0	546.7	586.6	10.2	- <mark>1</mark> 1.3	-2.7	0.3	6.6	-21.9	-6.5	0.0
DAVAO DEL NORTE	637.0	496.5	535.6	556.2	9.2	-12.5	-3.6	-1.5	1.1	-22.2	-7.9	-2.2
DAVAO DEL SUR	288.1	347.1	494.1	442.3	18.1	-9.8	-7.8	-2.4	15.2	-12.0	-12.6	-4.5
DAVAO ORIENTAL	827.3	611.8	540.4	599.2	12.3	-5.7	-4.7	1.2	15.9	-16.1	-9.9	4.9

Table b: Seasonal rainfall change (in %) in 2020 and 2050 under medium-range emission scenario in provinces in Region 12

	OBSER	OBSERVED BASELINE (1971-2000)				NGE in 202	20 (2006-	2035)	CHANGE in 2050 (2036-2065)				
	DJF	MAM	ALL	SON	DJF	MAM	ALL	SON	DJF	MAM	ALL	SON	
Region 12													
NORTH COTABATO	235.4	353.2	572.5	486.0	14. <mark>8</mark>	-5.9	-6.1	1.6	8.1	-4.5	-8.7	-4.2	
SARANGANI	212.3	212.6	333.6	302.5	10.1	-12.1	-9.3	-1.7	15.6	-17.6	-10.4	-5.3	
SOUTH COTABATO	183.3	234.1	402.8	351.7	10.1	-8.7	-12.1	-6.8	8.6	-10.8	-18.0	-14.4	
SULTAN KUDARAT	189.3	311.0	513.1	448.7	6.1	-2.3	-9.2	2.9	7.5	-4.2	-13.6	1.3	

### Figure 4-74. Seasonal Rainfall Change in 2020 and 2050 under Medium Range Emission Scenario in Regions 10, 11 and 12.

**Figure 4-75** shows the frequency of extreme events in 2020 and 2050 under medium-range emission scenario in Regions 10, 11 and 12.

Provinces	Stations	No. of Days w/ Tmax >35 °C		No. of Dry Days			No. of Days w/ Rainfall >300mm			
0.000.00000		OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
BUKIDNON	Malaybalay	26	477	1441	6537	3977	4461	0	1	1
LANAO DEL NORTE	Dipolog	217	2155	4004	7481	5384	5470	0	5	2
MISAMIS ORIENTAL	Cagayan De Oro	383	4539	6180	8251	6413	7060	0	2	0
	Lumbia	106	2012	3759	6495	6290	6580	0	4	1

Table c: Frequency of extreme events in 2020 and 2050 under medium-range emission scenario in provinces in Region 10

Table c: Frequency of extreme events in 2020 and 2050 under medium-range emission scenario in provinces in Region 11

Denvineer	Castions	No. of Days w/ Tmax >35 °C		No. of Dry Days			No. of Days w/ Rainfall >300mm			
Provinces	Stations	OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
DAVAO DEL SUR	Davao	109	2981	5373	7930	4789	5368	0	0	0

Table c: Frequency of extreme events in 2020 and 2050 under medium-range emission scenario in provinces in Region 12

Provinces	Canalisma	No. of Days w/ Tmax >35 °C			No.	of Dry D	ays	No. of Days w/ Rainfall >300mm		
	Stations	OBS	2020	2050	OBS	2020	2050	OBS	2020	2050
SOUTH	General	1207	27/19	6420	8704	7526	8052	0	0	4
COTABATO	Santos	1397	3746	0430	0/04	7520	0032	v	v	( <b>*</b> 1)

## Figure 4-75. Frequency of Extreme Events in 2020 and 2050 under Medium Range Emission Scenario in Regions 10, 11 and 12.

## 4.5.2.3 Sea Level Rise

The sea level has risen by as much as 5.7-7.0 mm/yr over the Philippine Sea based on the satellite observations, double the highest global average rate of 2.8-3.6 mm/yr observed between 1993-2010 (DOST-PAGASA, 2018). Projected changes in sea level indicate it will continue to be slightly larger than the global average. The Philippine coast is naturally exposed to tropical cyclones and storm surges and Cotabato City is one of the four cities most likely to be impacted by intensified storm surges based on percent of area exposed (Dasgupta, Laplante, Murray, & Wheeler, 2009). Strong winds are mostly associated with tropical cyclones, with destructive impacts.

## 4.5.3 Estimated GHG Emission

The primary greenhouse gases (GHG) encompass carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O). These gases trap solar heat to sustain a temperature conducive to life. Nevertheless, human activities, such as the combustion of fossil fuels and deforestation, have intensified the greenhouse effect. The heightened concentration of these gases in the atmosphere contributes to global warming, or climate change.

Human-generated sources of GHG include, but are not limited to, the following:

- Energy
- Deforestation
- Transportation
- Industry
- Wastes
- Agriculture

Among these, transportation, particularly through the combustion of fossil fuels, stands out as a significant contributor to GHG emissions. Consequently, understanding the GHG emission contributions from all types of vehicles traversing national roads, highways, and local roads becomes crucial. Recognizing the impact of vehicle emissions on various road networks is vital for local and international initiatives aimed at addressing climate change, enhancing air quality, and establishing sustainable transportation systems. Accordingly, concerted actions will be taken in key areas, including:

- Climate change mitigation
- Regulatory compliance; and
- Compliance with international commitments

Ambient air monitoring was conducted in various identified sections of the Main Corridors, including the Link Roads of the Project. The analysis considered parameters aligned with the standards outlined in the Philippine Clean Air Act of 1999, or RA 8749, specifically:

- Hydrocarbon
- Carbon Monoxide
- Nitrous Oxide
- Particulate Matters
- Carbon Dioxide
- Sulphur Dioxide
- Lead

 Table 4-29 presents a comprehensive overview of the findings. Among the listed gaseous

pollutants from vehicle emissions, hydrocarbons, carbon monoxide, nitrous oxide, and carbon dioxide are considered GHGs.

Vehicle	Hydrocarbon	Carbon Monoxide	Nitrous Oxide	Particulates	Carbon Dioxide	Sulfur Dioxide	Lead
Link Road '	1						
Car	116.40	970.01	393.37	0.97	28,957.70	9.70	3.91
Jeepneys	2.28	17.24	41.25	0.37	8,892.92	2.80	1.13
Pick- up/Van	294.19	2,451.58	1,097.71	2.45	73,186.74	24.52	9.87
Mini Bus	0	0	0	0	0	0	0
Big Bus	0	0	0	0	0	0	0
Truck 1	0	0	0	0	0	0	0
Truck 2	91.26	182.52	61.60	7.30	6,536.47	22.82	0
3-Axle Heavy Truck	0	0	0	0	0	0	0
4-Axle Heavy Truck	0	0	0	0	0	0	0
Motorcycle	3,658.41	12,194.69	1,219.47	6.09	162,548.50	60.97	24.56

#### Table 4-29. Estimated Gaseous Emissions of the Project

Vehicle	Hydrocarbo n	Carbon Monoxid e	Nitrous Oxide	Particulate s	Carbon Dioxide	Sulfur Dioxide	Lea d
Link Road	2						
Car	127.04	1,058.64	318.04	1.06	31,603.30	10.59	4.26
Jeepneys	3.51	26.39	84.58	0.86	20,452.67	6.44	2.59
Pick- up/Van	285.55	2,379.56	916.52	2.38	71,036.57	23.80	9.58
Mini Bus	0	0	0	0	0	0	0
Big Bus	0	0	0	0	0	0	0
Truck 1	1,266.95	2,533.91	855.19	101.36	90,743.58	316.74	0
Truck 2	116.68	233.36	78.76	9.33	8,356.98	29.17	0
3-Axle Heavy Truck	14,335.14	28,670.28	9,676.2 2	1,146.81	1,026,732.5 5	3,583.7 8	0
4-Axle Heavy Truck	0	0	0	0	0	0	0
Motorcycl e	913.83	499.97	168.74	20	17,904.95	62.50	0

Vehicle	Hydrocarbon	Carbon Monoxide	Nitrous Oxide	Particulates	Carbon Dioxide	Sulfur Dioxide	Lead
Link Road 3	3						
Car	60.6	500.49	219.61	0.50	14,940.94	5	2.02
Jeepneys	0	0	0	0	0	0	0
Pick- up/Van	23.45	195.39	91.79	0.20	5,832.89	1.95	0.79
Mini Bus	0	0	0	0	0	0	0
Big Bus	314.44	628.88	212.25	25.16	22,521.24	78.61	0
Truck 1	224.65	449.390	151.64	17.97	16,090.11	56.16	0
Truck 2	0	0	0	0	0	0	0

Vehicle	Hydrocarbon	Carbon Monoxide	Nitrous Oxide	Particulates	Carbon Dioxide	Sulfur Dioxide	Lead
3-Axle	0	0	0	0	0	0	0
Truck	0	0	0	0	0	0	0
4-Axle	0	0	0	0	0	0	0
Truck	0	0	0	0	0	0	0
Motorcycle	73.24	244.15	24.41	0.12	3,254.34	1.22	0.49

Vehicle	Hydrocarbo n	Carbon Monoxide	Nitrous Oxide	Particulate s	Carbon Dioxide	Sulfur Dioxide	Lead
Main Corri	dor Section 1						
Car	30,691.58	255,763.3 2	106,922.1 4	255.79	7,635,270.5 6	2,557.63	1,030.0 6
Jeepneys	1,150.04	8,659.33	14,879.98	128.73	3,049,547.5 3	963.60	388.10
Pick- up/Van	16,860.39	140,503.4 2	63,931.45	140.51	4,194,431.1 7	1,405.03	565.87
Mini Bus	0	0	0	0	0	0	0
Big Bus	15,265.20	1,545.90	521.74	61.84	55,361.43	193.24	0
Truck 1	1,461.45	30,530.41	10,304.01	1,221.22	1,093,346.8 9	3,816.30	0
Truck 2	20,526.52	2,922.90	986.48	116.92	104,674.13	365.36	0
3-Axle Heavy Truck	68,162.52	41,053.03	13,855.40	1,642.12	1,470,180.1 9	5,131.63	0
4-Axle Heavy Truck	0	136,325.0 3	46,009.70	5,453	4,882,036.3 7	17,040.6 3	0
Motorcycl e	80,228.80	0	0	0	0	0	0

Vehicle	Hydrocarbon	Carbon Monoxide	Nitrous Oxide	Particulates	Carbon Dioxide	Sulfur Dioxide	Lead
Main Corri	dor Section 2						
Car	33,261.92	277,182.64	82,401.22	277.16	8,274,699.80	2,771.85	1,116.35
Jeepneys	598.03	4,499.46	14,457.65	147.19	3,497,147.62	1,101.60	443.68
Pick- up/Van	19,749.77	164,581.59	62,921.28	164.59	4,913,234.17	1,645.83	662.84
Mini Bus	0	0	0	0	0	0	0
Big Bus	87,949.25	175,898.50	59,365.75	7,035.95	6,299,230.89	21,987.33	0
Truck 1	1,364.80	2,729.60	921.24	109.18	97,751.64	341.20	0
Truck 2	19,718.11	39,436.21	13,309.72	1,577.44	1,412,279,14	4,929.53	0
3-Axle							0
Heavy Truck	88,596.77	177,193.54	59,802.82	7,087.74	6,345,608,28	22,149.19	
4-Axle	0	0	0	0	0	0	0
Heavy							
Truck							
Motorcycle	50,282.49	167,608.10	16,760.85	83.81	2,234,123.66	838.06	337.52

## 4.6 People

The baseline social profile was generated using a review of existing secondary information on the communities covered by the MTCIP as well as an actual count of the structures that are projected to be affected by the construction and operation of the MTCIP. A description of the pre-project social conditions is made, taking into consideration sensitive receptors (such as ancestral domains, schools, and livelihood sources) within the impact zone of the project.

## 4.6.1 Land Ownership

For the Main Corridor, 32 percent of the area is classified as public roads, easements, water bodies, and floodways. Hence, this proportion of the Main Corridor is owned by the state. The rest is classified as alienable and disposable, or lands that are privately owned either by individuals or by corporations. However, a portion of the Municipalities of Quezon and Kitaotao in Bukidnon, as well as Arakan in Cotabato, are within the CADT of the Matigsalug-Manobo Tribe. Within the northern part of Davao City, the CADT area of the Obu-Manuvu Tribe is traversed by the Main Corridor alignment.

On Link Road 1, the alignment traverses Barangays Capitan Bayong, Cawayan, and Kibenton in the Municipality of Impasug-ong. The lands are covered by the Comprehensive Agrarian Reform Program (CARP), which awarded a Certificate of Land Ownership Agreement (CLOA) to members of farmer's cooperatives. Hence, land ownership in Link Road 1 is mainly held by agrarian reform beneficiaries.

While on Link Road 2, Barangays Salay, Malamba, Bantol, Paquibato, Malabog, and Mabhuhay on the Davao City side of Link Road 2 are recognized as ancestral lands of the Matigsalog cultural communities. The indigenous people's group is the recognized claimant of the ancestral lands. It is legally equivalent to "ownership" of the lands, as provided for by the Indigenous Peoples Rights Act (IPRA).

About 90% of the Link Road 2 barangays (Datu Abdul, Katipunan, Cacao, Kauswagan, Consolacion, Malativas, Little Panay, New Visayas, Gredu/Poblacion, and New Pandan) on the Panabo City side are classified as alienable and disposable lands (privately owned), and 10% are classified as public roads and easements.

On Link Road 3, Barangay Poblacion, Upper Mainit, San Miguel, San Roque, and Kinabalan in the Municipality of Malungon, Sarangani Province, and Barangays Sta. Maria Poblacion, San Isidro, Pongpong, San Antonio, and Datu Intan in Sta. Maria Municipality, Davao Occidental Province, are recognized ancestral domain of the Tagakaulo cultural communities by virtue of the Certificate of Ancestral Domain Title (CADT) in the name of the community.

## 4.6.2 LGUs Covered by the MTCIP

MTCIP will traverse 189 barangays, 13 municipalities, and the highly urbanized cities of Cagayan de Oro, Davao, and General Santos, along with seven cities, seven provinces (Misamis Oriental, Bukidnon, Davao del Norte, Davao del Sur, Davao Occidental, Sarangani, and South Cotabato), and three regions (Region X Northern Mindanao, Region XI Davao Region, and Region XII SOCCSKSARGEN). **Table 4-30** presents the summary of LGUs covered by the MTCIP. The full list is provided in **Annex 18**. **Table 4-31** presents the population, gender, and household data in the study area.

Region	Province/Highly Urbanized City	Land Area (sq km)	Number of Municipalities	Number of Cities	Number of Barangays
Region X	Cagayan de Oro City, Misamis Oriental	412.8	-	1	1
	Bukidnon	10,498.59	6	2	66

#### Table 4-30. LGUs covered by MTCIP

Region	Province/Highly Urbanized City	Land Area (sq km)	Number of Municipalities	Number of Cities	Number of Barangays
Region	Davao del Norte	3,422.61	0	1	15
XI	Davao del Sur	2,163.98	5	1	38
	Davao City, Davao del Sur	943.48	-	1	41
	Davao Occidental	2,163.45	1	0	5
Region	Sarangani	3,642.16	1	0	13
XII	General Santos City, South Cotabato	492.86	-	-	10
Total	7		13	7	189
Source: P	SA 2022 RSET Regions X, XI, XII				

## Table 4-31. Regional and Provincial Population, Gender, No. of Households, Average Family Size in MTCIP Area along MTCIP area

Administrative Unit	Total	Ger	nder	Number of	Average
	Population	Male	Female	nouseholds	household size
REGION X NORTHERN MINDANAO	5,022,768	2,554,944	2,452,854	1,197,736	4.2
Misamis Oriental (excluding Cagayan de Oro)	956,900	489,483	465,470	230,233	4.1
Cagayan de Oro City	728,402	364,706	358,965	190,225	3.8
Bukidnon	1,541,308	798,063	738,973	308,777	4.3
Impasug-ong	53,863	28,257	25,015	11,843	4.5
Malaybalay City	190,712	97,324	91,724	43,839	4.3
Maramag City	108,293	55,782	52,364	25,571	4.2
Kitaotao	53,796	28,074	25,719	12,835	4.2
Quezon	109,624	56,809	52,731	25,067	4.4
Valencia City	216,546	111,656	104,742	52,184	4.1
REGION XI DAVAO REGION	5,243,536	2,370,078	2,873,458	1,337,781	3.9
Davao del Norte	1,125,057			271,655	4.0
City of Panabo	209,230			51,097	4.1
Davao del Sur	680,481			182,681	3.7
Santa Cruz	101,125			26,424	3.8
Digos City	188,376			47,948	3.9
Padada	29,878			7,925	3.8
Hagonoy	56,919			14,634	3.9
Sulop	35,151			9,623	3.7
Malalag	40,158			11,519	3.5
Davao City	1,776,949			476,278	3.7
Davao Occidental	317,159			78,185	4.1
Sta. Maria	57,526			14,706	3.9
REGION XII SOCCSKSARGEN	4,360,974	2,093,268	2,267,706	1,065,453	4.1
Sarangani	558,946			133,865	4.2
General Santos City	697,315			175,345	4.0
Malungon	105,465			25,809	4.1
Source: Philippine Statisti	ics Authority, 20	20 Census of I	Population		

#### 4.6.3 Ethnicity

Within these communities, the presence of Indigenous Cultural Communities (ICCs) is observed, especially within the area traversed by the link roads. The ICCs account for 30%

Higa-onon on Link Road 1, 98% composed of Matigsalog and Islamized Ethnic Group (Kagan/Kalagan) on Link Road 2, and 98% Tagakaulo on Link Road 3.

Link Road 1 is predominantly inhabited by the Higa-onon tribal community, which represents 30% of the total population in the three barangays traversed by Link Road 1. Notably, this road lies outside the recognized ancestral domain of the Higa-onon community, with houses situated within municipal or barangay-zoned built-up areas.

Link Road 2 passes through the ancestral domain of the Matigsalog communities in the Marilog and Paquibato districts of Davao City. Additionally, Kagan and Kalagan communities have opted to settle in vacant land spaces alongside this road, categorizing them as informal settlers' families (ISF), with over 200 families constructing structures along this link road.

Link Road 3 cuts through barangays within the recognized ancestral lands of the Tagakaolo cultural communities, covering a distance exceeding 50 kilometers and traversing residential and agricultural areas of the Tagakaolo indigenous people. Maguindanaons also constitute informal settlers' families along this road. The barangay government in Link Road 3 permits Kagan/Kalagan to occupy public lands used as built-up areas, while some act as tenants on agricultural lands owned by medium- to commercial-scale agricultural producers. **Table 4-32**, **Table 4-33**, and **Table 4-34** presents the ethnic household population in the study area.



Plate 4-17. Typical Tagakaulo housing unit (Link Road 3) in Sitio Upper Lilan, Brgy. San Miguel, Malungon, Sarangani Province



Plate 4-18. Higa-onon Community Learns about MTCIP (Link Road 1) in Impasug-ong, Bukidnon Province

Table 4-32. Ethnic Household Population (Main Corridor and Link Roads	b) of Region X
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	Population					
Ethnic group	Region X	Bukidnon	Misamis Oriental	Cagayan de Oro City		
Bukidnon	62,815	61,475	427	428		
Higaonon	409,357	241,691	143,494	66,466		
Maguindanao	11,510	10,709	75	174		
Manobo	41,632	39,291	1,132	815		
Manobo-Pulanguihon	9,504	9,497	2	1		
Maranao	397,810	7,640	6,920	15,791		
Matigsalog	29,299	29,256	13	14		
Talaandig	100,455	99,700	345	364		
Tigwahanon	14,595	14,564	13	14		
Umayamnon	7,238	7,140	18	10		
Source: Ethnicity Statistical Tabl	Source: Ethnicity Statistical Table PSA 2020, Region X					

## Table 4-33. Ethnic Household Population (Main Corridor and Link Roads) of Region XI

			Population		
Ethnic group	Region XI	Davao City	Davao del Sur	Davao del Norte	Davao Occidental
Ata	25,875	17,285	65	8,176	7
Ata-Manobo	31,200	1,430	16	29,502	1
Blaan	113,167	7,606	33,675	2,068	68,451
Bagobo	51,160	21,064	20,069	5,813	218
Bagobo-Klata	17,932	17,693	104	77	7
Bagobo-Tagabawa	32,162	12,417	19,421	231	28
Kagan/Kalagan	84,488	16,799	9,928	14,481	1,955
Mandaya	412,150	37,021	2,854	51,066	317
Mansaka	75,879	1,774	307	10,415	13
Manobo	137,723	13,668	3,941	15,084	78,806
Obu-Manuvu	16,416	16,355	22	28	None
Maranao	33,818	18,545	4,288	5,910	672

			Population		
Ethnic group	Region XI	Davao City	Davao del Sur	Davao del Norte	Davao Occidental
Matigsalog	11,557	10,889	38	296	13
Sama/Samal	36,122	4,474	2,2,51	28,299	167
Tagakaulo	108,532	5,784	13,695	1,575	86,318
Tausug	40,410	18,906	5,382	4,660	4,487
Source: Ethnicity Statistic	cal Table PSA 202	20, Region XI			

Table 4-34.	Ethnic Hou	sehold Popu	lation (Main	Corridor and	d Link Roads	) of Region XII
						/ 01 10091011 /01

Ethnia Graun		Populatio	n
Ethnic Group	Region XII	Sarangani	General Santos City
B'laan	257,971	138,087	35,874
Maguindanaoan	580,770	41,516	40,073
Manobo	91,189	6,788	6,144
Maranao	25,959	996	10,065
Sangir/Sangil	10,898	7,073	3,558
Tagakaulo	42,462	31,149	4,321
Tausug	17,871	3,427	6,877
Tboli	176,555	37,254	3,195
Source: Ethnicity Statistical T	able PSA 2020, Regio	n XII.	

### Figure 4-76 shows the CADT areas traversed by Main Corridor and Link Roads of MTCIP.



Figure 4-76. Certificate of Ancestral Domain Titles

## 4.6.4 Poverty Incidence

Poverty incidence among the MTCIP provinces is highest in Davao Occidental, at 43.4% and in Sarangani Province, at 41.1%. Even with the higher annual per capita poverty threshold, the poverty incidence is least in the highly urbanized cities of Davao City (7.7%), Cagayan de Oro (9.1%), and General Santos (14.1%). **Table 4-35** presents the poverty threshold and incidence.

Region Province	Annual per Capita Poverty Threshold (pesos)	Poverty Incidence Among Population (%)
REGION X Northern Mindanao	28,836	26.1
Cagayan de Oro City	24,414	9.1
Misamis Oriental	24,018	21.1
Bukidnon	24,835	23.1
REGION XI Davao Region	28,102	16.8
Davao City	30,138	7.7
Davao del Norte	27,354	10.6
Davao Occidental	28,511	43.4
Davao del Sur	29,749	10.4
REGION XII SOCCSKSARGEN	26,443	28.1
General Santos City	24,930	14.1
Sarangani	24,070	41.1
Source: PSA 2022 RSFT Regions X.	XI, XII: Family Income and Expenditure	Survey 2021

Table 4-35. Poverty Threshold and Incidence, by Province and Highly Urbanized City, 2021

## 4.6.5 Dependency Ratio

The age dependency ratio is highest in Davao Occidental (69.0%), where every 100 persons of working age has to support 63 young dependents and six old dependents. In contrast, the dependency ratio is lowest in Cagayan de Oro City, at 50.2%. The dependency ratio is 66, the second highest in the MTCIP area, after Davao Occidental. **Table 4-36** presents the age dependency ratio.

Table 4-36. Age Dependency Ratio of the Household Population, by Province/City, 2015

Region Province	Dependency ratio	Child/Youth Dependency	Old-Age Dependency	
REGION X	62.9	55.8	7.1	
Northern Mindanao				
Cagayan de Oro City	50.2	44.4	5.8	
Misamis Oriental	63.8	55.9	7.8	
Bukidnon	67.2	56.0	5.8	
REGION XI	58.0	51.0	7.0	
Davao Region	56.6	51.0	7.0	
Davao City	52	46.0	6.0	
Davao del Norte	57.0	50.0	7.0	
Davao Occidental	69.0	63.0	6.0	
Davao del Sur	54.0	47.0	7.0	
REGION XII SOCCSKSARGEN	61.0	55.0	6.0	
General Santos City	54.0	48.0	5.0	
Sarangani	66.0	60.0	6.0	
Source: PSA RSET 2020; https://www.philatlas.com, October 2023				



Plate 4-19. Children in Sitio Bantalaan, Brgy. San Miguel, Malungon, Sarangani Province

### 4.6.6 Public Health

The leading causes of morbidity in the MTCIP area are pneumonia, acute upper respiratory infections, hypertensive diseases, bronchitis, and diseases of the urinary system. The leading causes of mortality are pneumonia, cancer, cardiovascular diseases, cerebrovascular diseases, hypertensive diseases, and diabetes mellitus. **Table 4-37** presents the leading causes of morbidity and mortality by region.

Region	Causes of Morbidity	Causes of Mortality	Number of Deaths (Per 100,000 Population)
REGION X	Pneumonia	Pneumonia Cancer, All Forms	1,315
Northern	Bronchitis/Bronchiolitis	Cardiovascular Diseases	1,337
Mindanao	Diarrhea	Hypertensive Cardiovascular	377
	Influenza Hypertension	Disease	611
		Hypertension	555
REGION XI	Acute Upper	Diseases of the Heart	2,370
Davao Region	Respiratory Infection	Cerebrovascular Diseases	1,784
	Pneumonia	Hypertensive Diseases Diabetes	1,158
	Hypertensive Diseases	Mellitus Pneumonia	1,070
	Other Disease of		948
	Urinary System		
	Diarrhea &		
	Gastroenteritis		
REGION XII	Pneumonia	Hypertensive Diseases Diabetes	2,012
SOCCSKSARGEN	Hypertensive Diseases	Mellitus Pneumonia	1,100
	Other Disease of		1,009
	Urinary System		
	Diarrhea &		
	Gastroenteritis		
Source: Department of	Health		

Table 4-37. Leading Causes of Morbidity and Mortality	by	Region
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## 4.6.7 Educational Attainment

About 37% of the population in the three project regions completed some elementary

education, while 35% had some or completed secondary education. Only 19% had some or completed tertiary education. About 4% of the population had no grade completed. **Table 4-38** presents the population by highest educational attainment by region.

The number of public and private elementary and secondary schools in Northern Mindanao, Davao Region, and SOCCSKSARGEN, as shown in **Table 4-39** suggests that there are enough to serve the school-going population. The public consultations and focus group discussions conducted for MTCIP, however, reveal stories of schoolchildren in remote areas struggling to reach the schools, often going by foot because public transport is either unavailable or costly.

Highest grade	Total population 5 years old and over			
completed	Northern Mindanao	Davao Region	SOCCSKSARGEN	
No grade completed	159,007	137,909	243,095	
Pre-school	125,209	133,978	125,443	
Special education	1,467	1,557	616	
Elementary	1,572,019	1,620,132	1,530,691	
1 <sup>st</sup> to 4 <sup>th</sup> grade	840,910	836,535	832,668	
5 <sup>th</sup> to 6 <sup>th</sup> grade	274,476	278,661	290,032	
Graduate	456,633	504,936	407,991	
Secondary	1,446,286	1,569,919	1,369,431	
Undergraduate	667,577	708,274	618,665	
Graduate	778,709	861,645	750,766	
Tertiary	829,047	878,654	730,768	
Undergraduate	397,052	436,722	351,637	
Graduate	431,995	441,932	379,131	
Post-graduate	6,211	6,038	5,158	
Source: Census of Population 2015				

Table 4-38. Population by Highest Educational Attainment by Region, 2015

Table 4-39. Number of Public and Private Schools, by Region and Level of Education,	SY 2020-
2021	

Level of education	Northern Mindanao	Davao Region	SOCCSKSARGEN	
Elementary	2,612	2,180	2,148	
Public	2,161	1,736	1,827	
Private	451	444	321	
Junior high school	860	817	823	
Public	583	576	628	
Private	277	241	195	
Senior high school	606	595	582	
Public	360	368	404	
Private	246	227	178	
Source: Department of Education				



Plate 4-20. Pongpong Elementary School, in Brgy. Pongpong, Santa Maria, Davao Occidental (Link Road 3)

## 4.6.8 Income and Employment

Among the three project regions, the labor force participation rate (LFPR) is lowest in SOCCSKSARGEN (57.4%) and highest in Northern Mindanao (69.8%). Among the provinces, Bukidnon has the highest LFPR, at 78.3%, and Davao Occidental has the lowest, at 56.6%.

In terms of the employment rate, the three regions vary considerably: the employment rate is 78.8% in SOCCSKSARGEN, 88.9% in Northern Mindanao, and 95.2% in Davao Region.

The services sector remains the biggest employer in the three project regions, followed by agriculture, and then industry, including manufacturing. When disaggregated by major industry group, the number of employed persons is highest in agriculture, hunting and forestry (2,183,000). The second biggest employer is wholesale and retail trade, including repair of motor vehicles and motorcycles, which employs 1,394,000 persons. **Table 4-40**, **Table 4-41**, and **Table 4-42** present the labor force participation by Region. **Table 4-43** and **Table 4-44** present the employed persons by region.

Table 4-40. Labor Force Participation, Region A Northern Minualiao, by Province					
Employment status	Region X	Bukidnon	Misamis Oriental	Cagayan de Oro City	
Population in the labor force	2,410,000	808,000	477,000	326,000	
Labor force participation rate	69.8%	78.3%	71.3%	62.8%	
Employed	2,007,000	779,000	456,000	295,000	
Employment rate	88.9%	96.5%	95.5%	90.7%	
Source: PSA CY 2021 RSET X. Labor Force Survey 2021					

Table 4-40. Labor Force Participation, Region X Northern Mindanao, by Province

Table 4-41. Labor Force Partic	ipation, Region )	XI Davao Region, k	by Province
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Employment status	Region XI	Davao City	Davao del Sur	Davao del Norte	Davao Occidental
Population in the labor force	2,219,000	809,000	288,000	460,000	130,000
Labor force participation rate	60.9%	63.5%	59.3%	63.2%	56.6%
Employed	2,113,000	758,000	279,000	442,000	125,000
Employment rate	95.2%	93.7%	96.8%	96.0%	96.0%
Source: PSA CY 2021 RSET XI, Labor Force Survey 2021					

#### Table 4-42. Labor force participation, Region XII SOCCSKSARGEN, by Province

Employment status	Region XII	Sarangani	General Santos City		
Population in the labor force	1,855,000	266,000	292,000		
Labor force participation rate	57.4%	68.9%	66.4%		
Employed	2,547,000	256,000	263,000		
Employment rate	78.8%	95.9%	90.0%		
Source: PSA CY 2021 RSET XII. Labor Force Survey 2021					

#### Table 4-43. Employment by sector, by region

Conton	Employment level				
Sector	Region X	Region XI	Region XII		
Agriculture	811,000	523,000	108,000		
	(42.26%)	(27.7%)	(22.6%)		
Industry /Manufacturing	102,000	306,000	84,000		
	(5.5%)	(16.24%)	(16.24%)		
Services	1,006,000	1,055,000	287,000		
	(52.42%)	(55.99%)	(55.99%)		
Source: PSA 2021 RSET, Labor Force Survey 2021					

#### Table 4-44. Employed persons by major industry group, by region, 2021

Industry group	Northern Mindanao	Davao Region	SOCCSKSARGEN
Agriculture, hunting, forestry	796,000	586,000	801,000
Fishing and aquaculture	50,000	45,000	84,000
Mining and quarrying	6,000	21,000	4,000
Manufacturing	115,000	112,000	125,000
Electricity, gas, steam and air conditioning supply	4,000	3,000	1,000
Water supply, sewerage, waste management	3,000	4,000	1,000
Construction	202,000	178,000	119,000
Wholesale and retail trade; repair of motor vehicles and motorcycles	475,000	479,000	440,000
Transportation and storage	135,000	148,000	127,000
Accommodation and food service activities	51,000	57,000	40,000
Information and communication	19,000	12,000	8,000
Financial and insurance activities	26,000	25,000	20,000
Real estate activities	4,000	11,000	2,000
Professional, scientific and technical activities	8,000	11,000	10,000
Administrative and support service activities	45,000	85,000	37,000
Public administration and defense	140,000	131,000	111,000
Education	72,000	70,000	65,000
Human health and social work activities	23,000	26,000	28,000
Arts, entertainment, recreation	7,000	13,000	7,000
Other service activities	110,000	97,000	85,000
Source: Philippine Statistical Yearbook 2022			

## 4.6.9 Agricultural Production

Bukidnon Province is the leading producer of palay, corn, and pineapple, which are delivered to local and international markets. Davao del Norte Province is the biggest producer of banana, which is also consumed locally and internationally. **Table 4-45** presents the agricultural production by major crop by region.

Ŭ	Pala	ay	Cor	n	Banai	าล	Pineap	ple
Region Province	Volume (tons)	Market	Volume (tons)	Market	Volume (tons)	Market	Volume (tons)	Market
REGION X Northern Mindanao	781,825	Local Intl	1338,165	Local Intl	1,977,157	Local Intl	1,541,643	Local Intl
Cagayan de Oro City								
Misamis Oriental	24,224	Local Intl	114,164	Local Intl	216,755	Local Intl	68,879	Local Intl
Bukidnon	484,698	Local Intl	855,672	Local Intl	1,397,155	Local Intl	1,471,925	Local Intl
REGION XI Davao Region	446,764	Local Intl	261,923	Local Intl	3,349,576	Local Intl	27,618	Local Intl
Davao City	No Data	NA	No Data	Local Intl	299,932	Local Intl	3,126	Local Intl
Davao del Norte	124,933	Local Intl	69,930	Local Intl	1,476,464	Local Intl	180	Local Intl
Davao Occidental	2,365	Local Intl	45,764	Local Intl	165,261	Local Intl	1,752	Local Intl
Davao del Sur	29,071	Local Intl	40,956	Local Intl	443,248	Local Intl	3,260	Local Intl
REGION XII SOCCSKSARGEN		Local Intl		Local Intl		Local Intl		Local Intl
General Santos City								
Sarangani		Local Intl		Local Intl		Local Intl		Local Intl

#### Table 4-45. Agricultural Production by Major Crop, by Region and Province



Plate 4-21. Large Scale Banana Plantation (Sumifru firm) in Link Road 1 of Brgy. Capitan Bayong, Impasug- ong, Bukidnon Province



Plate 4-22. Pineapple Plantation in Brgy. Cawayan, Impasug-ong, Bukidnon Province (Link Road 1)



Plate 4-23. Cassava and Banana Farms in Link Road 2 in Brgy. Bantol, Davao

### 4.6.10 Transportation

The primary mode of transportation for the residents of Sta. Maria along Link Road 3 was habal-habal, or skylab, allowing them to traverse both paved and unpaved roads. These modes were primarily used for transporting goods and passengers.



Plate 4-24. Habal-Habal Users in Santa Maria, Davao Occidental

## 4.6.11 Traffic

Traffic surveys were conducted in order to characterize the vehicle traffic characteristics within the MTCIP. The categorized traffic volume count and speed survey provide insights on the peak hours and number of users on the different roads of the project, and the speed survey gives an indication of the efficiency of travel along these roads. These were conducted based on these activities. The manual classification of vehicle counts for intersections (IC) was undertaken for three consecutive days over a period of 14 continuous hours. The recording of data during the survey was every 15 minutes. The summary and consolidation of data are done every 15 minutes for intersection counts. This method was used for the Main Corridor, Link Road 2, and Link Road 3. Survey locations are presented in **Table 4-46** and **Figure 4-77**.

For LR1, a moving observer count (MOC) was undertaken to get an indicative composition of the vehicle fleet and corresponding volumes for Link Road 1. The MOC method is a traffic survey tool that is conducted along a project road that lasts at least one hour, utilizing a moving vehicle. The different types of vehicles to be counted are put into three different categories: (a) vehicles traveling in the opposite direction (x); (b) vehicles overtaking the observer (y); and (c) vehicles overtaken by the observer (z).

No.	Station	Location
1	А	Barangay Puerto, Cagayan De Oro City, Misamis Oriental
2	В	Barangay Ala-e, Manolo Fortich, Bukidnon
3	С	Barangay Tankulan, Manolo Fortich, Bukidnon
4	D	Barangay Dalwangan, Malaybalay City, Bukidnon
5	E	Barangay San Jose, Malaybalay City, Bukidnon
6	E-1	Barangay Aglayan, Malaybalay City, Bukidnon
7	F	Barangay Mailag, Valencia City, Bukidnon
8	G	Barangay Dologon, Maramag, Bukidnon
9	Н	Barangay Dologon, Maramag, Bukidnon
10	H-1	Barangay Poblacion 2, Camp One, Maramag, Bukidnon
11	1	Barangay Butong, Quezon, Bukidnon
12	J	Barangay Talomo Proper, Davao City, Davao del Sur
13	К	Barangay Toril, Davao City, Davao del Sur
14	L	Barangay Cogon, Digos City, Davao del Sur
15	LR-1	Barangay New Visayas, Panabo, Davao del Norte
16	LR-2	Barangay Malabog, Davao City, Davao Del Sur
17	LR-3	Barangay Poblacion, Sta. Maria, Davao Del Sur
18	LR-4	Barangay Poblacion, Malungon, Sarangani
19	Μ	Barangay San Jose, Digos City, Davao del Sur
20	N	Barangay Katangawan, General Santos City, South Cotabato
21	0	Barangay Labangal, General Santos City, South Cotabato

Table 4-46. Lo	ocation of 1	Traffic Surveys
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Figure 4-77. Map of traffic survey locations in the Main Corridor and Link Roads

## 4.6.11.1 Classified Traffic Volume Count

**Main Corridor:** The results of the classified volume count in the Main Corridor reveal that for the northbound (to Cagayan de Oro City), peak hours of traffic occur at 7:00–8:00 and 17:00–18:00; the same were observed for the southbound (to General Santos City). The overwhelming majority of traffic was from passenger cars and motorcycles, accounting for 41.2% and 35.2%, respectively, on the northbound, while on the southbound, it was 38.3% and 37.7%, respectively.

**Link Road 1:** The peak time for traffic is in the morning for this Link Road. With the dominant vehicle is motorcycle at 69.01% and pick-up for goods at 13.38% from Sayre Highway-Cawayan-Kibenton-Sayre Highway direction. In the opposite direction, motorcycles account for 68.81% of the traffic while pick-up for goods comprise 13.76%.

**Link Road 2:** The peak hour for this alignment is at 7:00–8:00 and 17:00–18:00 for both north and south-bound directions. The predominant vehicles are motorcycles and tricycles, accounting for 56.2% and 21%, respectively, in the northbound direction, while in the southbound it comprises 56.9% and 21.2% of the traffic, respectively.

**Link Road 3:** The peak hour for this link road is also at 7:00–8:00 and 17:00–18:00, like the other roads in the MTCIP. Its vehicular traffic is mostly composed of motorcycles and tricycles in both north and southbound directions. These two types of vehicles account for 71.11% and 20.4%, respectively, of the traffic on the northbound, and on the southbound, it is 37.2% for motorcycles and 22.7% for tricycles.

## 4.6.11.2 <u>Speed Survey</u>

**Main Corridor:** From point to point of the surveyed stations within the Main Corridor, the average speeds range from 59.58 kph to 20.79 kph and 60.65 kph to 21.92 kph for peak hours during the weekdays and weekends, respectively. On non-peak hours of the same days, the average speeds of vehicles are 68.33 kph–24.12 kph and 70.03 kph–28.55 kph, respectively.

**Link Road 2:** The average speeds of vehicles during peak hours between the two station points along this link road range from 37.9 kph to 36.29 kph and 38.71 kph to 29.03 kph during weekdays and weekends, respectively. During non-peak hours, this rises to 39.81–41.05 kph and 39.49–34.81 kph on the same days of the week.

**Link Road 3:** In Link Road 3, the road connecting the two survey stations has not yet been completely established; there is a section with an existing alignment, but the road is inaccessible on the ground.

## 5. ENVIRONMENTAL AND SOCIAL IMPACTS AND MITIGATING MEASURES

## 5.1 Introduction

As mentioned in the Introduction section, this ESIA aims to systematically identify, analyze, and evaluate all anticipated environmental and social impacts of the proposed MTCIP. The results of the assessment will be used as a basis for improving the project design and identifying measures that can be implemented to minimize, if not totally prevent, the potential adverse social and environmental impacts of the Project.

## 5.2 Assessment of Risks/Impacts

The risk/impact assessment methodology adopted for MTCIP includes the following:

- Defining the nature of the impact, whether positive or negative, change to the baseline; and
- Assessing the risk or significance of the impact as a function of the consequence or magnitude of the impact and the likelihood of its occurrence. It is widely accepted that impact magnitude (or severity) is a function of the extent, duration, and intensity of the impact.
- Those identified as having significant impacts based on their magnitude and likelihood will be formulated with the corresponding mitigation measures in accordance with the World Bank mitigation hierarchy (avoid a possible mitigation, mitigate, reduce, minimize, compensate, and/or offset).

**Table 5-1** presents the summary of the impact assessment for the pre-construction, construction, demobilization, and operational phases of the proposed MTCIP. The environmental risk assessment is provided in **Annex 19**.

## Table 5-1. Summary of Impact Assessment for the MTCIP

Project Phase / Activities	Environmental Component(s)	Potential Impact(s) before Mitigation
PRE-CONSTRUCTION AND CONSTRUCTION PHASI	E	
Acquisition of Applicable Permits and Licenses	People	(+) Disclosure of project information to stakeholders and
	-	concerned government authorities
Land Acquisition for the RROW	People	(-) Displacement/disturbance of settlers, properties, and livelihood
	People	(-) Involuntary resettlement of IP households
Hiring of Workers	People	(+) Generation of employment opportunities
	People	(-) Possible SEA/SH
Site Preparation / Vegetation Clearing / Utilities	Land	(-) Loss of vegetation leading to fragmentation of habitats which
Relocation		may result to disruption of migration patterns and pollination/seed
		dispersal
	Water	(-) Possible siltation of nearby water bodies
	People	(-) Threat to delivery of basic services
Construction of Temporary Facilities and Influx of	Land, Water, People	(-) Generation of domestic solid wastes
Construction Workers	Land, Water, People	(-) Generation of domestic wastewater
	People	(-) Community health and safety risks, including peace and order
Civil Works for the Main Corridor and Link Roads	Land	(-) Ground vibration from heavy equipment and vehicles
	Land, Water	(-) Increased proliferation of invasive alien species
Main Corridor (i.e., Road Widening, Repair of	Land, Water	(-) Increased pressure on biodiversity (e.g. poaching, hunting)
Damaged Road Sections, Implementation of Slope	Land, Water, People	(-) Generation of construction spoils/debris and other solid wastes
Protection Measures, Drainage Works, Installation of	Land, Water, People	(-) Generation of hazardous wastes
Road Safety Infrastructures)	Water	(-) Possible siltation of nearby water bodies
Link Deede (i.e., the median frame the second Deede to	Land, Water	(-) Potential contamination of soil/water from accidental oil
Link Roads (i.e., Upgrading from Unpaved Roads to		spills/leaks from heavy equipment and vehicles
Concrete, Repair of Damaged Road Sections,	Air, People	(-) Generation of dust
Construction and Renabilitation of Bhoges,	Air, People	(-) Generation of air emissions and noise
Drainage Works, Installation of Road Safety	People	(-) Occupational health and safety risks
Infrastructure)	People	(-) Community health and safety risks, including road safety
	People	(-) Threat to delivery of basic services/resource competition
	People	(-) Traffic congestion
DEMOBILIZATION AND OPERATIONAL PHASE		
Dismantling of Temporary Facilities and	Land, Water	(-) Generation of debris and other solid wastes
Clearance/Clearing of Construction Debris and	Air, People	(-) Generation of dust, air emissions, and noise
Waste	People	(-) Occupational health and safety risks
	Land	(-) Increased light and noise generation affecting wildlife behavior

Project Phase / Activities	Environmental Component(s)	Potential Impact(s) before Mitigation
Road Operations and Long-Term Performance	Land, Water	(-) Increased pressure on biodiversity (e.g. poaching, hunting)
Based Maintenance (LTPBM)	Land, Water	(-) Increased proliferation of invasive alien species
	Water	(-) Increased rate of surface water runoff
	Water	(-) Altered hydrology will affect biodiversity especially of aquatic
		ecosystems
	People	(+) Enhancement of employment and livelihood opportunities
	People	(-) Generation of road traffic noise
	People	(-) Occupational health and safety risks
	People	(-) Traffic safety risks

# 5.3 Potential Impacts and Mitigating Measures during Pre-Construction and Construction Phases

### 5.3.1 Land

### 5.3.1.1 Land Use and Classification

#### Impact Assessment

**Impact on existing land uses**. The project's impact on the existing land uses in the Main Corridor and Link Roads 1, 2, and 3. The dominant land uses along the 40-m RROW of the Main Corridor are road and easement (29%), agricultural (27%), power, water, communication utilities (11%), residential (9%), and commercial (8%). The dominant land use along the 20-meter RROW of Link Road 1 is road and easement (95%), mainly local roads, and about three percent is used for agro-industrial activities. In Link Road 2, the dominant land uses along the 20-meter RROW are agricultural (55%), commercial (16%), road and easement (10%), residential (9%), and forest (6%). In Link Road 3, the dominant land uses along the 20-meter RROW are forest (45%), agricultural (43%), and agro-forestry (5%).

The MTCIP has a significant influence on land use and its classification. It is expected that the road project will traverse various zones and land uses for both the Main Corridor and Link Roads. Along the Main Corridor, the direct impact areas encompass land classified for residential, commercial, institutional, and agricultural purposes. Similarly, the direct impact areas of Link Roads 1, 2, and 3 mainly consist of residential, agricultural, and institutional lands. However, it's notable that the tenure of most lands traversed by the 40-meter Road Right-of-Way (RROW) in the Main Corridor is categorized as public, while Link Road 1 crosses a combination of public, agrarian, and privately-owned lands. Moreover, Link Roads 2 and 3 will pass through recognized ancestral lands, which are privately owned but communally managed.

The influence of MTCIP on land use and classification is further manifested by the alignment choices. In the Main Corridor, the road follows the existing national road, heavily utilized since the 1970s. Most of the Road Right-of-Way (RROW) acquisitions have been completed by the Government of the Philippines (GOP). Additionally, road widening and improvements in some segments of the Main Corridor occur within vacant spaces already acquired by the GOP. On the other hand, the three Link Roads utilize existing municipal, barangay, and village roads, with some sections passing through dense vegetation and abandoned logging roads.

In addition to this, constructions of new roads and road widening/rehabilitation activities will have impacts on both terrestrial and aquatic ecosystems. Anecdotal evidence can prove that roads can negatively affect biodiversity thru increased extraction (mostly illegal), fragmentation and alteration of habitats, introduction of invasive alien species and modifications of their physiological and behavioral patterns.

**Restricted land use**. The project restricted land use due to the conversion of lands from nonroad uses (agricultural, utilities, residential, and commercial) to road and easement uses. MTCIP is expected to restrict the use of land by farmers for agricultural production, agricultural workers for their source of livelihood, and the IP groups for their forest and natural resources. The restriction on land use emanates from new road openings that reduce land areas for agricultural production. It also re-routed road users from their areas of production, cultural monuments, and places of work.

#### Mitigating Measures

The project's alignment along existing roads helps avoid significant disruptions to existing properties. Existing structures are taken into account to minimize impact. Nevertheless, a significant number of structures are expected to be affected. Where involuntary resettlement impacts occur, Resettlement Action Plans will be prepared in accordance with the Resettlement Policy Framework. Consultations and relocation efforts are conducted in coordination with barangay and municipal government units. Informal settlers along the easement and public domain in the Main Corridor will be consulted and relocated to designated areas either beside the road, in LGU relocation sites, or in nearby owned lots. Similarly, households affected along Link Road 1 will be informed and relocated in coordination with barangays. For Link Roads 2 and 3, Free, Prior, and Informed Consent (FPIC) will be obtained from Indigenous Peoples and Indigenous Cultural Communities (IPs and ICCs) to determine consensus regarding RROW. Consultations with informal settlers from other ethnic groups or sectors will also be coordinated with barangay LGUs and relevant government agencies.

Link Roads primarily traverse agricultural lands, impacting various crops in the process. To mitigate these impacts, a strategic approach is necessary. For areas utilized by banana, pineapple, and high-value crop contract growers, construction should be scheduled after harvest seasons to minimize disruption to cultivation. Access to these plantations must be maintained throughout the process. Affected individuals should receive fair compensation for any remaining crops and trees on their property, calculated according to their market value, to account for crop losses incurred. Close collaboration with the National Irrigation Administration (NIA) is crucial for areas involving irrigated and irrigable lands, especially those dedicated to rice cultivation. This collaboration ensures that project construction and implementation do not disrupt the continuous flow of water to affected parcels. Additionally, involving the Department of Agriculture is essential. These agencies can help maintain rice production levels in unaffected areas, supporting income restoration and rehabilitation for affected rice farmers. This comprehensive approach aims to mitigate adverse effects on agricultural livelihoods while facilitating the smooth execution of the project.

The local government unit concerned will also be one of the primary partners to mitigate effects of the roads on biodiversity loss. LGUs can establish baseline information and monitor biodiversity, in coordination with the DENR in order to prevent introduction and proliferation of invasive alien species and the decrease of flora and fauna populations. In addition to this, "regreening" of roadsides will be considered and in a certain extent, facilitate nature-based solutions to decrease likelihood of landslides, rockfalls and flashfloods.

## 5.3.1.2 Geology and Geomorphology

#### Impact Assessment

**Change in sub-surface geology.** Given that the Main Corridor currently exists as a paved concrete road, it is anticipated that any alterations to the surface landform, geomorphology, topography, terrain, or slope will be negligible to nonexistent. Similarly, the Link Roads, though already paved but not concreted, are likely to undergo minimal changes during road upgrading activity, predominantly in the mountainous terrain, particularly in sloping areas, where adjustments may be necessary to accommodate the construction of a two-lane road.

**Inducement of subsidence, liquefaction, flooding, landslides etc.** Potential hazards that may occur in the area are mostly focused on landslides, flooding, ground subsidence due to sinkhole, and earthquake-induced hazards, such as ground shaking and liquefaction.
There is a potential occurrence or triggering of geological phenomena such as subsidence (the sinking or settling of the ground surface), liquefaction (the process where soil temporarily loses strength and behaves like a liquid during an earthquake), flooding (the inundation of land areas by an excess of water due to heavy rainfall or the overflow of bodies of water such as rivers), ground subsidence due to sinkhole collpase and landslides (the movement of a mass of rock, debris, or earth down a slope) within the scope of the MTCIP. This implies that the construction activities or changes introduced by the project could lead to or exacerbate these geological hazards, posing risks to the infrastructure, surrounding environment, and potentially human safety.

For instance, a subsurface assessment such as a resistivity survey was conducted at KM 1617 and aimed to identify the underlying causes of frequent road subsidence. The results of this investigation provided clear details on subsurface features that are not manifested on the ground surface. The survey revealed the presence of highly saturated ground supported by limey marine clastic and fine-grained sedimentary materials beneath the paved concrete of the national highway. Field observations further highlighted that subsidence was exacerbated by the accumulation of water due to poorly maintained underground drainage flowing through the opposite side of the highway. The persistent occurrence of subsidence in this area has resulted in significant expenses from the DPWH District Office and inconvenience for travelers.

This kind of hazard often stems from changes in the overlying load or soil washing into voids in the underlying rock. Uneven settling poses risks for ground-level sections. Mitigation measures may include the improvement of drainage infrastructure to prevent water accumulation underground. Properly designed and maintained drainage systems can help divert water away from the road surface, reducing the risk of saturation and soil instability. Additionally, implementing ground stabilization techniques such as soil reinforcement, grouting, or soil cementation can enhance the strength and stability of the underlying soil layers. Regular monitoring of ground conditions and subsidence indicators can also aid in early detection and intervention to mitigate potential hazards.

#### Mitigating Measures

The following presents options for mitigating identified geohazards in MTCIP.

**Ground shaking.** As the MTCIP crosses several traces of active and potentially active faults along its alignment, it is necessary to anticipate and minimize the potential impact of the risks associated with ground movement, rupture, and ground shaking. PHIVOLCS recommends setting up a buffer distance of about 5m on either side of a fault trace. However, considering the present alignment and the extension of these fault traces, completely avoiding the geologic structures may not be feasible. Thus, it is essential that the design of the highway take into consideration the possibility of ground rupture along the fault line crossings of the alignment. Bridges and larger structures should be located away from these traces. In addition, regular monitoring for signs of movement in these areas should be conducted, and detailed studies should be undertaken to ensure a sound foundation for the road network. Expected seismic intensities provided by DOST-PHIVOLCS should be taken into consideration in road design and ancillary infrastructure.

The MTCIP is also prone to ground shaking and will be subjected to extreme ground acceleration during major earthquakes. Flexible pavement designs may be considered to prevent deformation and cracking or settling due to ground shaking. Proper compaction should also be followed to reduce the risk of embankment failure. Bridge design and other facilities

should accommodate horizontal and earthquake movements of up to the modeled intensities. Seismic retrofitting may also be undertaken for existing structures and roadways. A real-time monitoring network, especially along fault traces, should be established to detect deformations and signs of imminent fault movements. Expected seismic intensities provided by DOST-PHIVOLCS should be taken into consideration in road design and ancillary infrastructure.

**Liquefaction.** Taking into account the possibility of liquefaction in some portions of the MTCIP, it is highly recommended that this be considered in designing future construction along the alignment, including bridges and highways. Foundations and retaining structures should be able to accommodate potential liquefaction-related ground settlement as well as lateral spreading. Bridges and culverts should have deep foundations and flexible abutments to accommodate possible movement. Soil stabilization measures such as vibro-compaction, stone columns to densify loose soils, injection of binders, and others should be implemented to increase seismic resilience. Retrofitting of existing structures should also be carried out, such as adding dampeners and strengthening bridge columns and foundations. Regular monitoring must be undertaken along these areas that are prone to liquefaction for early detection of possible ground settlement and movement.

**Tsunami hazard.** Early warning systems, including sirens, mobile apps, social media, and traditional media, should be established related to the sections of the highway that are susceptible to tsunamis to ensure that the riding public and other road users have enough time to evacuate the area. Moreover, signage and warning signs should be installed in the sections of the road affected with proper information about evacuation areas and routes. Drainage networks should also be designed to remove water efficiently and prevent accumulation along these sections. Construction of coastal defense structures such as seawalls, breakwaters, and other wave dissipating devices to help reduce the impact of the oncoming waves. Natural coastal defense systems, such as mangroves and other coastal vegetation, should also be conserved and encouraged to proliferate.

**Volcanic hazard.** As some portions of the MTCIP might be affected by volcanic activity, proper traffic management must be developed and clearly communicated to the concerned agencies, institutions, and communities. The system should include protocols for highway closures and rerouting when there is an imminent eruption or ashfall event. Monitoring systems, such as ashfall sensors and the use of satellite imagery, must also be in place to provide ample warning time and allow affected commuters to prepare.

The establishment of routine cleaning schedules during an event should also be provided to prevent ashfall buildup, and hierarchical prioritization of routes should be determined in order to ensure that essential transport routes remain accessible.

**Storm surge.** As this section of the highway is situated in a very narrow coastal plain and is bounded by steep to very steep slopes on the other side, realignment away from the coast may not be feasible for some areas. Whenever possible, moving the highway alignment further inland will significantly reduce its susceptibility to storm surges. In addition, proper monitoring and warning systems should be established to provide enough lead time for motorists and other road users to get to safety. Evacuation sites and routes should also be clearly indicated to assist road users during a storm surge. Detailed studies and modeling of the indicated storm surge heights in this area should also be carried out to assist in designing future storm surge barriers and mitigations.

Flooding. To ensure the resilience of core civil infrastructure such as road networks or

highways, it takes a multifold approach, especially in areas with high-risk locations, difficult conditions, and limited resources. Concerted efforts must be made by the concerned agencies and the community. Within the MTCIP, to increase resilience to climate change-related circumstances, it is important to consider the following:

- Detailed hydrologic and hydraulic studies were conducted within the critically flooded areas to guide the design of an effective drainage network, taking into consideration the off-site runoff contribution as well as the final conditions of the surrounding areas.
- Increase the number of cross-drains in sections that are identified to be natural water flow directions, despite the lack of well-defined channels such as creeks or streams.
- Assessment of the effects of raising the road grade with respect to the hydrology of the whole region to minimize disruptions of the natural systems that may lead to disastrous conditions for the road and its surrounding areas.
- Establishment of flood control structures such as levees, dikes, proper ditches, and culverts.
- Establishment of a monitoring network, early warning systems, and flood emergency management framework to ensure that road network accessibility will not be hindered, limited, or stopped during these events, which may have indirect effects on the operability of critical facilities such as hospitals, fire stations, evacuation centers, etc.
- Comprehensive hydraulic and hydrologic study on the northeastern side of Link Road 3 to ensure that plans will be able to consider the nature and magnitude of the surface runoff frequently diverted into the road alignment.
- To prevent critical blockages within drainages, a regular maintenance and inspection schedule of culverts, ditches, and stormwater inlets should be established in order to prevent conditions from worsening that may lead to flooding of the highways.
- Construction of sediment controls in adjacent slopes may likely contribute significant debris into roadside ditches, culverts, and stormwater inlets, which may include erosion-control blankets and anchoring devices.
- For segments exposed to the potential impacts of sea level rise, upgrading the roadbed and retrofitting bridges and culverts may be considered with due consideration of the projected water level rise based on climate change projections.
- The construction of seawalls, revetments, and bulkheads may also be considered in sections that are very close to the waterline to serve as barriers against extreme erosion and rises in water levels.

Landslides. In view of the present landslide risks to the MTCIP and the looming impacts of climate change that may aggravate these conditions, it is imperative that measures be instituted to improve the resilience of this critical infrastructure. Appropriate slope protection must be implemented to reinforce existing slopes and stabilize potentially unstable areas. However, these designs must be coupled with detailed site-specific studies on the geology, geotechnical properties, and slope stability analysis of the road sections, as the determination of the type, extent, and nature of the landslide will be fundamental in designing appropriate stabilization structures. Accurate determination of the failure plane will guide mitigation design and minimize the probability of the landslide reactivating in the future. Drainage along the road alignment as well as within the surrounding slopes is also critical for stabilization, as high moisture conditions increase the likelihood of failure. Installation of sufficient drainage within the landslide-prone areas, such as ditches, drainpipes, interceptor drains, and others, may be considered. Retrofitting of existing highways that are within landslide-prone areas, such as

reinforcing slopes and enhancing drainage systems, may also be considered. For new alignments, route planning and site selection should consider landslide risks. In addition, the installation of monitoring systems, warning signs, and early warning systems works in concert to prevent injury, loss, and damage to road users when landslide risks are high.

Moreover, nature-based solutions to landslide mitigation can involve measures such as reforestation and vegetation, slope stabilization through the use of vegetation with deep root systems that bind the soil, the construction of gabions and retaining walls using natural materials or covered with vegetated surfaces (hybrid green-gray infrastructure), terracing techniques, and contour plowing.

In addition to the options discussed above, nature-based solutions can be included to mitigate the main natural hazards and risks in the project. Nature-based solutions as defined by the International Union for Conservation of Nature (IUCN) refer to actions to protect, sustainably manage, and restore natural or modified ecosystems that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits. For example, NbS for landslide mitigation can involve measures such as reforestation/revegetation, slope stabilization through the use of vegetation with deep root systems that bind the soil, the construction of gabions and retaining walls using natural materials or covered with vegetated surfaces (hybrid green-gray infrastructure), terracing techniques and contour plowing.

Coastal vegetation and mangrove restoration can help mitigate the impacts of tsunamis and storm surges. Coastal vegetation acts as a natural buffer, reducing the force of waves and protecting coastal communities, stabilize shorelines and reduce coastal erosion, and provide habitats and nurseries for various species.

Restoration of wetlands, creation of retention ponds, constructing vegetated swales and permeable pavements (for urban areas) can help mitigate flooding. These natural features act as sponges, slowing down, filtering, and retaining stormwater runoff, reducing the risk of overflow and downstream flooding. They also provide additional benefits such as improving water quality, enhancing biodiversity, and providing recreational spaces.

Below is an overview of different NbS or hybrid solutions that could be considered as may be relevant in the project area:

Tropical cyclones and sea level rise

- Restoration and preservation of mangroves, coral reefs, and seagrasses to act as natural buffers
- Coastal Vegetation and Dune Restoration, beach nourishment

Landslides, erosion

- Reforestation, Soil Conservation
- Agroforestry, Terracing, Contour Planting
- Vegetative Cover along slopes to stabilize soil and Riparian Buffer Strips along watercourses to stabilize banks and filter runoff
- Rock Terracing Constructing terraces with a combination of rocks and vegetation to reduce erosion
- Gabion Walls filled with rocks combined with planted vegetation for slope stabilization

Flooding (inland)

- Reforestation and Afforestation
- Vegetative Check Dams, rain garden, and vegetated swales to slow down water flow and reduce erosion
- Wetland Restoration

# 5.3.1.3 Terrestrial Ecology

### Impact Assessment

**Vegetation removal and loss of habitat**. The whole alignment of the proposed MTCIP can be categorized mostly by residential area, major commercial areas, urban land use, public road easement, and forest. As the whole area is concerned, it does not cross any environmentally critical areas or critical habitats.

Loss of vegetation due to clearing will be one of the impacts on the biological environment. However, it will have a moderate effect in terms of species habitat since most of the area vegetation consists mostly of grasses and shrubs, with occasional trees.

Most of the floral species in the area are considered pioneer, invasive, and introduced species in the area. Nevertheless, the project requires the land preparation and construction of roads and facilities, which greatly affect the community and the existing fauna in the area.

Compared to the flora species, which cannot be relocated easily, especially premium species, fauna wildlife has the capacity to relocate or displace from their habitat to another as preconstruction activities commence (e.g., delineation of area and land preparation). This will cause a significant change to the faunal community.

**Hindrance to wildlife access.** During the construction phase, most of the heavy activities will commence with the use of heavy equipment and intensive human activities, which cause land and noise disturbances. These disturbances cause pollution, like noise pollution and high-intensity vibration of the equipment, which may disturb them and make them stay away from the area. The use of lubricants and fuels in construction machinery and hazardous chemicals like solvents and paints will pollute the soil, and species will be affected.

### **Mitigating Measures**

The impacts on the flora and fauna can be mitigated with a proper management plan, preventive measures, and hazardous waste management. This activity will not pose a negative threat or adversity to the species.

Taking into consideration the rehabilitation of the area by planting native species that will serve as habitat, sources of food, and can function in their corresponding niches, which may persist in the area as the project is implemented. The projects must exercise proper assessment to ensure the minimal causes of climate change from greenhouse gas emissions through energy conservation and establish effective conservation strategies to sustain ecosystem services, biodiversity, species conservation, and diversity of genetics.

Republic Act No. 9147, also known as the Wildlife Resources Conservation and Protection Act of 2001, and its Implementing Rules and Regulations state that it is illegal for any person to exploit wildlife resources on purpose and their habitats. As stated in Chapter VI of the said Republic Act, among the illegal acts are the following:

- Dumping of waste products that are detrimental to wildlife
- Squatting or otherwise occupying any portion of the critical habitat

- Collecting, hunting, or possessing wildlife, their by-products, and derivatives:
- Gathering and destroying active nests, nest trees, host plants, and the like;

Opening and clearing areas to build roads will clearly disturb the ecosystem of the said locale. Flora species will be cut and cleared, but those feasibly available for earth-balling may be considered for relocation. In the case of faunal species, they will naturally relocate to other parts of the locale where disturbance will be minimal. Also, in the long run, most fauna species will get accustomed to the presence of vehicular traffic, provided there is ample vegetation and no visible regular threats (e.g., illegal trapping, hunting). Once roadsides and easements were rehabilitated and re-vegetated using native species, fauna species (especially birds) may be expected to return and continue to thrive where the road alignment is established. In addition to this, wildlife crossings or corridors may be considered to provide fauna species (e.g., snakes, rodents, etc.) with a safe passage from one side of the road to the other. Such can also be considered for aquatic flora and fauna species, provided that the water quality and quantity of nearby rivers and creeks are maintained, and none are filled with overburden materials.

Overall, the effects of the project on biodiversity, especially on those existing roads, will be minimal to almost none. This is because of the established "disturbance" in the area, for which faunal species have adapted. Although the presence of easy access to sources of flora and fauna resources increases their susceptibility to exploitation (e.g., poaching), establishing linkages for increased ENR awareness and enforcement measures can mitigate this threat.

Alignments located near the vicinities of protected areas, or KBAs, are not exactly intruding on the means and bounds of the said areas. Moreover, the management zonings near where the alignments can be found are usually designated as multiple-use zones (MUZs), wherein harmonious co-existence of human activities and the natural ecosystem is being practiced, as indicated in the provisions of RA 7586, as amended. In this context, the presence of roads will give an added boost to ecotourism activities within the protected areas, as accessibility to such areas will be easier and will attract more visitors. An increase in the number of visitors usually equates to a higher generation of user's fees, which are deposited in the IPAF and then utilized for the management and development of protected areas. Furthermore, there are guidelines set forth should MUZs be needed for development. If the alignment falls within a PA under the NIPAS, clearance shall be obtained from the concerned management board, and the proponent will need to secure the issuance of a special use agreement in protected areas (SAPA), among other permits like a tree cutting permit, a discharge permit, etc.

Although the Philippine Eagle was noted as one of the observed fauna species, historical records show that most of the nesting sites and confirmed sightings are on the Davao Oriental side, from Monkayo towards Gov. Generoso (Phil. Eagle Foundation report). As such, the sightings along the proposed alignment may only indicate that these areas form only part of their hunting range and do not necessarily indicate the presence of nesting areas.

### 5.3.2 Water

### Impact Assessment

Preconstruction activities, including the clearing of timber, the extraction of earthen materials, and the construction of staging areas, can impact the water quality due to the damage they can cause, such as erosion and siltation. The loss of vegetation can impact the habitats of aquatic life, thereby affecting their population and their biodiversity.

During the construction stage, multiple activities can cause harm to the water quality. The use of construction materials may release hazardous waste such as oil, grease, and other chemicals that can leak or accidentally be spilled into rivers and creeks, which are toxic to aquatic life by affecting their respiratory system and photosynthesis. Oil and grease harm the aquatic environment as they kill microorganisms such as plankton and larva, which are the basic sources of food for fish. The juvenile fish consume these oil-contaminated microorganisms, which are fatal to them. Intensified construction activity may also cause disturbances in the soil, which can cause erosion and siltation that damage the water bodies. The construction can also cut their paths towards other habitats, especially where construction is done on river systems.

Improper disposal of solid waste such as plastics and toxic chemicals can also contribute to the degradation of the environment.

The construction of the roads on its proposed alignment is not foreseen to have a long-term adverse impact on the aquatic biota found in the rivers and creeks within or along the proposed alignment. While the road project might result in the relocation of some fish habitat, this is not seen as overly significant.

#### **Mitigating Measures**

To address drainage issues, it's important to regularly clean out debris and trash from ditches and improve the design of drainage structures to handle runoff better. Educating the community about responsible waste disposal can also prevent blockages. Installing screens or traps along the drainage system can catch debris before it clogs ditches. Having an emergency plan ready to deal with blockages or overflows is crucial for highway safety.

The impacts can be prevented by proper road alignment planning and implementing good construction practices. The project can also replace the loss of these flora by planting new seedlings. The project proponent must comply with environmental standards and the latest guidelines on sustainable construction practices. Erosion control measures can be implemented, such as sediment basins, silt barriers, and slope protection.

A well-designed solid waste management plan can alleviate these concerns through the implementation of regular disposal of solid waste and the construction of sanitary facilities. Regular monitoring should be done to swiftly respond to accidents in the project area.

Water use conservation during the construction phase, with the possible recycling of used water for dust spraying and vegetation watering, can also be considered.

#### 5.3.3 Air and Noise

#### 5.3.3.1 <u>Air Quality</u>

#### Impact Assessment

There is a potential air quality impact within the MTCIP during the pre-construction, construction, and abandonment phases. During pre-construction, activities like tree cutting and demolition released carbon dioxide and other gases, negatively impacting air quality. In the construction phase, increased construction vehicle activity, especially during excavation, generates dust, raising particulate matter (PM) levels. However, these effects are typically short-term and diminish post-construction.

#### Mitigating Measures

Effective planning, along with on-site control measures, is key to reducing the impacts of preconstruction and construction activities. This means scheduling work smartly to avoid dusty conditions and training workers on dust control and pollution prevention. It's important to raise awareness about the health and environmental effects of dust to ensure everyone follows the necessary protocols and lessens disturbance to the community.

During the pre-construction phase, it's essential to initiate tree-planting programs to absorb carbon dioxide and mitigate its concentration in the atmosphere. Dust pollution control measures for demolition include water spraying, dust suppressants, and windbreaks to minimize airborne dust emissions, with additional methods like enclosures and dust control equipment. Proper maintenance of vehicles and strategic scheduling of construction activities are crucial for reducing dust generation.

Throughout the construction phase, effective dust control management and adherence to standard construction practices are imperative. This involves the use of dust covers on transport trucks, strategic scheduling of heavy dust-generating activities to minimize community exposure, and ensuring workers have proper personal protective equipment (PPE) like dust masks. In order to reduce dust generated by construction, hauling, and grading activities, as well as any others that might raise dust, specifications for dust control should include standard emission controls on construction vehicles and sufficient watering of the area to accompany such activities. This watering will be included in the contract provisions for this project. This would effectively mitigate the most particulate air quality impacts. Moreover, regular water spraying of the access road and properly maintained and well-conditioned equipment shall be utilized to further control the impacts on air quality.

#### 5.3.3.2 Noise Level

Noise disturbance is raised as a significant issue by local communities concerned about infrastructure developments such as roadways and highways, and therefore it is important to assess the baseline conditions in order to assess the potential impacts during construction and operation. Due to a lack of measuring instruments, baseline information on vibration is excluded in this ESIA Report.

### Impact Assessment

The potential impact of noise from the MTCIP is expected mostly during the construction phase. During this phase, segments where construction is ongoing may experience higher noise due to noise generated by machinery and construction activities, which may cause community disturbances in nearby residential, school, hospital, and workplace areas. Wildlife may also be disrupted, especially for certain avian and faunal species, which can affect their communication and mating rituals and may result in habitat avoidance and altered foraging patterns. However, these impacts are expected to be temporary and are limited in extent to the sections that are undergoing construction work.

### **Mitigating Measures**

Noise impacts, mostly during construction, can be effectively minimized by employing strategies to manage the primary noise-generating activities. Scheduling and restrictions on operational hours for heavy machinery and high-noise activities to hours that reduce community disturbance and avoid nighttime construction. Vibration dampening techniques could also be used, as well as equipment that may reduce vibrations. Community engagement is also critical to promote understanding within affected communities and reduce concerns.

# 5.3.4 People

#### Impact Assessment

### 5.3.4.1 <u>Physical and Economic Displacement due to Involuntary Resettlement, Loss of</u> Land, Structures, Trees, and Livelihood

**Impacts on land.** The MTCIP is estimated to have a direct and indirect impact on lands, structures, trees, and livelihoods. The estimated replacement cost for the loss of assets will have a possible short-term or permanent impact. Based on the engineering study of road alignment, right-of-way acquisition for the road upgrading and improvement component required a total land area of 1,383,273 m<sup>2</sup>, broken down (**Table 5-2**) as follows:

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Road	Length (m²)			
Main corridor	45,225 m²			
Link Road 1	237,990 m <sup>2</sup>			
Link Road 2	357,920 m²			
Link Road 3	740,138 m²			
TOTAL	1,383,273 m²			
Source: MTCIP Options Analysis Report, January 2024				

#### Table 5-2. Summary of Project-Affected Land, per Road

**Impacts on structures.** The initial census along the proposed alignment listed a total of 8,341 affected structures. The types of structures are either residential, residential-commercial, commercial, or secondary. **Table 5-3** presents a summary of the project-affected structures, per proposed option, along the Main Corridor and Link Roads 1, 2, and 3.

#### Table 5-3. Summary of Project-Affected Structures, by Road, by Option

MTCIP Road	Option 1	Option 2	Option 3
Main Corridor	5,013*	5,015	5,422
Link Road 1	361	517	814*
Link Road 2	1,478	1,478	1,708*
Link Road 3	847	806	806*
Source: Structure count - Enviror	nment and Social Team; (	Google Earth approximation	on - Engineering Team,
Galerio Environmental Consultant	cy Inc.		

\*Preferred Option per Road

**Impacts on households, including informal settlers families (ISFs).** Some 3,683 households will be affected by the project due to involuntary resettlement. **Table 5-4** shows a summary of the project-affected households on the Main Corridor, Link Roads 1, 2, and 3.

#### Table 5-4. Summary of project-affected households, by road, by option

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MTCIP Road	Option 1	Option 2	Option 3				
Main Corridor	1,002*	1,003	1,035				
Link Road 1	312	448	707*				
Link Road 2	1,082	1,082	1,217*				
Link Road 3	790	757	757*				
Source: Structure count - Environment and Social Team; Google Earth approximation - Engineering Team,							
Galerio Environmental Consultancy Inc.							
*Preferred Option per Road							

Of the total project-affected households, an estimated 305 households can be considered informal settler families. These ISFs reside within the 20-meter width of Link Road 2 and Link Road 3 (92 ISFs in Link Road 2 and 213 ISFs in Link Road 3). No ISFs occupy the 20-meter space within Link Road 1 and along the Main Corridor. This preliminary information on the

housing tenure of the PAPs needs to be validated during the FS and DED stages of the MTCIP.

**Impact on trees and crops.** The road upgrading activities and land acquisition result in a lesser productive capacity among owners affected by the loss of trees and crops. With less productivity, the owners will have a decline in income.

**Conflict in land ownership**. Issues of ownership may cause disputes in land acquisition for RROW. A certificate of land ownership may not always be present to attest to ownership. Living in the public domain will not be compensated, and those on private land may not be willing to relocate. A risk during project operations is related to the compensation for affected assets and involuntary resettlement. There might be delays in project implementation, especially in the release of compensation for lands acquired and for the loss of assets used for livelihood. This issue was raised in public consultations conducted for MTCIP (*public consultation, Sept. 27, 2023, Provincial Capitol Conference Hall, Tagum City; public consultation, Sept. 27, 2023, DPWH Regional Office Conference Hall, Davao City; public consultation, Sept. 28, 2023, City Hall, General Santos City).* 

**Impact on public access.** The regulations on access to the Main Corridor and the link roads when they are upgraded to national roads might limit road user access (e.g., users of modes of transport such as *habal-habal*). Public access on the Main Corridor will be affected by the temporary closure of the road segment. If not integrated in local road infrastructure development plans and in the LGU Comprehensive Land Use Plan, the project might worsen road congestion or affect logistics systems, especially in the city or municipal central business district or in areas leading to the ports.

**Displacement of indigenous peoples/indigenous cultural communities (IPs/ICCs).** MTCIP will cut across recognized ancestral lands and have an impact on indigenous cultural communities (ICCs) in the area. The ICCs account for 30% Higa-onon on Link Road 1, 98% composed of Matigsalog and Islamized Ethnic Group (Kagan/Kalagan) on Link Road 2, and 98% Tagakaulo on Link Road 3. The project poses a risk of physical and economic displacement of IPs affected by the land acquisition for road widening.

#### IPs/ICCs

Link Road 1 is predominantly inhabited by the Higa-onon tribal community, which represents 30% of the total population in the three barangays traversed by Link Road 1. It should be noted that Link Road 1 lies outside the recognized ancestral domain of the Higa-onon community, with houses situated within municipal or barangay-zoned built-up areas.

Link Road 2 passes through the ancestral domain of the Matigsalog communities in the Marilog and Paquibato districts of Davao City. Additionally, Kagan and Kalagan communities have opted to settle in vacant land spaces alongside this road, categorizing them as informal settlers' families (ISF), with over 200 families constructing structures along this link road.

Link Road 3 cuts through barangays within the recognized ancestral lands of the Tagakaolo cultural communities, covering a distance exceeding 50 kilometers and traversing residential and agricultural areas of the Tagakaolo indigenous people. Maguindanaons also constitute informal settlers' families along this road. The barangay government in Link Road 3 permits Kagan/Kalagan to occupy public lands used as built-up areas, while some act as tenants on agricultural lands owned by medium- to commercial-scale agricultural producers.

**Impacts on public health and safety.** The project will entail hiring workers who may originate

outside the project sites and LGUs. This will lead to a labor influx in the local community, presenting risks of sexual exploitation and abuse/sexual harassment (SEA/SH), an increase in gender and child-related violence, cultural insensitivity, and competition for access to health services and food resources.

### 5.3.4.2 Cultural/Lifestyle Change

**Impact on cultural heritage**. The project may cause a loss of cultural practices due to the non-preservation of intangible cultural resources and a change in the traditional practices of indigenous cultural communities.

#### 5.3.4.3 Impacts on Physical Cultural Resources

**Possible disturbance to ancient grounds (Main Corridor).** The sourcing of volume of river mix aggregates and boulders/cobbles from the two river sources in Misamis Oriental, 10 river sources located in Bukidnon, and the Davao River in Marilog District could unearth tangible relics valuable to local communities and indigenous peoples in the mountain areas. All Bukidnon rivers and the Davao River are revered and ritual grounds of the indigenous cultural communities. The loss of cultural grounds that sustain indigenous knowledge, systems, and practices will be a risk.

**Possible disturbance to ancient grounds (Link Roads).** The proposed scope of works (i.e. road widening, re-blocking, asphalt overlay, side ditching, new bridge construction, bridge widening, slope protection, road shoulder and turn-outs) will possibly disturb ancient grounds linked to the cultural values of the local and indigenous people communities. The possibility is high in Link Roads 2 and 3, as the proposed roads will cut across ancestral lands of indigenous cultural communities. Some archeological finds might be immovable, which must remain intact or preserved in its place.

### 5.3.4.4 Threat to Public Health and Safety

**Labor influx.** The project will entail hiring workers, which may originate outside the project sites and LGUs. This will lead to a labor influx in the local community, presenting risks of sexual exploitation and abuse/sexual harassment (SEA/SH), an increase in gender and child-related violence, and cultural insensitivity. With the entry of MTCIP, agricultural and forestry workers will likely apply for construction-related jobs. This poses labor risks, such as the hiring of workers younger than 15 years and coercing people to work beyond the assigned tasks. The project workers themselves face the risk to their own health and safety brought about by living in makeshift tents and temporary shelters with no basic utilities. Over time, migrants will be attracted to urban areas connected by MTCIP. This might strain LGU resources to manage rapid in-migration and compromise the quality of public services provided to residents and migrants alike.

The services sector remains the biggest employer in the project regions of Northern Mindanao, Davao, and SOCCKSARGEN, followed by agriculture, and then industry, including manufacturing. When disaggregated by major industry groups, the number of employed persons is highest in agriculture, hunting, and forestry (2,183,000).

Threat to human security from the escalation of personal, communal, and tribal violence or conflict. The entry of project workers from outside the area increases conflict and security risks in the host community. In the long term, the opening of roads will result in a decrease in insurgency but will likely increase organized crime because of the influx of people,

goods, and services, especially along the Main Corridor. This issue was raised in a focus group discussion with the 4<sup>th</sup> Infantry Division officers on October 16, 2023.

#### **Mitigating Measures**

The following mitigating measures are recommended to address potential impacts on people during the construction phase:

- Coordinate with the concerned utility service providers and residents on the schedule of utilities relocation.
- Coordinate with the host city/municipal and barangay LGUs and local PNP for maintaining peace and order for the duration of the construction activities.
- Provide training on construction safety for workers.
- Ensure wearing or proper and complete PPE by construction workers.
- Ensure supervision of construction activities by trained professionals.
- Implement occupational health and safety policy.
- Install safety barriers to prevent unauthorized access to construction areas.
- Install and maintain signs, signals, markings, and other devices that regulate traffic.
- Implement traffic management plan in coordination with the local authorities.
- Implement Labor Management Procedures including Code of Conduct, GRM for workers, etc.
- A code of conduct will be developed in which workers will be trained on SEA/SH. The LMP details the SEA/SH sensitive grievance mechanism and the available of SEA/SH services to which survivors can be referred if they choose so.

### 5.4 Potential Impacts during Operation Phase

#### 5.4.1 Land

#### Impact Assessment

In the operational phase, the projects are expected to cause significant vehicle traffic.

#### Mitigating Measures

To lessen the impacts of the road project, the following recommendations are made:

- There must be rehabilitation in the area closely identical to its former state so that the existing wildlife will continue its niche and live harmoniously with the other organisms.
- Premium species existing in the affected alignment will stay in their place for the fauna to live as their habitat, nesting ground, and hiding places, especially those animals that depend on the trees for their lives.
- The clearing of vegetation must be done in a gradual manner so that the fauna will have enough time to adapt to the changes and migrate to another suitable area.
- Create a monitoring scheme on environmental biodiversity once the project is fully operational in accordance with the conditions under the ECC permit.
- Require a waste management plan system from pre-construction to post-construction phases of the project to minimize the particular hazards that may arise, especially those hazardous wastes that may be used in the project.

• Proponents will enhance native plants and trees in open spaces and along the roads.

### 5.4.2 Water

### Impact Assessment

After completion, the impacts on water quality are minimized. Yet, weathering can damage the roadwork, which can cause erosion and pollute nearby water bodies. Also, though rare, oil and grease spills from road accidents can happen, which can leak into nearby water bodies.

#### Mitigating Measures

The following mitigating measures are recommended to address potential impacts on water during operation:

- Spill response training: Equipping personnel with proper training and resources allows for swift and effective response to spills when accidents happen, minimizing environmental damage.
- Regular inspections: Regularly identifying and addressing minor road damage, such as cracks and potholes, prevents major deterioration that could lead to increased erosion.

#### 5.4.3 Air

#### Impact Assessment

During the operation phase, increased vehicle usage may elevate emissions levels.

### Mitigating Measure

Regular monitoring of air quality is vital for identifying and addressing potential issues, allowing for the implementation of optimal solutions in the future.

### 5.4.4 People

#### Impact Assessment

The projected positive impacts of MTCIP include the following:

**Greater value for agricultural commodities and an increase in farmer income**. Farmers will get more value for their products because the commodities remain in good condition when they reach the market. On a regular basis, transporting agricultural goods from the hinterlands to the poblacion creates more economic losses because farmers end up paying more for transportation than their potential income. The Link Roads will reduce travel time, which will translate to savings for farmers and a lower cost of transporting goods. Local business entrepreneurs will be enticed to operate food and tourism-related establishments along the upgraded Main Corridor and Link Roads.

**Road safety and road user convenience**. Road safety will be enhanced on the Main Corridor and the link roads, resulting in fewer road crashes. Consultations among the road users indicate that they use the Main Corridor and the three Link Roads on a regular basis for work or livelihood, going to school, a health center, or a hospital, accessing government services, getting water, and transporting farm products such as coconut, banana, and vegetables to the urban market. The increased connectivity will enable road users to arrive at their destinations in a shorter time, for a lesser cost, and in a more convenient manner. The project addresses the Link Road users' difficulty in using the road when it rains or when it is flooded, especially roads with poor drainage. Local discussions raised the challenge of navigating the slippery, unpaved, uneven link roads, steep and narrow roads, as well as roads blocked by boulders. The poor conditions lead to road crashes, families being stranded when the roads are flooded, students being late for school, and teachers having to commute for hours to reach the school. With rehabilitated roads, users, especially older persons, children, and persons with disabilities, will be safer using the road. The local users report that some segments of the linked roads lack lighting and road safety signage. The senior citizens lament the lack of signs or crosswalks that could help them cross the street safely. With MTCIP road safety measures such as lighting and signage, users, especially women and older people, will feel safer using the road.

**Enhanced access to and delivery of basic services**. MTCIP communities will have easier access to basic services, including health, education, social welfare, and protective services. Road users will be able to reach offices, places of work, schools, health centers, and hospitals faster and at a lesser cost. State organizations will be able to provide basic services to geographically isolated and depressed areas, and the families will be able to use these services.

**Employment opportunities**. Project hiring for MTCIP provides local employment opportunities for skilled and unskilled workers.

#### **Mitigating Measures**

The following mitigating measures are recommended to address potential impacts on people during the operation phase:

- Installation of safety signage, guard rails, etc.
- Coordination with the LGU on traffic management.
- Setting of speed limits and installation of pedestrian lanes in sensitive receptor areas such as schools, commercial areas, health facilities, churches and offices, and residential areas.

#### 5.5 Cumulative Impact Assessment

Cumulative impacts are defined as impacts "that result from the successive, incremental, and/or combined effects of an action, project, or activity (collectively referred to as "developments") when added to other existing, planned, and/or reasonably anticipated future ones."<sup>2</sup> Assessment of cumulative impacts is done when there is concern that a proposed development under review may contribute to cumulative impacts on one or more valued environmental components (VECs).

In the case of the MTCIP, there were no concerns on cumulative impacts raised during the stakeholders' consultation activities conducted. There were no other existing or proposed national, regional, provincial, or local projects identified that will be implemented within the same period and/or area as the MTCIP.

Increased vehicular traffic, which can be considered a cumulative effect of the project since the proposed roads follow existing road alignments, will be addressed by the same mitigating measures for road safety and road convenience during the operational phase.

<sup>&</sup>lt;sup>2</sup> IFC (2013). Good Practice Handbook (GPH) on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets.

# 6. ANALYSIS OF ALTERNATIVES

# 6.1 Alternative for Project Categorization

As per the Revised Procedural Manual for DENR Administrative Order, Series of 2003, and EMB MC 2014-005 (Revised Guidelines for Coverage Screening and Standardized Requirements under Philippine EIS System), **infrastructure projects**, such as roads for widening and rehabilitation and/or improvement, are designated as non-environmentally critical projects (ECP) and are categorized as Category B (*Link Roads*) and D (*Main Corridor*) projects (**Table 6-1**).

Table 6-1. Project Threshold for	Coverage Screening and Categorization (yellow for Link
Roads and orange for Main Corr	idor)

	Cove	Not covered (may secure CNC)		
Projects/Description	Category A: ECP	Category	Category B: Non-ECP	
	EIS	EIS	IEE Checklist	PD (Part I only)
3.4 Roads and Bridges				
3.4.2 Roads, widening, rehabilitation and/or improvement	None	>50% increase in capacity (or in terms of length/width) AND	>50% increase in capacity (or in terms of length/width) AND	≤ 50% increase in capacity (or in terms of length/width) but ≤ 2 km increase in length
		≥ 20.0 km (length with no critical slope) OR ≥ 10.0 km	>2 km but <20.0 km (length with no critical slope) OR	
		(length with critical slope)	>2 km but <10.0 km (length with critical slope)	
Source: Revised Guidelines for Coverage Screening and Standardized Requirement under the Philippine EIS System (EMB Memorandum Circular 005 July 2014)				

The Main Corridor project encompasses a pre-existing paved concrete 2- to 6-lane highway previously recognized by the UPMO. Spanning a total length of 421.12 km, only 20 sections, totaling 8.23 km, are subject to improvement. These sections are distributed across Regions X, XI, and XII, with each segment measuring less than 2.0 km. Consequently, in accordance with PD 1586 and EMB MC 2014-005, the aforementioned 20 sections of the Main Corridor fall outside the scope of PD 1586. It's essential to highlight that the enhancement of major roads pertains solely to these 20 sections, each less than 2 km in length, scattered across the three regions. Consequently, for the purpose of PD 1586, these sections are classified as Category D projects as per EMB MC 2014-005, Section 3.4.2, and may be eligible for a Certificate of Non-Coverage (CNC).

Meanwhile, the Link Roads (existing roads) are considered non-ECP projects under Category B, in accordance with the Philippine EIS system (EMB Memorandum Circular 05 July 2014), Section 3.4.2 Roads, widening, rehabilitation, and/or improvement.

# 6.2 Alternative for Alignment Options

Three alignment options were considered for the roads included in the MTCIP: Main Corridor and Link Roads 1-3. The selection of the final option is detailed within Workstream 3: Options Analysis Report and considers different technical, social, environmental, economic, and financial factors. A brief description of the options will be presented in **Table 6-2**.

Key Points						
Option						
The best option						
<ul> <li>421.12 km following the present Main Corridor alignment</li> </ul>						
<ul> <li>Includes road widening to a minimum of four lanes.</li> </ul>						
Construction of roadside elements (slope protection, drainage, paved						
shoulders)						
<ul> <li>Reconstruction of PCCP and ACP, including road safety mitigation works</li> </ul>						
Includes scope of works in Option 1, plus retrofitting of existing Atugan Bridge						
and construction of a new bridge parallel to Atugan Bridge.						
<ul> <li>Implementation will be in stages, with major works staggered through a few</li> </ul>						
years.						
Includes all scope of work in Option 2 plus additional rehabilitation of other						
bridges along the Main Corridor.						
It will also include road widening within downtown Digos City to mitigate traffic						
congestion.						
Device of the 0.0 km are veloced until 1/th enter						
Paving of the 9.0 km gravel road until Kibenton     Construction of neurod shoulders conserved ditabase energy during outfalls						
<ul> <li>Construction of paved shoulders, concrete-lined ditches, cross drains, outlails, and environd line ditches in urban cross</li> </ul>						
and covered-line ditches in urban areas						
<ul> <li>Includes the scope of work in Option 1 plus the paving of an existing gravel</li> <li>read (2.2 km) diverting towards the Atugan Biver and the construction of a new</li> </ul>						
bridge crossing this river						
<ul> <li>The alignment will connect to an existing naved road in Bray. La Fortuna</li> </ul>						
which is also connected to the Main Corridor further east provides increased						
access to farmlands.						
The best option						
• Similar scope of work to Option 1 (9.0 km) plus connects this to the existing						
route between Kibenton and Intavas, resulting in greater access to Mt.						
Kitangland Range Natural Park and more public-owned farms.						
Includes the upgrading of the existing spillway across the Atugan River to a						
bridge.						
<ul> <li>Present alignment of 58.34 km with existing 35 km PCCP</li> </ul>						
<ul> <li>Construction and paving of unpaved sections (23 km), improvement and</li> </ul>						
widening of existing PCCP, concrete paved shoulders, slope protection works,						
and lined ditches.						
Construction of 3 bridges and one box culvert						
• Follows the existing route (Option 1); however, no widening or improvement						
will be undertaken; only maintenance will be undertaken along the existing						
FUUF.						
<ul> <li>Construction and paving of unpaved sections, paved shoulders, ditches, and slope protection</li> </ul>						
Sight protection of 3 bridges and box cultures						
Construction of 5 bindges and box cuiverts     The heat option						
<ul> <li>The pest option</li> <li>Follow the present alignment with a diversion to the existing Melabor. Curritor</li> </ul>						
<ul> <li>Follow the present anyonnent with a diversion to the existing manabog-Gumitan</li> <li>Read towards Dangi Ageam Poad, then connect back to the existing</li> </ul>						
alignment.						

 Table 6-2. Summary of Alignment Options

Alignment Option	Key Points
	<ul> <li>Construction of PCCP in a paved section (11.94 km), paved shoulders, lined ditches, and slope protection works</li> <li>Construction of 3 bridges and 1 box culvert</li> </ul>
Link Road 3	
Option 1	<ul> <li>44.5 km DPWH DEO suggested alignment with a diversion into Brgy. Kidandan</li> <li>Construction of 14 new bridges, 3 bridge reconstructions, asphalt overlay, lined ditches, paved shoulders, footpaths, and slope protection</li> <li>Provisions for revetments for sections running beside the river</li> </ul>
Option 2	<ul> <li>45.03 km following the alignment recommended by the DPWH-XII FS, which involves several river crossings across the length of the Mainit River.</li> <li>Includes 10 new bridges and 3 bridge reconstructions.</li> <li>Construction of roads, lined ditches, paved shoulders, footpaths, and slope protection.</li> </ul>
Option 3	<ul> <li>The best option</li> <li>Similar to Option 2, except only 2 bridges will be reconstructed and 1 bridge (Mamulawan Bridge) will be retained and rehabilitated.</li> </ul>

The following **Figure 6-1**, **Figure 6-2**, **Figure 6-3**, and **Figure 6-4** present the maps of the different options that were considered for the four road components of the MTCIP.



Figure 6-1. Options for the Main Corridor



Figure 6-2. Options for the Link Road 1



Figure 6-3. Options for the Link Road 2



Figure 6-4. Options for the Link Road 3

# 6.2.1 Comparison of Alternatives

The option selection process takes into consideration key criteria categorized into technical, environmental, social, financial, and economic. The options were carefully rated using numerical scaling and weighing, with the highest-scoring option being selected as the best option. Considerations under the technical category include the lengths of new road and bridge construction and rehabilitation, the overall road alignment characteristics, the extent of climate resilience works such as the construction of slope protection, and the ease of construction activities. For the environmental aspects, parameters that were considered include the extent of the impact on water quality, trees that may need to be cut down, existing geologic hazards that the alignment will traverse, and the change in land use precipitated by the project. For the social parameters, these include the number of structures that will be affected by road and bridge construction activities, project-affected people that may need to be relocated, the impact of the project on vulnerable groups, and the impact of the project on the population. The last category, financial and economic, considers the total cost of construction as well as the acquisition of the road right of way, as well as the impacts of the project on travel time savings, VOC savings, value added to tourism, and gross value added to the agricultural production of the area.

From the options analyses undertaken, as detailed in Workstream 3, for the Main Corridor, the best option is Option 1, which includes the widening of the Main Corridor to a minimum of 4 lanes and re-blocking of distressed sections. This option does not include major bridgeworks, such as the construction of a new Atugan Bridge, in consideration of the budgetary constraints of the project.

For Link Road 1, the best option is Option 3, which provides connectivity between Kibenton

and Intavas, eventually forming a loop back into the Main Corridor. This enhances the accessibility of farmlands in the agricultural barangays as well as improving climate and disaster resilience by offering redundant access to the Main Corridor should problems arise at Atugan Brige, the only Atugan River crossing along the Main Corridor. This alignment also adds tourism value to the area as it connects to the entry point of Mt. Kitanglad Nature Park without encroaching on the park buffer zone. Works planned for this Link Road 1 include the paving of the existing 9-kilometer gravel road, the upgrading of the existing spillway across the Atugan River to a bridge structure, and the construction of paved shoulders and lined ditches.

For Link Road 2, the third option is also the best option. This Link Road provides more efficient connectivity between Panabo City and the northern areas of Davao City and the Province of Bukidnon. And Option 3 alignment entails the least cost by connecting to existing paved Malabog-Gumitan Road and Pangi-Agsam Road. The use of this road section also reduces the number of affected structures and the projected number of affected people that may need relocation.

Link Road 3 connects the Main Corridor, around Malungon in the Davao del Sur area, to the center of Sta. Maria, Davao Oriental. Option 3 is the best option for this link road, which significantly improves access to farmlands and connectivity to markets in this region. It is relatively cheaper than other options, with 35.25 km of new road construction and 10 new bridges, with another 2 for reconstruction and 1 for rehabilitation.

#### 6.2.2 Environmental Impacts of Alternatives

The environmental impacts of the project alternatives and options were evaluated and compared based on several criteria. These criteria were given "weighting proportions" based on the consensus of experts as to their level of importance or impact on the environment in reference to the proposed development. The proportions then represent the fraction of each criterion in the total environmental score of each option.

The criteria considered for the environmental impact of the project are the following:

- Water quality: the effect on local water bodies, including measures for water pollution control, sediment runoff, and protection of aquatic ecosystems.
- Number of trees affected: loss of trees along the proposed rehabilitation areas.
- Geologic hazards: length of the alignment that runs through areas that are identified as landslide-prone and flood-prone.
- Land use: affected land use change of forestland and agricultural lands along the project alignment.

The social impact of the project was assessed using a similar methodology as the environmental impact. The social criteria considered for the evaluation of options are the following:

- Number of affected structures: loss of residential, residential-commercial, commercial, and community structures along the proposed rehabilitation areas.
- Number of PAPs for relocation: physical and economic displacement of projectaffected people (PAPS) due to land acquisition for the proposed road rehabilitation.
- Impact on the population: the potential for the project to stimulate economic growth, create job opportunities, increase property values, and enhance the local economy.
- Impact on vulnerable groups: road safety and security of PAPs are considered

### vulnerable groups.

The best option, the selected option, for the MTCIP was taken from the highest scorer in the options analysis for all road types. This ensures that the adverse impacts and negative factors are kept to a minimum and the positive effects of the projects are maximized. The alignment options considered are relatively similar, as most of the routes are well established and in use, with minor modifications to optimize the benefits of the project and reduce the environmental and social footprint.

For the Main Corridor, the chosen option (Option 1) allows for better and more resilient connectivity and improves on the current status of roads that connect major commercial and industrial cities within Mindanao while staying within the projected budget ceiling of the project, optimizing the economic and financial benefits. In Link Road 1, the final option selected (Option 3) provides increased access to farms and improves the climate resilience of the transport network in the area without increasing environmental impact by connecting to existing road networks and minimizing ground activity that will affect natural elements through minimal road widening and no new river crossings at the Atugan River.

The Link Road 2 selected option (Option 3) also provides the necessary connectivity and access to farmlands and communities with the smallest environmental impact by connecting to the existing paved road in Malabog-Gumitan, thereby reducing the need for new road openings that will affect the surrounding forest and natural habitats. This option will also increase the number of people who can directly benefit from the road network as it passes through more established community centers.

Finally, the Link Road 3 selected option (Option 3) affords an efficient transport route between Saranggani, Davao del Sur, and Davao Occidental that was not possible prior to this project because of the lack of connected paved roads in this alignment. This Link Road will significantly boost the economic opportunities in the area and provide efficient passage for farm products and services. The selected option optimizes the economic and financial benefits of the project by minimizing the cost by reducing bridge construction costs and retaining one bridge that is still serviceable.

### 6.3 Alternative for Project Management

Traditional management by administration has been commonly implemented by the DPWH on its road development projects. Other alternative types of project management may be implemented based on the prevailing goals and constraints of the agency. For the MTCIP, the following alternative management may be implemented based on the different procurement methods used by each type:

- 1. Design and Build (D&B), also known as turnkey project management, involves a single entity to handle both the design phase and the construction phase.
- 2. Earned Value Management (EVM): This is an efficient method to monitor the progress of the project by comparing planned work with actual work being accomplished. It is good for assessment of project progress, scope integration, scheduling, and cost management.
- 3. Output and Performance-Based Road Contracts (OPRC): This is an approach to road infrastructure development that utilizes the rewards system based on performance and output achieved.
- 4. Waterfall Project Management: This is a traditional method where projects are divided into sequential phases and require detailed documentation to record the project's progress, decisions, and design.

- 5. Systems Approach: This method manages road projects akin to the developmental process of a system with various components and involves interdisciplinary collaboration, stakeholder engagement, lifecycle management, sustainability and environmental considerations, adaptability and flexibility, and risk management.
- 6. Critical Chain and Critical Path Approach: This is a dynamic and resource-sensitive method of project management that focuses on the schedule and resources of the project.
- 7. Public-Private Partnership (PPP): This is a collaborative framework between the government and private sector to finance, build, operate, and maintain road projects.

#### 6.4 Alternative for Resources

The inventory of resources within the areas traversed by the MTCIP shows that there are available sources of building materials and aggregates that can be locally sourced for project implementation. Along the Main Corridor, several cement manufacturing plants such as Holcim and La Farge (now Republic) Cement and Apo Cement are proximal to the alignment. There are also nine accredited asphalt plants within Regions X, XI, and XII. Batching plants within Region X include nine accredited companies and another ten in Regions XI and XII. Aggregates can be sourced from several river quarries along the alignment, with a total of 121 quarry material suppliers in the three regions.

Along the Link Roads, Link Road 1 can utilize material sources that are found along the Main Corridor. While Link Road 2 traverses areas where several local quarry suppliers operate, for Link Road 3, material sources in the Davao-GenSan segment of the Main Corridor may be potential suppliers for the construction.

### 6.5 No Project Option

Mindanao is the second-largest island in the country and hosts rich natural resources that produce significant agricultural products that support national food security and economic growth. The island has historically faced many development challenges as well as conflicting conditions that have further hindered its growth. Road networks are crucial factors that promote the transport of resources, goods, and services that will enable Mindanao to catch up and boost its agricultural productivity, as well as attract investment, increase tourism, improve access to services, facilitate peace efforts, reduce poverty, and enhance disaster response and resilience.

Without the MTCIP project, it is expected that the Main Corridor will experience continued declining levels of service, resulting in higher congestion rates, slower travel speeds, and significantly longer delays. An increase in congestion may also lead to an increase in road accidents. The bridges would also further degrade, which may pose safety concerns to road users and critically endanger the connectivity of the whole island.

Within Link Road 1, should no project ensue, residents of Kibenton and Cawayan will continue to have long travel times and be subjected to muddy and flooded roads, which may be impassable during inclement weather. This condition will significantly hinder economic growth in the region because of the lack of linkage to industry, tourism, trade, and commerce.

Should there be no project along Link Road 2, connectivity between Panabo City and the northern portions of Davao City and Bukidnon (BuDA) will be nonexistent as vehicular traffic will be unable to make the several river crossings. This will stifle economic growth in the region because of the lack of efficient transport of goods to the market and access to services, as

well as employment opportunities.

The Link Road 3 will provide connections between the provinces of Saranggani and Davao Occidental, without such connections, communities in the inland areas will travel longer distances to reach other provinces. Transport of goods and services is also extremely limited with the lack of connected roads, and access to employment and trade opportunities will be very scarce.

### 7. STAKEHOLDERS' ENGAGEMENT

The conceptualization, planning, and design of MTCIP include consultation with direct road users, government agencies and offices, local government units, businesses, and other sectoral groups that will be directly affected by the project. Stakeholders' engagement was planned at the start of the project. The strategies to consult and inform them were laid out in a stakeholder's engagement plan (SEP). The SEP aims to identify the main stakeholders, and given the conflict situation in the area, it describes the best approach to engaging them. The SEP will also provide the opportunity to involve key stakeholders in the discussions so that the project can be used as an instrument for peacebuilding and/or conflict resolution. The SEP also contains a GRM for stakeholders, which applies to the project.

The steps and processes for stakeholders' engagement with MTCIP are described below.

### 7.1 Stakeholder Identification

The Due Diligence and Options Analysis (DDOA), the Consultant identified affected stakeholders, other interested stakeholders, and vulnerable groups. The major and direct stakeholders, engagement activities, and information needed for DDOA are indicated in **Table 7-1**. These stakeholders and focal persons will be consulted and engaged in all phases of the study, but especially in the following:

- a. Establishment of the environmental and socio-economic profile of the Project areas, including the direct and indirect impact zones for the project components considered.
- b. ES assessment to identify the E&S risks considering the WB's Environmental and Social Standards (ESS) and recommendation of potential mitigating or enhancement measures through site-specific environmental and social management plan (ESMPs)
- c. Conflict analysis and identification of vulnerable groups, particularly the IPs along the Main Corridor and in the five Link Roads.
- d. Conduct of capacity development of DPWH in managing ES risks by increasing their knowledge on the WB Environmental and Social Framework (ESF), including the conduct of an environmental and social assessment (ESA) and enabling them to develop instruments under relevant ESS.

Stakeholder/Focal Person	Stakeholder Type	Data and Information Requests	DDOA Activity	Stakeholder Engagement Technique/Methodology
<b>DPWH</b> Department of Public Works and Highways	Implementing Agency	Project information List of project cities, municipalities, and barangays Environmental permits secured and records of compliance monitoring	Environment and socio-economic profile E&S assessment Identification of E&S risks Capacity development	Coordinate with and request endorsement of data and information requests from other government agencies, regional line agencies, and project LGUs. Collaborate on the conduct of five stakeholder consultations among project affected provinces or provincial clusters. Collaborate on 'learning by doing' activities. Conduct interviews with key resource persons.
<b>DENR</b> Department of Environment and Natural Resources	Interested party	Data on endangered flora/fauna and sensitive/critical natural habitats/protected areas in the project areas	E&S assessment Identification of E&S risks	Request and review EIS and other environment data. Invite to stakeholder consultations
NCIP National Commission on Indigenous Peoples NCMF National Commission on Muslim Filipinos	Interested parties	Data on hydrology/hydrogeology, water quality and air quality	Conflict analysis and identification of vulnerable groups identification of E&S risks	Invite to stakeholder consultations
NEDA National Economic and Development Agency	Interested party	Maps showing geologically hazard areas (erosion, landslide and flood prone areas, active faults, volcanic activity) Maps showing Land Cover/Use	Identification of vulnerable groups E&S assessment Identification of E&S risks	Request and review poverty information and RDPs for the socio-economic profile, E&S assessment, and identification of E&S risks
<b>PSA</b> Philippine Statistics Authority	Interested party	(Same with data request from DENR)	Socio-economic profile Identification of vulnerable groups	Review planned development projects in the

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Stakeholder/Focal Person	Stakeholder Type	Data and Information Requests	DDOA Activity	Stakeholder Engagement Technique/Methodology
		EIS of any section of the MTCIP corridor or link roads		region that might affect the MTCIP. Invite to stakeholder consultations. Request and review data
DHSUD Department of Human Settlements and Urban Development	Interested party	Poverty incidence and magnitude of poor population and families, by province, all MTCIP provinces Regional Development Plan, Regions 10, 11, 12	Socio-economic profile Identification of vulnerable groups Identification of direct and indirect impact zones	Request and review spatial information Invite to stakeholder consultations
<b>MinDA</b> Mindanao Development Authority	Interested party Coordinating agency	Total barangay population by sex, all MTCIP barangays Total number of households, all MTCIP barangays Men and Women in SOCCKSARGEN Region, Davao Region, Northern Mindanao Region Land use map, by province or region, all project provinces, Regions 10, 11,12 List of major resettlement projects in MTCIP area Number of informal settler families in MTCIP area Population by housing tenure, MTCIP area	Identification of vulnerable groups Conflict analysis	Request updated information and collaborate in ground- truthing of analysis. Coordinate in all field activities
Project Affected Households (PAHs) Directly and indirectly affected: displacement, livelihood disruption,	Project affected, vulnerable groups		E&S assessment Identification of E&S risks and mitigating measures	Invite to stakeholder consultations Interviews with randomly selected household heads Conduct of survey questionnaire
services IP groups	Project affected,		E&S assessment	Invite to stakeholder
	vulnerable groups			consultations

Stakeholder/Focal Person	Stakeholder Type	Data and Information Requests	DDOA Activity	Stakeholder Engagement Technique/Methodology
Bukidnon – Talaandig, Manobo, Higa-onon Davao – Mansaka, B'laan, Mandaya, Tagakaulo Maguindanao ethnic group Islamized ethnic groups			Identification of E&S risks and mitigating measures Conflict analysis	Courtesy call/ dialogue with Council of Elders, together with NCIP, NCMF and LGU Comply with FPIC guidelines
Barangay and city/ municipal/ provincial government units	Interested parties	LGU Ecological Profile Comprehensive Development Plan Comprehensive Land Use Plan Local Ordinances /declarations that may apply to the Project Conflict-related information, e.g., land disputes, ideological disputes, political dissidents, etc.	Environment and socio-economic profile Identification of vulnerable groups Identification of direct and indirect impact zones	Request (thru letter, email or stakeholder visits) and review LGU information, including ongoing and planned projects that will affect the MTCIP or be affected by it Invite to stakeholder consultations\

# 7.2 Information Disclosure, Consultation and Participation

Based on the DPWH Social and Environmental Management Systems (SEMS) Manual of 2021, initial public project announcements through courtesy calls, IEC, and consultation with the regulatory agencies and LGUs, as well as with affected residents, civil society, and NGOs, shall be done as early as the project identification phase. This is to gather, as early as possible, feedback and/or support for the project from the stakeholders and other interested parties.

Through consultation with the local communities and LGU officials, the environment and social safeguards specialist also identifies any community issues related to the project, such as incidences of flooding, flood-prone areas, availability of road access and materials stockpile areas, proximity to sensitive receptors such as residential communities and religious places, the presence of cultural and historical sites, trees and crops, and economic enterprises (e.g., farm product loading areas, copra dryers, etc.) that may be affected. By the project. Considering and integrating the aforementioned community issues in the formulation of mitigation measures shall pacify opposition parties to the project, if there are any.

Continuing stakeholder engagement and information disclosure continue during project implementation and operation, particularly during emergency response after the occurrence of a natural disaster such as an earthquake or typhoon, and rehabilitation works may have to be urgently undertaken.

MTCIP will engage with affected communities, including host communities, through the process of stakeholder engagement described in WB ESS10. Decision-making processes related to resettlement and livelihood restoration will include options and alternatives from which affected persons may choose. All PAPs and stakeholders will be meaningfully consulted in all phases of the resettlement planning and implementation processes.

Disclosure of relevant MTCIP information and meaningful participation of affected communities and persons will take place during the consideration of alternative project designs and thereafter throughout the planning, implementation, monitoring, and evaluation of the compensation process, livelihood restoration activities, and relocation process.

Project information disclosure will be carried out through community meetings and the distribution of brochures and other information materials. Materials will be prepared in the local dialect. The material shall contain MTCIP details and other relevant information and shall be distributed by DPWH UPMO to all PAPs. Aside from community meetings, the UPMO shall mount posters with the same information contained in the brochure in conspicuous locations such as the provincial, municipal, city, and barangay halls where the project will be located.

Community meetings will be organized in accessible locations and at convenient times to allow the participation of all PAPs. Separate discussions with vulnerable groups will be held to ensure that their specific needs and views are obtained and acted upon through the RPF. If necessary, DPWH will provide the PAPs with a transportation allowance.

Additional provisions apply to consultations with Indigenous Peoples, in accordance with WB ESS7. In accordance with the Indigenous Peoples Policy Framework (IPPF), Indigenous Peoples Plan (IPP) will be formulated and shall be part of the Memorandum of Agreement (MOA) between the IPs/ICCs, NCIP, and DPWH-UPMO-RMC II. It shall be disclosed to WB for clearance and shall be considered part of any investment. Engagement with Indigenous Peoples will follow requirements for free, prior, and informed consent (FPIC) where relevant. **Annex 20-22** presents the summary of information disclosure, consultation, and participation

activities conducted by DPWH-UPMO-RMC, MinDA, and GECI. It shows the dates, venue, number, and gender of people attending the meetings, including their comments, concerns, and corresponding responses.

Consultations among the road users of the Main Corridor and Link Roads indicate that they use the Main Corridor and the three Link Roads on a regular basis for work or livelihood, going to school, a health center, or a hospital, accessing government services, getting water, and transporting farm products such as coconut, banana, and vegetables to the urban market.

Their experience, however, includes difficulty using the road when it rains or when it is flooded, especially roads with poor drainage. It is a common challenge to navigate slippery, unpaved, uneven-link roads, steep and narrow roads, as well as roads blocked by boulders. The poor conditions lead to road crashes, families being stranded when the roads are flooded, students being late for school, and teachers having to commute for hours to reach the school. The local users report that some segments of the link roads lack lighting and road safety signage.

On a regular basis, transporting agricultural goods from the hinterlands to the Poblacion creates more economic losses because farmers end up paying more for transportation than their potential income.

During medical emergencies, residents say it is difficult to get timely help when they have to navigate the poor road conditions. The senior citizens wish that there were signs or crosswalks that could help them cross the street safely. The portions of the Main Corridor that pass through the town center are observed to have traffic congestion. Finally, road users are frustrated by the endless road repairs that often delay traffic.

### 7.3 Grievances Redress Mechanism (GRM)

Grievance Redress Mechanism (GRM) is designed for MTCIP to solicit feedback from and to project stakeholders and address issues, concerns, complaints, and recommendations related to project activities and the environmental and social operation of the project.

The GRM for MTCIP will adhere to the principles and steps stipulated in Republic Act 10752 and the DPWH Right-of-Way Acquisition Manual (DRAM). The GRM levels, procedures, and expected resolution are illustrated in detail in **Figure 7-1**.



Figure 7-1. Detailed GRM Flowchart for MTCIP

# 7.3.1 GRM for RROW, Involuntary Resettlement

Right-of-way acquisition and resettlement for MTCIP must be fully compliant with RA 10752 and its IRR, as well as with the World Bank safeguards requirement on a grievance redress mechanism.

Low-to-medium grievances about the environmental and social performance of the project during the construction phase will be handled by the Grievance Officer (GO), while highly sensitive grievances will be handled by the Grievance Redress Committee (GRC). The GRC shall be chaired by DPWH, with members from multi-sectoral organizations. Both the GO and GRC are expected to provide expeditious resolutions to complaints.

Complaints during the operations phase will be brought to the attention of the DPWH UPMO. DPWH UPMO shall promptly address, at no cost to the complainant and without retribution, any complaints, and concerns.

The creation of the GRM and its operationalization shall be included in appropriate sections of the civil works contract of MTCIP.

A Grievance Desk shall also be established at the project site to ensure timely conveyance of any grievance filed by the complainant(s) to the GO/GRC.

PAPs will be exempt from all administrative and legal fees incurred pursuant to the grievance redress procedures. All complaints received in writing (or written when received verbally) from PAPs will be documented and acted upon immediately according to the above-outlined procedures.

DPWH UPMO shall disclose the proposed GRM during public consultations.

During stakeholder engagement activities such as public consultation meetings and small or focused group discussions with affected stakeholders, grievance redress shall be discussed

and presented. Leaflets and brochures will also contain information regarding grievance redress. When available, the project website will also contain links to grievance redress information and complaint forms. Names and contact numbers of responsible persons in this grievance mechanism shall be included in the RAP report.

Aggrieved parties or complainants may also submit their complaints to DENR-EMB. The EMB is mandated by PD 1586 to act on complaints about the environmental and social performance of projects issued by an ECC.

# 7.3.2 GRM for Indigenous Peoples

The WB ESF and ESS7 require the establishment of mechanisms for grievance resolution to guarantee that IPs' recommendations and development plans are incorporated into the implementation of IPPF. It also provides IPs with a legal platform to monitor and evaluate the implementation of IPPF. The grievance mechanism allows the affected ICCs and persons to obtain rightful compensation, replacement, and resolution on any RROW acquisition, involuntary resettlement, natural resource use restriction, or other issues in the project operation.

Joint DPWH and NCIP grievance procedures for IP will be followed in the steps enumerated below:

- a. Conflicts within the affected IP community will be addressed within the community itself in the context of its customary law and customary dispute resolution process and mechanisms, in the presence of the relevant staff of the NCIP office with jurisdiction over the area, and if so invited, project-related staff and other stakeholders, e.g., formal local leadership in the barangay.
- b. Intercommunity conflicts will be addressed between the communities themselves, according to their customary or agreed-upon dispute resolution processes and mechanisms. If an outside facilitator, mediator, or arbiter is required or requested, DPWH-PMO and LGU, together with their monitoring units in the field, will seek the intervention of the NCIP to act as facilitator, mediator, or arbiter. This guideline applies to conflicts or disputes between the IP community and any of the project units and implementers.
- c. The social safeguards focal person at the Regional Interim Monitoring Committee (RIMC) and sub-committee levels shall document the proceedings of the discussion or negotiations. This is in addition to the documentation done by the IP community themselves and by the NCIP. If there is no satisfactory result or impasse, the IP communities shall be allowed to elevate their complaints and grievances to the Local HPBS Grievance Team. The grievance procedure established herein in no way substitutes for or replaces the grievance procedure set forth in the FPIC Guidelines of 2012. At their choosing, the IPs may avail of the grievance procedure and mechanisms spelled out in the FPIC Guidelines of 2012.
- d. Further, NCIP/IP/Ethnic Group membership in all Grievance Teams and Levels shall be ensured by the DPWH/LGU.

DPWH's Grievance Mechanism Process Flow will be the general reference for the hearing and resolution of any issues in RROW within ancestral domains and IPs/ICCs. All costs incurred in meetings, consultations, communication, and reporting/information dissemination will be borne by DPWH. There are no costs for the complainant at any stage of the GRM. Cost estimates for grievance redress are included in the resettlement cost estimates under administration costs. The complainant will not have to pay any fee for his or her case (official or unofficial).

# 7.3.3 Subproject-Specific GRM

A subproject-specific grievance redress mechanism (GRM) will be established at the DPWH District Engineering Office (DEO) before the start of construction to receive, evaluate, and facilitate the complaints and grievances of affected persons on the sub-project's environmental performance. This mechanism will be disclosed to the host communities prior to the commencement of site work. Contact information on how to access the GRM will be included in project information billboards.

The District Engineer will appoint an Environment Officer and establish the Grievance Redress Committee (GRC), to be chaired by the DPWH District Engineer. Members will include the following:

- a. the contractor's highest official at the site, such as the construction manager or the construction superintendent;
- b. Barangay Chairperson; and
- c. Environment Specialist of the Construction Supervision Consultant.

# 7.3.4 Filing of Grievance

For the quick filing of complaints, the GRC will use the grievance intake form. The DEO's Environment Officer will be responsible for the registration of grievances and communication with the aggrieved party. To facilitate addressing complaints, the contractor will be required to provide contact details of its representative(s) on site in its campsite offices and on project billboards that will be erected at the starting point of the project. The billboard shall likewise include the contact details of DPWH representatives in the event that complaints are not readily addressed by the contractor on-site.

The steps to be followed in filing complaints and the procedures for redress are the following:

- a. The complainant will provide the background and file the complaint directly, either verbally or in writing, with the on-site contractor representative(s) and the barangay through its officials for immediate corrective action.
- b. The contractor(s) representative is then required to act immediately on valid complaints and record such complaints in a complaints registry that must be maintained on the project office.
- c. Complaints that cannot be immediately attended to by the contractor shall be filed either verbally or in writing with the DEO or with the DEO's Environment Officer, who will assist the complainant in filling- out the grievance intake form.
- d. Within 2 working days, the Environment Officer, contractor's representative, and complainant will discuss if the complaint can be resolved without calling for a GRC meeting.
- e. Within 3 days of lodging the complaint, the DEO's Environment Officer will provide the complainant with written feedback on the process, steps, and timeframe for resolving the complaint.
- f. If the complaint cannot be resolved, a GRC meeting with the complainant will be called within 5 working days.
- g. The GRC will have 15 days to resolve the complaint.
- h. The complainant will receive feedback from the DEO's Environment Officer within 5

working days after the various steps of the GRM are done.

i. If the complainant is unsatisfied with the decision, the existence of the GRC will not impede the complainant's access to the government's judicial and administrative remedies or through concerned government agencies (e.g., the Community Environment and Natural Resources Office, the Provincial Environment and Natural Resources Office of DENR, and the Regional Offices of Environmental Management).

The GRC will receive, follow up on, and prepare monthly reports regarding all complaints, disputes, or questions received about the project and the corresponding actions taken to resolve the issues. These reports will be included in the semi-annual environmental monitoring reports to be submitted by DPWH to WB.

# 8. ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

# 8.1 Environmental and Social Management Plan

The Environmental and Social Management Plan (ESMP) is formulated to minimize or mitigate the potential adverse impacts and enhance the potential positive impacts of the proposed project. **Table 8-1** presents the proposed ESMP for every phase of the MTCIP. Indicated in the matrix are the mitigating and enhancement measures, the entities responsible, and the estimated cost of implementing the measures for each identified potential project impact. The environmental and social management measures implementation costs per package is provided in the **Annex 23**.

# 8.1.1 Construction Environmental Program

A Construction Environmental Program shall be implemented to avoid, minimize, and/or mitigate the anticipated environmental impacts of the proposed project construction activities. The program shall be implemented by the designated contractor(s) under the supervision of the DPWH-UPMO-RMC II and shall be consistent with the conditions stipulated in the ECC granted for the project. Among the management measures to be included in the program are:

- a. Avoidance or minimization of unnecessary earth movement and vegetation clearing;
- b. Implementation of a solid waste management plan in accordance with RA 9003
- c. Implementation of a hazardous waste management plan in accordance with RA 6969;
- d. Implementation of an oil spill management plan;
- e. Elimination or minimization of pollution sources through the application or installation of pollution control measures such as dust suppression techniques, noise control devices, and non-vibration or vibration-avoiding techniques during construction;
- f. Elimination or minimization of occupational health and safety risks through strict implementation of occupational safety and health plans and procedures during construction; and
- g. Implementation of a traffic management plan in coordination with the local authorities.

# 8.1.2 Solid Waste Management

In accordance with RA 9003, a Solid Waste Management Plan (SWMP) shall be formulated and implemented by the DPWH and its Contractors to properly manage the solid waste that will be generated during the pre-construction, construction, and demobilization phases of the Project. The plan shall include measures on the following:

- a. Waste minimization, reduction, and recycling measures;
- b. Waste segregation consistent with the local scheme;
- c. Provision of solid waste handling and interim storage facilities (i.e., dumpsters, trash bins) at strategic areas within the workers' camps and construction sites; and
- d. Coordination with the local authorities and/or DENR-registered haulers for the timely collection and disposal of municipal solid waste and construction debris.

### 8.1.3 Hazardous Waste Management

In accordance with RA 6969, a Hazardous Waste Management Plan (HWMP) shall also be formulated and implemented by the DPWH and its Contractors to properly manage the hazardous waste that will be generated from the Project activities. The plan shall include measures on the following:

- a. Hazardous waste identification, labeling, and segregation scheme;
- b. Onsite handling and interim storage procedures;
- c. Coordination with DENR-registered haulers and treatment, storage, and disposal (TSD) facilities.

# 8.1.4 Occupational Safety and Health

The DPWH occupational health and safety policy shall be implemented throughout the Project phases in order to prevent or reduce the likelihood of damage to life and property. The following are basic occupational health and safety guidelines that may be applicable to the Project:

- a. All construction personnel shall undergo a construction safety and health awareness seminar conducted by DOLE-accredited safety professionals, organizations, or institutions prior to deployment.
- b. A Construction Safety and Health Committee shall be formed with the following personnel as described in DOLE Department Order No. 13, Series of 1998:
  - (i) Project manager or his representative as the chairperson ex officio;
  - (ii) General Construction Safety and Health Officer;
  - (iii) Construction Safety and Health Officers;
  - (iv) Safety representatives from each subcontractor,
  - (v) Doctors, nurses, and other health personnel, pursuant to the requirements stated in Rule 1042 of the OSHS, who shall be members ex officio;
  - (vi) Workers' representatives (minimum of three union members if organized, not necessarily from one employer).
- c. Workers must be provided with and be required to wear the necessary personal protective equipment (PPE) within the project construction sites at all times.
- d. The required minimum inventory of medicines, supplies, and equipment shall be provided on the construction site.
- e. All heavy equipment shall be operated only by their duly certified operators.
- f. Construction safety signage, in a language understandable to most of the workers employed, shall be posted at strategic locations to warn the workers and the public of hazards in the workplace.

### 8.1.5 Vehicular Traffic Management

A Traffic Management Plan (TMP) shall be formulated and implemented in coordination with the concerned local government authorities. The plan may include measures on the following:

- a. Provision of traffic safety barriers, warning signs, and markings in the vicinity of construction sites;
- b. Imposition of appropriate speed limits;
- c. Provision of traffic personnel with appropriate PPE (e.g., reflectorized vest) and devices to direct the flow of vehicles at affected road sections; and
- d. Provision of adequate parking spaces for heavy equipment and service vehicles to prevent obstruction of traffic flow.

Project Phase / Activities	Environmental	Potential Impact(s)	Mitigating/Enhancement Measures		Responsible	Estimated	Guarantee/
Froject Filase / Activities	Component(s)	before Mitigation			Entities	Cost	Arrangements
PRE-CONSTRUCTION AND	CONSTRUCTION	PHASE					
Acquisition of Applicable Permits and Licenses	People	(+) Disclosure of project information to stakeholders and concerned government authorities	<ul> <li>Submit com requirement processing application.</li> </ul>	plete s for of permit	<ul> <li>DPWH- UPMO- RMC II</li> <li>ESSU</li> <li>DEDC Consultant</li> </ul>	19.46 Million	Pre- Construction Expenses
Land Acquisition for the RROW	People	(-) Displacement/ disturbance of settlers, properties, and livelihood	<ul> <li>Prepare and Resettlemer in accordance Resettlemer Framework</li> <li>Coordinate v concerned of and baranga</li> <li>Conduct prepare Remedial/Co Action Plan prior incol acquisition compensatio</li> </ul>	l implement that Action Plan ce with the the Policy with the sity/municipal ay LGUs. audit and orrective as needed for mplete land and on	DPWH- UPMO- RMC II	48.64 Million	Pre- Construction Expenses
	People	(-) Involuntary resettlement of IP households	Prepare and Indigenous F (IPP)	l implement of Peoples Plan	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	48.64 Million	Pre- Construction Expenses
Hiring of Workers	People	(+) Generation of employment opportunities	<ul> <li>Prioritize hir qualified won the host bar</li> <li>Coordinate v PESO of con city/municip</li> </ul>	ing of rkers within angays. with the ncerned al LGUs and	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> </ul>	29.18 Million	Pre- Construction Expenses

#### Table 8-1. Environmental and Social Management Plan for the MTCIP
Project Phase / Activities	Environmental	Potential Impact(s)	Mitigating/Enhancement	Responsible Entities	Estimated	Guarantee/
	Component(s)	before mitigation	the barangays for posting of labor requirements.	Littles	COSt	Anangements
		(-) Possible SEA/SH	<ul> <li>Orientation of contractors/workers on this issue.</li> <li>Formation of GRM to address SEA/SH concerns</li> <li>Implementation of the MTCIP Labor Management Procedures</li> </ul>	Contractor	c/o DPWH	Pre- Construction/ Construction Expenses
Site Preparation / Vegetation Clearing / Utilities Relocation	Land	(-) Loss of vegetation	<ul> <li>Limit vegetation clearing to the approved project development area.</li> <li>Apply for tree cutting permit, as necessary.</li> <li>Comply with the tree replacement guidelines as provided in JMC 2014- 01 (i.e., 100 seedlings/ saplings/ propagules replacement for every tree cut).</li> </ul>	DPWH- UPMO- RMC II     CSC	9.73 Million	Pre- Construction Expenses
	Water	(-) Possible siltation of nearby water bodies	<ul> <li>Establish sediment traps, erosion barriers, and/or silt curtains as applicable.</li> <li>Ensure regular removal of silt and sediments.</li> </ul>	DPWH- UPMO- RMC II     CSC	19.46 Million	Pre- Construction Expenses
	People	(-) Threat to delivery of basic services	• Coordinate with the concerned utility service providers and residents on the schedule of utilities relocation.	DPWH- UPMO- RMC II     CSC	29.18 Million	Pre- Construction Expenses
Construction of Temporary Facilities and	Land, Water, People	(-) Generation of domestic solid wastes	Implement solid waste     management plan in	DPWH- UPMO- RMC II	32.89 Million	Contractor's EMP, Site

Project Phase / Activities	Environmental Component(s)	Potential Impact(s)	Mitigating/Enhancement Measures	Responsible Entities	Estimated Cost	Guarantee/ Arrangements
Influx of Construction Workers			accordance with RA 9003.	CSC     Contractor	0001	Inspection Report
	Land, Water, People	(-) Generation of domestic wastewater	<ul> <li>Ensure provision of adequate sanitation facilities for the workers.</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	24.67 Million	Contractor's EMP, Site Inspection Report
	People	(-) Community health and safety risks, including peace and order	<ul> <li>Coordinate with the host city/municipal and barangay LGUs and local PNP for maintaining peace and order for the duration of the construction activities.</li> <li>Ensure strict implementation of drug- and alcohol-free work environment.</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	41.11 Million	Contractor's EMP, Site Inspection Report
Civil Works for the Main Corridor and Link Roads Main Corridor (i.e., Road Widening, Repair of Damaged Road Sections, Implementation of Slope Protection Measures, Drainage Works, Installation of Road Safety Infrastructures) Link Roads (i.e., Upgrading	Land	(-) Ground vibration from heavy equipment and vehicles	<ul> <li>Notify nearby residents in advance about the use of heavy equipment that may generate ground vibration.</li> <li>Apply non-vibration and/or vibration-avoiding techniques during construction, whenever possible.</li> <li>Ensure compliance of hauling trucks with road weight limits.</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	8.22 Million	Contractor's EMP, Site Inspection Report
from Unpaved Roads to Concrete, Repair of Damaged Road Sections, Construction and Rehabilitation of Bridges,	Land, Water, People	(-) Generation of construction spoils/debris and other solid wastes	<ul> <li>Implement solid waste management plan in accordance with RA 9003.</li> </ul>	DPWH- UPMO- RMC II     CSC     Contractor	8.22 Million	Contractor's EMP, Site Inspection Report

Project Phase / Activities	Environmental Component(s)	Potential Impact(s) before Mitigation	Mitigating/Enhancement Measures	Responsible Entities	Estimated Cost	Guarantee/ Arrangements
Implementation of Slope Protection Measures, Drainage Works, Installation of Road Safety Infrastructure)	Land, Water, People	(-) Generation of hazardous wastes	<ul> <li>Ensure proper onsite handling of hazardous waste in accordance with RA 6969.</li> <li>Ensure proper transport, treatment, storage, and disposal of hazardous waste by DENR- registered transporters and facilities.</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	16.44 Million	Contractor's EMP, Site Inspection Report
	Water	(-) Possible siltation of nearby water bodies	<ul> <li>Apply erosion and sediment control measures to minimize runoff to nearby canals/waterways.</li> <li>Implement proper staging techniques to minimize spillage of paving materials to nearby canals/waterways.</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	32.89 Million	Contractor's EMP, Site Inspection Report
	Land, Water	(-) Potential contamination of soil/water from accidental oil spills/leaks from heavy equipment and vehicles	<ul> <li>Implement oil spill management plan.</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	24.67 Million	Contractor's EMP, Site Inspection Report
	Air, People	(-) Generation of dust	<ul> <li>Avoid dust-generating activities during windy days, if possible.</li> <li>Minimize unnecessary earth movement.</li> <li>Apply dust control measures, such as water spraying and use of</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	8.22 Million	Contractor's EMP, Site Inspection Report

Project Phase / Activities	Environmental	Potential Impact(s)	Mitigating/Enhancement	Responsible	Estimated	Guarantee/
	Component(s)	before Mitigation	Measures	Entities	Cost	Arrangements
			<ul> <li>canvas cover for soil piles.</li> <li>Ensure wearing of PPE by workers to protect from airborne dust.</li> </ul>			
	Air, People	(-) Generation of air emissions and noise	<ul> <li>Ensure regular maintenance of heavy equipment and vehicles.</li> <li>Avoid performing noisy activities at nighttime.</li> <li>Locate noise-generating sources away from sensitive receptors (e.g., schools, hospitals, worship areas).</li> <li>Use noise control devices (e.g., temporary noise barriers/deflectors, mufflers), as necessary.</li> <li>Ensure wearing of PPE by workers to protect from excessive noise.</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	8.22 Million	Contractor's EMP, Site Inspection Report
	People	(-) Occupational health and safety risks	<ul> <li>Provide training on construction safety for workers.</li> <li>Ensure wearing or proper and complete PPE by construction workers.</li> <li>Ensure supervision of construction activities by trained professionals.</li> <li>Implement occupational health and safety policy.</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	205.54 Million	Contractor's EMP, Site Inspection Report
	People	(-) Community health and safety	<ul> <li>Install safety barriers to prevent unauthorized</li> </ul>	DPWH- UPMO- BMC II	41.11 Million	Contractor's EMP, Site

Project Phase / Activities	Environmental Component(s)	Potential Impact(s)	Mitigating/Enhancement Measures	Responsible Entities	Estimated Cost	Guarantee/ Arrangements
		risks, including road safety	<ul> <li>access to construction areas.</li> <li>Provide early warning devices and/or road safety signs.</li> </ul>	CSC     Contractor		Inspection Report
	People	(-) Threat to delivery of basic services/resource competition	Coordinate with the concerned utility service providers and residents on the schedule of utilities relocation.	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	41.11 Million	Contractor's EMP, Site Inspection Report
	People	(-) Traffic congestion	<ul> <li>Implement traffic management plan in coordination with the local authorities.</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	82.22 Million	Contractor's EMP, Site Inspection Report
DEMOBILIZATION AND OP	ERATIONAL PHA	SE				
Dismantling of Temporary Facilities and Clearance/Clearing of Construction Debris and Waste	Land, Water	(-) Generation of debris and other solid wastes	<ul> <li>Implement solid waste management plan in accordance with RA 9003.</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	67.28 Million	Contractor's EMP
	Air, People	(-) Generation of dust, air emissions, and noise	<ul> <li>Apply dust control measures, such as water spraying and use of canvas cover for soil piles.</li> <li>Ensure wearing of PPE by workers to protect from airborne dust and excessive noise.</li> <li>Ensure regular maintenance of heavy equipment and vehicles.</li> <li>Avoid performing noisy activities at nighttime</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	336.40 Million	Contractor's EMP

Project Phase / Activities	Environmental	Potential Impact(s)	Mitigating/Enhancement	Responsible	Estimated	Guarantee/
	Component(s)	before willgation	Use noise control devices     (e.g., temporary noise     barriers/deflectors,     mufflers) as pecessary	Entities	Cost	Arrangements
	People	(-) Occupational health and safety risks	<ul> <li>Provide training on construction safety for workers.</li> <li>Ensure wearing or proper and complete PPE by workers.</li> <li>Ensure supervision of construction activities by trained professionals.</li> <li>Implement occupational health and safety policy.</li> </ul>	<ul> <li>DPWH- UPMO- RMC II</li> <li>CSC</li> <li>Contractor</li> </ul>	26.56 Million	Contractor's EMP
Road Operations and Long-Term Performance Based Maintenance	Water	(-) Increased rate of surface water runoff	Implement stormwater management practices.	DPWH- UPMO- RMC II	134.56 Million	
(LTPBM)	People	(+) Enhancement of employment and livelihood opportunities	<ul> <li>Prioritize hiring of qualified workers within the host barangays.</li> <li>Coordinate with the PESO of concerned city/municipal LGUs and the barangays for posting of labor requirements.</li> </ul>	DPWH- UPMO- RMC II	17.71 Million	SDP
	People	(-) Generation of road traffic noise	<ul> <li>Install "No Blowing of Horn" signage at road sections adjacent to noise sensitive areas such as schools, hospitals, and worship places.</li> </ul>	DPWH- UPMO- RMC II	8.85 Million	
	People	(-) Occupational health and safety risks	<ul> <li>Provide training on construction safety for workers.</li> </ul>	DPWH- UPMO- RMC II	26.56 Million	

Project Phase / Activities	Environmental Component(s)	Potential Impact(s) before Mitigation	act(s) Mitigating/Enhancemer ation Measures			esponsible Entities	Estimated Cost	Guarantee/ Arrangements
			•	Ensure wearing or proper and complete PPE by maintenance workers.				
			•	Ensure supervision of maintenance activities by trained professionals.				
			•	Implement occupational health and safety policy.				
	People	(-) Traffic safety risks	•	Install and maintain signs, signals, markings, and other devices that regulate traffic.	•	DPWH- UPMO- RMC II Host	8.85 Million	
			•	Impose appropriate speed limits.		LGUs		

# 8.2 Chance Finds Procedure

In conformance with WB ESS 8 'Cultural Heritage' and in compliance with RA 10066 (Philippine Cultural Heritage Act), procedures for dealing with situations in which buried Physical Cultural Resources (PCR) are unexpectedly encountered shall be incorporated in Contracts for civil works involving excavations.

Republic Act No. 10066 provides for the Protection and Conservation of the National Cultural Heritage, Strengthening the NCCA and its Affiliated Cultural Agencies, and for Other Purposes. The following procedure is based on the provisions stated in this Act.

# 8.2.1 PCR Definition

Movable or immovable objects, sites, structures or groups of structures having archeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance.

The following are also specifically defined under the new Act

- (a) "Built Heritage" shall refer to architectural and engineering structures, such as but not limited to bridges, government buildings, houses of ancestry, traditional dwellings, quarters, train stations, lighthouses, small ports, educational technological and industrial complexes, and their settings, and landscapes with notable historical and cultural significance;
- (b) "**Cultural Heritage**" shall refer to the totality of cultural property preserved and developed through time and passed on to posterity;
- (c) "Cultural Property" shall refer to all products of human creativity by which a people and a nation reveal their identity, including churches, mosques and other places of religious worship, schools and natural history specimens and sites, whether public or privatelyowned, movable or immovable, and tangible or intangible;
- (d) "**Important Cultural Property (ICP)**" shall refer to a cultural property having exceptional cultural, artistic, and historical significance to the Philippines, as shall be determined by the National Museum and/or National Historical Institute.
- (e) **"Tangible cultural property"** shall refer to a cultural property with historical, archival, anthropological, archaeological, artistic and architectural value, and with exceptional or traditional production, whether of Philippine origin or not, including antiques and natural history specimens with significant value.
- (f) "**Indigenous properties**" The appropriate cultural agency in consultation with the National Commission on Indigenous Peoples shall establish a program and promulgate regulations to assist indigenous people in preserving their particular cultural and historical properties.

# 8.2.2 Ownership

All cultural property found in terrestrial and / or underwater archaeological sites belong to the State. The Commission, upon the recommendation of the appropriate cultural agency, shall provide incentives for persons who discover and report heretofore unknown archaeological sites, in accordance with its rules and regulations implementing the provisions of this Act.

# 8.2.3 Recognition

This is the most difficult aspect to cover. As noted above, in PCR-sensitive areas, the

procedure may require the contractor to be accompanied by a specialist. In other cases, the procedures may not specify how the contractor will recognize a PCR, and a clause may be required by the contractor disclaiming liability.

## 8.2.4 Procedure upon Discovery

## 8.2.4.1 Suspension of Work

When the presence of any cultural or historical property is discovered, the contractor must immediately report the discovery to the Resident Engineer or Supervisor. The National Museum or the National Historical Institute shall immediately be contacted and informed of the chance find. The contractor will suspend all activities that will affect the site and shall immediately notify the National Museum (see contact details provided below). The local government unit having jurisdiction where the discovery was made shall promptly adopt measures to protect and safeguard the integrity of the cultural property so discovered and within five (5) days from the discovery shall report the same to the appropriate agency. The suspension of these activities shall be lifted only upon the written authority of the National Museum or the National Historical Institute and only after the systematic recovery of the archaeological materials.

### 8.2.4.2 After work stoppage

The contractor may not be entitled to claim compensation for work suspension during this period. The Resident Engineer may be entitled to suspend work and request from the contractor some excavations at the contractor's expense if he thinks that a discovery was made and not reported.

### 8.2.4.3 <u>Demarcation of the Discovery Site:</u>

With the approval of the Resident Engineer, the contractor is then required to temporarily demarcate, and limit access, to the site.

### 8.2.4.4 Non-Suspension of Work:

The procedure may empower the Resident Engineer to decide whether the PCR can be removed and for the work to continue, for example in cases where the find is one coin.

### 8.2.4.5 Chance Find Report

The contractor should then, at the request of the Resident Engineer, and within a specified time period, make a Chance Find Report, recording the following:

- Date and time of Discovery;
- Location of the Discovery;
- Description of the PCR, with photos if possible;
- Estimated weight and dimensions of the PCR;
- Temporary protection implemented.

The Chance Find Report should be submitted to the Resident Engineer, and other concerned parties as agreed with the cultural authority, and in accordance with national legislation.

The Resident Engineer, or other party as agreed, is required to inform the cultural authority accordingly.

Responsible Authority in the Philippines:

Mr. Angel Bautista (or the authorized/designated representative) Cultural Properties Division National Museum of the Philippines P. Burgos St. Manila Tel. No.: +632 5271216; Fax: +632 527121

## 8.3 Environmental and Social Monitoring Plan

The Environmental and Social Monitoring Plan (ESMP) is formulated to monitor the implementation and evaluate the effectiveness of the proposed mitigating measures as provided in the ESMP. **Table 8-2** presents the proposed ESMP for every phase of the MTCIP. Indicated in the matrix are the indicators to be monitored, the location, frequency, type, and duration of monitoring and sampling activities to be conducted, as well as the entities who will be responsible for monitoring and supervising the activities.

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Table 8-2. Environm	Environment	Monitoring Pl	an for the MIC	P	8 Maaguram	ont Dian					EODI Ma	nagement Sch	0000	
Project Phase /	al	Impact(s)	Parameter(s	Sampling			Lead	Annual		EQPL Range		nagement Sch M	anagement Me	easure
Activities	Component(s	before Mitigation	) to be Monitored	Method	Frequency	Location	Person	Cost (PHP)	Alert	Action	Limit	Alert	Action	Limit
PRE-CONSTRUCT	ON AND CONST	RUCTION					1	1	I					
Land Acquisition for the RROW	People	(-) Displacemen t/ disturbance of settlers, properties, and livelihood, including IPs	Compensatio n for affected land and structures, including IPs	Consultation meetings; Parcellary survey	Monthly until the ROW is fully acquired	Per affected barangay including relocation sites, if any	DPWH- UPMO- RMC II	Included in RAP cost; PHP 50,000 per activity	N/A	N/A	N/A	Address grievances based on GRM.	Address grievances based on GRM.	100% compensation prior to displacement
Hiring of Workers	People	(+) Generation of employment opportunities	No. of locally employed workers	Logbook/ database registration	Daily	Project site	DPWH- UPMO- RMC II	Minimal	N/A	N/A	N/A	N/A	N/A	N/A
Site Preparation / Vegetation Clearing / Utilities Relocation	Land	(-) Loss of vegetation	Survival rate of replacement trees	Visual inspection; Tree count	Semi- annually	Replanting sites	Contractor s in coordinatio n with DPWH- UPMO- RMC II and concerned DENR Office(s)	Included in the construction cost PHP 1,500 per person/hour PHP 100 per sapling	60% survival rate	50% survival rate	40% survival rate	Replace non- surviving tree(s).	Replace non- surviving tree(s). Assess soil quality of area(s) where low survival rate is observed.	Assess the need to change species planted to increase survival rate.
	Water	(-) Possible siltation of nearby water bodies	Total suspended solids (TSS)	Visual inspection; Water sampling as per DAO 2016-08	Daily inspection; Quarterly sampling	Established surface water quality sampling stations	Contractor s and 3 <sup>rd</sup> - party laboratory in coordinatio n with DPWH- UPMO- RMC II	Included in the EMF PHP 1,500 per person- hour PHP 500 per sample	60 mg/L	70 mg/L	80 mg/L	Check condition of erosion controls.	Remove silt/sedimen t build-up as necessary to maintain good working conditions of erosion controls.	Assess need to replace or apply additional erosion control(s).
Construction of Temporary Facilities and Influx of Construction Workers	Land, Water, People	(-) Generation of domestic solid wastes	Weight or volume of wastes generated	Weighing/log- book recording	Daily	Temporary facilities	Contractor s in coordinatio n with DPWH- UPMO- RMC II	Included in the construction cost PHP 1,500 per person- hour	N/A	N/A	N/A	N/A	N/A	N/A
	People	(-) Community health and safety risks, including peace and order	No. of valid complaints	Survey/ interview with affected communities; Review of barangay records	Daily / Immediatel y, in case of accidents	Affected barangays	Contractor s in coordinatio n with DPWH- UPMO- RMC II	Included in the construction cost PHP 1,500 per person- hour	1 valid complaint annually	1 valid complaint semi- annually	1 valid complaint per quarter	Address grievances based on GRM.	Address grievances based on GRM.	Address grievances based on GRM.

	Environment	Potential	<b>D</b> ( (	Sampling	& Measurem	ent Plan					EQPL Ma	nagement Sch	eme	
Project Phase /	al	Impact(s)	Parameter(s) ) to be		_		Lead	Annual Estimated		EQPL Range	)	М	anagement Mo	easure
Activities	Component(s	Defore Mitigation	Monitored	Method	Frequency	Location	Person	Cost (PHP)	Alert	Action	Limit	Alert	Action	Limit
Civil Works for the Main Corridor and Link Roads Main Corridor (i.e., Road Widening, Repair of	Land	(-) Ground vibration from heavy equipment and vehicles	No. of project construction vibration- related complaints	Survey/ interview with affected communities; Review of barangay records	Daily / Immediatel y, in case of accidents	Affected barangays	Contractor s in coordinatio n with DPWH- UPMO- RMC II	Included in the construction cost	N/A	N/A	N/A	Address grievances based on GRM.	Address grievances based on GRM.	Address grievances based on GRM.
Damaged Road Sections, Implementation of Slope Protection Measures, Drainage Works, Installation of	Land, Water, People	(-) Generation of construction spoils/debris and other solid wastes	Weight or volume of wastes generated by type	Weighing/log- book recording	Daily	Constructio n areas	Contractor s in coordinatio n with DPWH- UPMO- RMC II	Included in the construction cost	N/A	N/A	N/A	N/A	N/A	N/A
Road Safety Infrastructures) Link Roads (i.e., Upgrading from Unpaved Roads to Concrete, Repair of Damaged Road	Land, Water, People	(-) Generation of hazardous wastes	Weight or volume of wastes generated by type	Weighing/log- book recording	Monthly	Project Site	Contractor s in coordinatio n with DPWH- UPMO- RMC II	Included in the construction cost	N/A	N/A	N/A	N/A	N/A	N/A
Concrete, Repair of Damaged Road Sections, Construction and Rehabilitation of Bridges, Implementation of Slope Protection Measures, Drainage Works, Installation of	Water	(-) Possible siltation of nearby water bodies	Total suspended solids (TSS)	Visual inspection; Water sampling as per DAO 2016-08	Daily inspection; Quarterly sampling	Established surface water quality sampling stations	Contractor s and 3 <sup>rd</sup> - party laboratory in coordinatio n with DPWH- UPMO- RMC II	Included in the EMF PHP 1,500 per person- hour PHP 500 per sample	60 mg/L	70 mg/L	80 mg/L	Check condition of erosion controls.	Remove silt/ sediment build-up as necessary to maintain good working conditions of erosion controls.	Assess need to replace or apply additional erosion control(s).
Infrastructure)	Land, Water	(-) Potential contaminatio n of soil/ water from accidental oil spills/leaks from heavy equipment and vehicles	Oil spill	Visual inspection	Weekly inspection; Immediatel y in case of spill	Constructio n areas; Maintenanc e yards for heavy equipment and vehicles	Contractor s in coordinatio n with DPWH- UPMO- RMC II	Included in the EMF	Incidence of oil spill	Oil-spill related complaint persists	Oil-spill related complaint persists	Initiate spill clean-up.	Address grievances based on GRM.	Address grievances based on GRM.
	Air, People	(-) Generation of dust	Total Suspended Particulates (TSP)	High Volume / Gravimetric Method	Annually or as required by DENR- EMB	Established ambient air quality monitoring	Contractor s and 3 <sup>rd</sup> - party laboratory	Included in the EMF PHP 1,500	172.5 μg/NCM	195.5 µg/NCM	230 μg/NCM	Check efficiency of pollution control	Restore good working condition of	Restore good working condition of pollution control
			Particulate Matter 10 (PM10)	High Volume / Gravimetric Method		stations	in coordinatio n with	per person- hour	112 μg/NCM	127.5 μg/NCM	150 μg/NCM	device(s).	pollution control device(s).	device(s).
		(PM10) No. of projec dust-related complaints	Survey/ interview with affected communities; Review of barangay records	Daily	Affected barangays	n with DPWH- UPMO- RMC II	PHP 30,000 to 80,000 per sampling station depending on parameters	1 valid complaint annually	1 valid complaint semi- annually	1 valid complaint per quarter	Address grievances based on GRM.	Address grievances based on GRM.	Address grievances based on GRM.	

	Environment	Potential	Deverse ter/e	Sampling	& Measurem	ent Plan		Ammunal			EQPL Ma	nagement Sch	eme	
Project Phase /	al Component(s	Impact(s)	) to be	Mathad	Fraguanay	Location	Lead	Estimated		EQPL Range	3	M	anagement M	easure
Activities	)	Mitigation	Monitored	wiethod	Frequency	Location	Feison	Cost (PHP)	Alert	Action	Limit	Alert	Action	Limit
	Air, People	(-) Generation	Sulfur Dioxide	Gas Bubbler / Pararosanilin	Annually or as required	Established ambient air	Contractor s and 3 <sup>rd</sup> -	Included in the EMF	135	153	180	Check efficiency of	Restore good	Restore good working
		of air	(SO <sub>2</sub> )	e	by DENR-	quality	party		μg/NCM	μg/NCM	μg/NCM	pollution	working	condition of
		emissions and noise	Nitrogen Dioxide (NO <sub>2</sub> )	Gas Bubbler / Griess- Saltzman	EMB	stations	in coordinatio n with	PHP 1,500 per person- hour	112 μg/NCM	127.5 μg/NCM	150 μg/NCM	device(s).	condition of pollution control device(s).	pollution control device(s).
		No. of proj		Direct reading using sound level meter (daytime and nighttime)	Semi- annually; Immediatel y in case of complaints	Established noise level monitoring stations near identified sensitive receptors	oise level UPMO- nonitoring RMC II tations ear lentified ensitive eceptors		Detected sound level near the NPCC noise standards.	Detected sound level exceeds the NPCC noise standards annually.	Detected sound level exceeds the NPCC noise standards semi- annually.	efficiency of pollution control device(s).	Restore good working condition of pollution control device(s).	Restore good working condition of pollution control device(s).
			No. of project air emissions and noise- related complaints	Survey/ interview with affected communities; Review of barangay records	Daily	Affected barangays			1 valid complaint annually	1 valid complaint semi- annually	1 valid complaint per quarter	Address grievances based on GRM.	Address grievances based on GRM.	Address grievances based on GRM.
	People	(-) Occupational health and safety risks	No. of work- related illnesses/ injuries	Logbook	Daily	Project site	Contractor s in coordinatio n with DPWH- UPMO- RMC II	Included in the construction cost	1 near- miss incident semi- annually	1 near- miss incident per quarter	1 accident per quarter	Conduct OSH re- orientation for involved worker(s).	Conduct department al re- training of workers on OSH. Inspect the area where the near- miss incidents happen.	Conduct external safety audit and implement recommendation s.
	People	(-) Community health and safety risks, including road safety	No. of project construction- related accidents involving residents at nearby communities	Survey/ interview with affected communities; Review of barangay records	Daily / Immediatel y, in case of accidents	Affected barangays	Contractor s in coordinatio n with DPWH- UPMO- RMC II	Included in the construction cost	1 valid complaint annually	1 valid complaint semi- annually	1 valid complaint per quarter	Address grievances based on GRM.	Address grievances based on GRM.	Address grievances based on GRM.
	People	(-) Traffic congestion	Traffic volume	Traffic count / actual traffic observation and documentatio n	Daily	Affected road sections	Contractor s in coordinatio n with DPWH- UPMO- RMC II	Included in the construction cost	N/A	N/A	N/A	Address grievances based on GRM.	Address grievances based on GRM.	Address grievances based on GRM.
DEMOBILIZATION	AND OPERATIO		Weight or	Weighing/log	Monthly	Project site	Contractor	Included in	N/A	N/A		Ν/Δ	N/A	
Temporary Facilities and Clearance/Clearin	Lanu, Walei	Generation of debris and	volume of wastes	book recording	wonuny		s in coordinatio n with	the demobilizatio n cost				IN/ <i>I</i>		

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Envi	Environment	Potential	Parameter(s	Sampling	& Measurem	ent Plan		Annual	EQPL Management Scheme					
Project Phase /	al	Impact(s)	) to be				Lead	Annual Estimated		EQPL Range			anagement M	easure
Activities	Component(s )	before Mitigation	Monitored	Method	Frequency	Location	Person	Cost (PHP)	Alert	Action	Limit	Alert	Action	Limit
g of Construction Debris and Waste		other solid wastes	generated per type				DPWH- UPMO- RMC II							
	People	(-) Occupational health and safety risks	No. of work- related illnesses/ injuries	Logbook	Daily	Project site	Contractor s in coordinatio n with DPWH- UPMO- RMC II	Included in the demobilizatio n cost	1 near- miss incident semi- annually	1 near- miss incident per quarter	1 accident per quarter	Conduct OSH re- orientation for involved worker(s).	Conduct department al re- training of workers on OSH. Inspect the area where the near- miss incidents happen.	Conduct external safety audit and implement recommendation s.
Road Operations and Long-Term Performance Based Maintenance (LTPBM)	People	(-) Occupational health and safety risks	Working Environment Measuremen t (WEM)	DOLE BWC- OSHC Method	Quarterly	Project site	DPWH- UPMO- RMC II	Included in the maintenance cost	Parameter s for good working conditions are near the DOLE OSH limits	Parameter s for good working conditions are equal to or exceed DOLE OSH limits	Parameter s for good working conditions exceed the DOLE OSH limits for 2 consecutiv e quarters	Review maintenance and housekeepin g activities and revise as needed.	Apply corrective action(s).	Conduct external audit of working environments.

# 8.4 Capacity Strengthening on Environmental and Social (ES) Aspects

DPWH shall formulate and conduct environmental and social orientation and training programs on E and S aspects for contractors, including workers and pertinent LGU staff, to be involved in monitoring environmental and social mitigation implementation. This program would include the following:

- Orientation of prospective contractors on ESMP
- Orientation of concerned LGU officers and personnel on ECC compliance and multipartite environmental monitoring

## 8.5 Implementation Arrangements

MTCIP will be implemented over seven years, following project effectiveness. DPWH will act as the Implementing Agency (IA) for Components 1 to 4, with the Department of Finance acting as the IA for Component 5. **Figure 8-1** shows the organizational chart for the Project.



Figure 8-1. Project Organizational Chart

**DPWH is the main Implementing Agency (IA) for this Project**. The DPWH is the executive department of the Philippine government, solely vested with the mandate to "be the state's engineering and construction arm." It is tasked with policy related to the engineering and construction fields, including continuous technology development, and responsible for ensuring the safety of all infrastructure facilities, together with efficacy and quality in construction. DPWH is responsible for the planning, design, construction, and maintenance of infrastructure, especially the national highways, flood control and water resources development system, and other public works in accordance with national development. The institution is divided into six main bureaus (Bureau of Design; Bureau of Construction; Bureau

of Maintenance; Bureau of Equipment; Bureau of Research & Standards; Bureau of Quality & Safety) and has divisions responsible for Public-Private Partnerships (PPPs), the operations of foreign-assisted projects (i.e., UPMO), and key technical services (planning, finance, legal, and special concerns, among others). DPWH also has regional field offices across the country.

A Project Steering Committee (PSC) will be set up. The PSC will provide overall strategic direction and policy guidance and support interagency coordination for the Project. The PSC, headed by the DPWH Secretary, will provide overall strategic guidance and direction for the Project. Its oversight functions will include defining the Project's roadmap, approving its work and financial plan, and other strategic initiatives; initiating and developing special activities and Projects, reviewing and assessing implementation progress; and evaluating the performance of the Project Implementation Unit (PIU). The PSC will meet quarterly to review project progress towards the development objectives and help resolve any interagency issues that may arise. The terms of reference (TOR) governing the PSC will be detailed in the Project Operations Manual (POM).

Under the Project Steering Committee are the Undersecretary of Planning Service and PPP, which controls the Planning Service. The Planning Service provides technical services for planning, programming, and project development. It prepares the Department's medium-term development plan and medium-term public investment program, including the formulation of the annual infrastructure program (AIP), for presentation and approval by Congress.

Under the Undersecretary for Technical Services and IMS are the Bureaus, namely: (i) Bureau of Design (BOD), (ii) Bureau of Construction (BOC), (iii) Bureau of Maintenance (BOM), (iv) Bureau of Research and Standards (BRS), and (v) Bureau of Quality and Safety (BQS). These Bureaus will review and assess the design plans, road safety, material quality assurance and control, cost estimates, and maintenance procedures.

**DPWH's UPMO RMC-II cluster will be the Project Implementation Unit (PIU).** The UPMO RMC-II will be responsible for the daily management of the project. The fiduciary function will be carried out by the respective procurement and financial management-related units in DPWH, while the RMC-II will be responsible for contract management, including preparing all the needed procurement documents. Additional fiduciary support will be provided under the project, e.g., the hiring and designation of FM and procurement specialists as needed. RMC II shall also provide support in terms of the initial processing and review of billings from contractors and the preparation and submission of Statement of Expenditures and Withdrawal Applications to the World Bank. The Mindanao Development Authority (MinDA), as the lead agency for Mindanao's development, is the key government office that the DPWH will be coordinating in the approval of the proposed MTCIP. The LGUs in the project area will be supporting the RMC-II of project implementation.

**PIU Staffing**. The PIU within DPWH's UPMO RMC-II is set up with the following roles:

- i. **Project Manager**: Oversees the day-to-day implementation of the Project, coordinates the implementation of the Project, and acts as the focal point for communication with WB and other agencies;
- ii. **Deputy Project Manager**: assist the project manager in day-to-day Project implementation, oversee technical and safeguard aspects of the project, and also communicate on behalf of the project manager to the WB and other agencies.
- iii. **Technical support staff** will consist of technical specialists who will be responsible for the respective aspects of the project. These technical support staff include those

for environmental, social/resettlement, gender, road safety, financial planning, procurement, etc.

**Annex 24** presents the Office Order of DPWH officials and personnel assigned to the Due Diligence and Options Analysis (DDOA), Feasibility Studies (FS), and Detailed Engineering Design (DED) for MTCIP.

**Third-Party Monitoring**. DPWH will engage an External Monitoring Agent (EMA), who will perform semi-annual integrated performance audits covering, among others, engineering designs, management of social and environmental issues, including the implementation of the SEA/SH action plan, and quality assurance. Construction Supervision Consultants (CSC) will provide regular supervision of the work contracts. Consultants and non-governmental organizations will aid DPWH in the implementation of resettlement, GBV, VAC, and HIV/AIDS action plans. A Road User Satisfaction Survey consultant will carry out baseline, mid-term, and end-stage user satisfaction surveys. Results Monitoring Consultants will develop methodologies, collect data, carry out required surveys, and measure the values of outcome and intermediate indicators. Consultants procured under the Project will carry out the studies and/or training under Components 3 and 4. The World Bank, through meetings with PIU, DPWH, and the implementation support missions, will regularly monitor the progress of all the activities supported under the Project and the Project's compliance with environmental, social, technical, health, and safety requirements. The World Bank will also work closely with the DPWH to continually monitor the protection environment throughout project implementation.

**A Project Operations Manual (POM) will be prepared.** It will contain detailed arrangements and procedures for implementation of the Project including, inter alia: (i) implementation arrangements, including the delineation of roles and responsibilities of various entities, institutions, and agencies involved in Project implementation and their coordination; (ii) procurement procedures and standard procurement documentation; (iii) disbursement arrangements, reporting requirements, financial management procedures, and audit procedures; (iv) procedures for preparing and reviewing a consolidated annual work plan and budget for each fiscal year; (v) the Project performance indicators and monitoring and evaluation arrangements; (vi) arrangements and procedures for mitigating environmental and social risks and impacts; (vii) a grievance redress mechanism; (viii) information, education, and organizational arrangements and procedures as shall be required for the Project. **Table 8-3** presents the responsibilities for the ESMP implementation.

Agency	Responsibility
Department of Public Works and Highways	<ul> <li>Implementing Agency (IA) with overall responsibility for project construction and operation</li> </ul>
(DPWH)	• Ensure that sufficient funds are available to properly implement the ESMP.
	<ul> <li>Ensure that project implementation complies with government environmental policies and regulations;</li> </ul>
	<ul> <li>Ensure that the project, regardless of its financing source, complies with the provisions of the ESMP, WB ESS, and GOP statutory requirements;</li> </ul>
	<ul> <li>Obtain necessary environmental approval(s)/clearances/permits from the DENR-EMB and/or other concerned government agencies prior to the commencement of civil works;</li> </ul>
	• Ensure that tender and contract documents for design, supervision, and civil works include the relevant ESMP requirements.

Table 8-3. Responsibilities for the ESMP Implementation

Responsibility
<ul> <li>Establish information on an environmental grievance redress mechanism to receive and facilitate resolution of affected people's concerns; and</li> <li>Submit semi-annual monitoring reports on ESMP implementation to the WB</li> </ul>
<ul> <li>Project Implementing Office (PIO) with direct responsibility for the implementation of civil works, engineering designs, and project coordination, including the incorporation of ESMP design measures in the detailed design;</li> <li>Shall conduct an environmental assessment, prepare the necessary environmental document, and secure the corresponding environmental clearance, whether ECC or CNC, prior to project implementation. (DO 057 s. 2016).</li> <li>Ensure that the cost of implementing these ESMP conditions and mitigating measures in the ECCs and EMPs/EMoPs is included in the project budget (DO 245 s. 2003).</li> <li>Ensure that the costs of implementing the environmental compliance and monitoring activities, as indicated in the SEMS Operations Manual, are included in the project budget. (DO 245 s. 2003).</li> <li>Ensure that ESMP provisions are strictly implemented and monitored during various project phases (design/preconstruction, construction, and operation) to mitigate environmental impacts to acceptable levels;</li> <li>Ensure compliance with environmental permits; and</li> <li>Include relevant provisions of the ESMP in the bid and contract documents for design, civil works, and supervision.</li> <li>Coordinate with DENR-EMB, LGUs, and other concerned agencies related to environmental aspects to maintain the project's compliance with environmental spects to maintain the project's</li> </ul>
<ul> <li>Assist the UPMO-RMC II and CSC in undertaking their environment-related tasks, such as the review of EIA documents, the review of ESMP and Construction ESMP (CESMP), and monitoring and reporting on CESMP implementation and contractor compliance with GOP regulations applicable to MTCIP.</li> </ul>
<ul> <li>Incorporate into the project design the environmental protection and mitigation measures identified in the ESMP for the design/pre-construction stage; and</li> <li>Assist UPMO to ensure that all relevant mitigation and monitoring measures from the ESMP are incorporated in the bidding and contract documents for project supervision and civil works.</li> </ul>
<ul> <li>Prior to the establishment of the contractor's facilities and the commencement of civil works, undertake a review of specific environmental management plans (e.g., borrow pits and quarries, develop spoil disposal facilities, etc.) to be prepared by contractors to ensure that such plans are consistent with the provisions of the ESMP.</li> <li>Engage, as necessary, environment specialists who will undertake supervision and monitoring of ESMP implementation and the contractor's environmental performance;</li> <li>Conduct periodic site visits to assess the status of ESMP implementation and the overall environmental performance of the project.</li> <li>Review environmental monitoring reports submitted by the contractor to ensure that adverse impacts and risks are properly addressed; and</li> <li>As part of day-to-day project supervision, closely supervise the</li> </ul>

Agency	Responsibility
	CESMP and ESMP, including monthly monitoring of the contractor's environmental performance and the overall implementation of the ESMP;
	<ul> <li>Prepare semi-annual environmental monitoring reports on the status of ESMP implementation for submission to DPWH;</li> <li>Based on the results of ESMP monitoring, identify environmental</li> </ul>
	corrective actions and prepare a corrective action plan, as necessary, for submission to WB.
Contractor	<ul> <li>Recruit a qualified environmental and safety officer (EHSO) to ensure compliance with environmental statutory requirements, contractual obligations, and CESMP/ESMP provisions;</li> <li>Provide sufficient funding and human and physical resources for the proper and timely implementation of the required mitigation and monitoring measures in the ESMP; and</li> <li>Implement additional environmental mitigation measures, as necessary, to avoid, minimize, and/or compensate for adverse impacts due to construction works and related activities performed by the contractor.</li> </ul>
DENR-EMB	Review and approve environmental assessment reports required by the government; and
	<ul> <li>Undertake monitoring of the project's environmental performance based on their mandate.</li> </ul>
World Bank	<ul> <li>Conduct periodic site visits to assess the status of ESMP implementation and the overall environmental performance of the project.</li> <li>Boview environmental monitoring reports submitted by the</li> </ul>
	<ul> <li>Review environmental monitoring reports submitted by the Implementing Agency to ensure that adverse impacts and risks are properly addressed; and</li> </ul>
	<ul> <li>Publicly disclose, through posting on the WBs website, environmental monitoring reports and corrective action plans prepared by the Implementing Agency during project implementation.</li> </ul>

# 9. CONCLUSION AND RECOMMENDATIONS

The proposed MTCIP is projected to improve transport infrastructure and accessibility across Mindanao, further boosting economic and social development needs. It will also enhance road users' safety along the Main Corridor and Link Roads.

This Draft ESIA looked into development activities in terms of managing environmental and social issues. The issues considered were based on the potential impacts of the project on land, water, air, and people. The environmental and social impacts that will arise during the construction and operation will be managed through the implementation of the mitigating measures mentioned in the ESMP and the monitoring requirements in the ESMOP.

The specific recommendations of this Draft ESIA study are:

- All activities during the construction, demobilization, and operation phases will be implemented along with the implementation of the ESMP.
- ESMP will be implemented during the construction, demobilization, and operation phases to determine the effectiveness of measures to mitigate the identified potential impacts.
- The baseline environmental sampling conducted during the preparation of the draft ESIA of the MTCIP may not be sufficient to provide an accurate picture of the condition of the study area. It is recommended that more comprehensive monitoring be implemented during the DED stage to properly assess the potential impacts during construction and operation.
- Establishment of the institutional arrangements, including training on environment, health, and safety during the construction and operation phases of the project.

**Table 9-1** presents the summary of costs for the implementation of environmental and social management measures.

Project Activities	Environmental Components	Type of Cost	Cost	%	Final Cost (in millions)		
PRE-CONSTRUCT	PRE-CONSTRUCTION PHASE						
Acquisition and Applicable Permits processing	People	Development Cost	194.57	10.00%	19.46		
Land Acquisition RROW	People (Disturbance/Displacement of Settlers)		194.57	25.00%	48.64		
	People (households' involuntary resettlements)		194.57	25.00%	48.64		
Hiring of Workers (Local)	People (barangay host		194.57	15.00%	29.19		
Site Preparation	Land		194.57	5.00%	9.73		
Vegetation Clearing	Water		194.57	10.00%	19.46		
Utilities Relocation	People		194.57	15.00%	29.19		
CONSTRUCTION PHASE							
Construction of Temp Facilities	Land, Water, People (Solid Waste Management Plan)	Civil Works Cost	164.43	20.00%	32.89		
for Workers	Land, Water, People		164.43	15.00%	24.66		

Table 9-1. Summary Costs	y of Environmental	and Social	Management Me	easures Ir	nplementa	ation
						_

Project Activities	Environmental Components	Type of Cost	Cost	%	Final Cost (in millions)
	(Adequate Sanitation Facilities)				
	People (Safety, Risks, Peace		411.09	10.00%	41.11
	and Order) Coordinators				
Civil Works for	Land (ground vibration control)		164.43	5.00%	8.22
the Main Corridor	Land, Water, People (Proper		164.43	5.00%	8.22
and Link Roads	disposal of debris/spoils and				
	other solid wastes)				
	Land, Water, People (Proper		164.43	10.00%	16.44
	onsite handling, transport and				
	disposal of hazardous				
	materials)				
	Water (implementing measures		164.43	20.00%	32.89
	for water spillage)				
	Land, Water (oil spill		164.43	15.00%	24.66
	management implementation)				
	Air, People (dust control		164.43	5.00%	8.22
	measures)				
	Air, People (Air emission and		164.43	5.00%	8.22
	noise control measures)				
	People (Occupational Safety		411.09	50.00%	205.55
	and Health				
	People (safety risks: Barriers,		411.09	10.00%	41.11
	early warning devices)			40.000/	
	People (coordinator for basic		411.09	10.00%	41.11
	resources/providers, residents				
	Deeple (treffic centrel		444.00	20.000/	00.00
	People (traffic control		411.09	20.00%	82.22
DEWOBILIZATION Diamontling of	Lond Water (solid waste		67.00	40.000/	26.012
Temporary	management plan)		07.20	40.00 %	20.912
Facilities for	Air People (Air emission and		336.40	20.00%	67.28
Workers	noise control measures)		000.40	20.0070	07.20
	People (Occupational Safety		88.53	30.00%	26 559
	and Health		00.00	00.0070	20.000
Road	Water (storm water		336.40	40.00%	134.56
Operations	management implementation)				
•	People (enhancement		88.53	20.00%	17.706
	employment livelihood)				
	People (Road traffic noise		88.53	10.00%	8.853
	control)				
	People (Occupational Safety		88.53	30.00%	26.559
	and Health				
	People (traffic control		88.53	10.00%	8.853
	measures implementation)				