

**PREPARATORY SURVEY
FOR
CEBU-MACTAN BRIDGE AND COASTAL
ROAD CONSTRUCTION PROJECT
(NEW MACTAN BRIDGE
CONSTRUCTION PROJECT)
IN
THE REPUBLIC OF THE PHILIPPINES**

**ENVIRONMENTAL IMPACT
STATEMENT**

FINAL REPORT

August 5, 2019

**DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
IN COOPERATION WITH
JAPAN INTERNATIONAL COOPERATION AGENCY
ORIENTAL CONSULTANTS GLOBAL CO., LTD.
CHODAI CO., LTD.
NIPPON KOEI CO., LTD.
ALMEC CORPORATION**



Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
CENTRAL OFFICE
Manila

July 3, 2019

Engr. WILLIAM P. CUÑADO
Regional Director
Environmental Management Bureau-7
Banilad, Mandue City

Attention: **EIA Review Committee**

Dear Dir. Cuñado:

Submitting herewith is the Draft Final Report of **Environmental Impact Assessment (EIA)** relative to the **New Mactan Bridge Construction Project**, which incorporated the results of public consultations and public hearings from both Mandaue and Lapu-Lapu City. With this submission, may we request for a review of this report for the issuance of ECC.

Very truly yours,


VIRGILIO C. CASTILLO
Project Director

19.1 AERA/RCM

ENVIRONMENTAL IMPACT ASSESSMENT

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List of Abbreviations

AQSS	Air Quality Sampling Station
BCDA	Bases Conversion Development Authority
BOD	Biochemical Oxygen Demand
Brgy.	Barangay
BRT	Bus Rapid Transit
BSWM	Bureau of Soils and Water Management
CCA	Climate Change Adaptation
CCC	Climate Change Commission
CCLEX	Cebu Cordova Link Expressway
CCPL	Central Cebu Protected Landscape
CCTV	Closed-circuit Television
CENRO	City Environment & Natural Resources Office
CFARMC	City Fishery Aquatic Resource Management Council
CIBE	Commercial, Industrial/Institutional, Businesses Enterprise
CLUP	Comprehensive Land Use Plan
CMR	Compliance Monitoring Report
CO	Carbon Monoxide
COD	Chemical Oxygen Demand
COPD	Chronic Obstructive Pulmonary Disease
CPH	Census of Population and Housing
DA	Department of Agriculture
DAO	DENR Administrative Order
dB	Decibel
dBA	A-Weighted Decibel
D/D	Detailed Design
DENR	Department of Environment and Natural Resources
DGS	Department of General Services
DIV	Dutch Intervention Value
DO	Dissolved Oxygen
DOE	Department of Energy
DOLE	Department of Labor and Employment
DOST	Department of Science and Technology
DOTr	Department of Transportation

DPWH	Department of Public Works and Highways
DPWH CO	DPWH Central Office
DPWH-ESSD	DPWH Environmental Social Safeguards Division
DPWH RO	DPWH Regional Office
DPWH-UPMO	DPWH Unified Project Management Office
DRAM	DPWH Right-of-Way Acquisition Manual
DSWD	Department of Social Welfare and Development
DTI	Department of Trade and Industry
ECC	Environmental Compliance Certificate
EGF	Environmental Guarantee Fund
EIA	Environmental Impact Assessment
EIARC	EIA Review Committee
EIS	Environmental Impact Statement
EMB	Environmental Management Bureau
EMoP	Environmental Monitoring Plan
EO	Executive Order
EPRMP	Environmental Performance Report and Management Plan
EQPL	Environmental Quality Performance Levels
ERP	Emergency Response Plan
ESC	Environmental and Social Considerations
ES	Elementary School
ESHO	Environment Safety and Health Officer
FGD	Focus Group Discussion
F/S	Feasibility Study
GFIS	Green Framework of Innovative Strategy
GHG	Greenhouse gases
GOP	Government of Philippines
GRT	Gross register tonnage
HC	Hydrocarbons
HSE	Health, Safety and Environment
HUDO	Housing and Urban Development Office
IBA	Important Bird Area
ICC	Investment Coordination Committee
IEC	Information, Education and Communication
IFC	International Finance Cooperation

IIA	Indirect Impact Area
IMP	Impacts Management Plan
IRR	Implementing Rules and Regulations
ISF	Informal Settlers Family
JICA	Japan International Cooperation Agency
JPT	JICA Project Team
KBA	Key Biodiversity Area
Kph	Km per hour
LARRIP	Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy
LGU	Local Government Unit
MBAS	Methylene Blue Active Substances
MCDCB	Metro Cebu Development and Coordinating Board
MCENRO	Mandaue City Environment and Natural Resources Office
MCLUTS	Metro Cebu Land Use and Transportation Study
MCUT	Master Plan and Institutional Development of Urban Transport System in Metro Cebu
MCUTMP	Master Plan Study and Institutional Development on Urban Transport System in Metro Cebu
MCWD	Metropolitan Cebu Water District
MEZ	Mactan Export Processing Zones
MGB	Mines and Geosciences Bureau
MMDA	Metro Manila Development Authority
MMI	Modified Mercalli Intensity Scale
MOA	Memorandum of Agreement
MPN	Most Probable Number
mps	Meters per second
MUIA	Mactan-Cebu International Airport
NAAQGV	National Ambient Air Quality Guideline Value
NAAQS	National Ambient Air Quality Standards
NAMRIA	National Mapping and Resource Information Authority
NCIP	National Commission on Indigenous Peoples
NEDA	National Economic and Development Authority
NEXCO	Nippon Expressway Company Limited
NDRRMC	National Disaster Risk Reduction Management Council

NFA	National Food Authority
NFSCC	National Framework Strategy on Climate Change
NGO	Non-Government Organization
NHA	National Housing Authority
NIPAS	National Integrated Protected Areas System
NLSS	Noise Level Sampling Station
NRIMP	National Road Improvement and Management Program
NPCC	National Pollution Control Commission
NSO	National Statistics Office
NSWMC	National Solid Waste Management Commission
OIWS	Olango Island Wildlife Sanctuary
OSHS	Occupational Safety and Health Standards
PABX	Private Automatic Branch Exchange
PAGASA	Philippine Atmospheric, Geophysical and Astronomical Services
PAF	Project Affected Family
PAH	Project Affected Households
PAP	Project Affected Person
PAR	Philippine Area of Responsibility
PCO	Pollution Control Officer
PD	Presidential Decree
PEIS	PHILVOCS Earthquake Intensity Scale
PEISS	Philippine Environmental Impact Statement System
PHIVOLCS	Philippine Institute of Volcanology and Seismology
Php	Philippine Peso
PM	Particle Matter
PPE	Personal Protective Equipment
Pphpd	Persons per hour per direction
PUV	public utility vehicles
PWD	Persons with Disabilities
RA	Republic Act
RAP	Right of way Action Plan/ Resettlement Action Plan
RIZ	Regional Impact Zone
ROW	Right of Way
RPM	Revised Procedural Manual
SCADA	Supervisory Control and Data Acquisition
SMED	Small and Medium Enterprise Development

SMP	Self-Monitoring Reports (SMR)
SOP	State of Responsibility
SWCDS	Synchronized Waste Collection and Disposal System
SWMB	Solid Waste Management Board
TEU	Twenty-Foot Equivalent Units
TESDA	Technical Education and Skills Development Authority
THQ	Target Hazard Quotients
TIA	Traffic Impact Assessment
TMP	Traffic Management Plan
TOD	Transit-Oriented Development
TPMA	Third Party Monitoring Agent
TSS	Total Suspended Solids
TSP	Total Suspended Particles
WACS	Waste Analysis and Characterization Study
WB	World Bank
WQSR	Water Quality Status Report

EXECUTIVE SUMMARY

Japan International Cooperation Agency (JICA) has conducted Roadmap Study for Sustainable Urban Development (2013-2015) and Urban Transport Master Plan Study (2017-2019) for Metro Cebu and has proposed several priority projects including 4th Cebu-Mactan Bridge. In February 2018, 4th Philippines-Japan High-Level Joint Committee Meeting discussed about the implementation of the Project. In June 2018, Government of the Philippines through DPWH requested Government of Japan for conducting Feasibility Study on the Project. In December 2018, JICA and DPWH commenced Feasibility Study for construction of 4th Cebu-Mactan Bridge and Mandaue Coastal Road.

As the project is covered under the Philippine Environmental Impact Statement System (PEISS) and is required to secure an Environmental Compliance Certificate (ECC) from the Environmental Management Bureau-Regional Office 7 (EMB7), it has undergone a series of public participation process/activities, namely: Information, Education and Communication (IEC), public and technical scoping, and public hearing. It also has to comply with the JICA guidelines/requirements for prior notification and consultations with the affected stakeholders before such public scoping and the Right of way Action Plan/ Resettlement Action Plan (RAP) survey has to be conducted.

Project Description

The project area is located in the Province of Cebu in the Central Visayas (Region VII), Philippines. The 4th Cebu-Mactan Bridge with the Mandaue City Coastal Road is located in the Cities of Mandaue and Lapu-lapu, Cebu, Philippines. The coastal road alignment traverses six (6) barangays in Mandaue City, namely: North Reclamation Area/CEPZ, Centro, Looc, Opao, Umapad and Paknaan, while in Lapu-lapu City it covers the Barangays of Pusok and Ibo.

The project components include the construction and eventual operations of the 4th Cebu-Mactan Bridge, Mandaue Coastal Road, Interchanges and Intersections in Mandaue and Lapu-lapu area.

A number of route alignment options for the Mandaue Coastal Road and the 4th Bridge were assessed and evaluated by function, cost, accessibility, workability and natural/social environment, and then the preferred alignment was selected.

Summary of Project Description

Total Length	8.2 km
4th Cebu-Mactan Bridge	3.3 km
Mandaue Coastal Road (approach viaduct and Mandaue Coastal Road Viaduct)	4.9 km
No. of lanes for Main Bridge	4
No. of lanes for Viaduct	4
Roadway width	22.5-29.5 m
Median Island	1.5 m
Interchanges	2
Viaduct length	8.2 km
Implementation Period	67 years
Detailed Engineering Design	15 months
Land Acquisition	Start 2019
Civil works construction	36-42 months
Target Start of operation	2026

Source: JICA Survey Team

Alternative options for the 4th Cebu-Mactan Bridge

Option 1:	Connect with Mactan Circumferential Road and airport access road	land: 1.6 km; sea: 1.0 km
Option 2:	Connect with Mactan Circumferential Road at the entrance of an economic zone	land: 1.6 km; sea: 1.0 km
Option 3:	Connect with Mactan Circumferential Road at the east end of Mactan Island	land: 0.6 km; sea: 2.0 km

Alternative options for Mandaue Coastal Road

Option 1:	Route recommended in the JICA M/P Study but modified to avoid the impact on tidal flats and to reflect the results of the discussions made with the stakeholders and municipalities	5.37 km
Option 2:	Route that passes through the city center	4.62 km
Option 3:	Route recommended in the JICA M/P Study	7.22 km

Baseline Environmental Conditions

-Land-

The existing/actual land use pattern of the areas and vicinities that the 4th Cebu-Mactan Bridge-Mandaue Coastal Road traverses is mixed of residential, commercial, and industrial. The dense settlements in Mandaue are mostly informal settlers along the coastal areas.

The protected areas designated under the Republic Act No. 7586 are not within the project site, but tidal flat with its area being approximately 50 hectare is located nearby the project site. These tidal flats have been found to be providing a habitat for herons, snipes and terns and to be offering to more than 300 birds a feeding ground.

The general topography of 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment and surrounding areas are generally flat to nearly level being in the lowlands coastal regions. It geologically falls within the Central Physiographic Province of the Philippines, which is composed of cordilleras, lowlands, troughs and offshore basins. In a provincial scale of risk assessment, the Province of Cebu has a general low risk to earthquake. The geologic hazards that were identified to have potential impacts on the proposed project are seismic hazards and differential settlement.

The study area and its vicinities consist of one (1) soil type, which is the Mandaue Clay. Based on the baseline survey for soil /sediment quality, soil contamination was not confirmed, except the value of copper exceeded the standard value at the sampling site near the Umapad Dumpsite.

A terrestrial flora and fauna, mangrove study were conducted in the affected areas of the project. The preliminary bird survey in December 2018 found 360 individuals that fall under 11 species in the survey area, but threatened species were not observed. Based on the second bird survey in March 2019, a total of 175 numbers of individuals of bird species, a total of the twenty-one (21) species belonging to twelve (19) families were identified. These species include migratory Egret spp., most probably, either Great Egret, Intermediate Egret or Little Egret.

A total of four (4) mangrove species belonging to three (3) families were identified in the area. A total of twenty-six (26) species belonging to fourteen (14) families of terrestrial trees were found in the area. Molave (*Vitex parviflora*) is included in the list of threatened plants in the Philippines and their category stipulated in DAO No. 1-2007, being classified as category B belonging to endangered species.

-Water-

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment is generally located at the coastal area and most portions hugged the coastlines of Mactan channel which is the strait between the main island

of Cebu and the Mactan Island. The 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment will pass Butuanon River and its brunch that flow into the channel. The main water source of Metro Cebu is groundwater, and surface water accounts for only a small fraction. The hydrogeological and hydrologic hazards that were identified to have potential impacts on the proposed project include flooding, coastal hazards such as coastal erosion, storm surge/tsunami and coastal subsidence/sea level rise.

The water quality benchmarks are prescribed as Class D Waters for Butuanon River, which is primarily used for the Navigable Waters, and Class SC Waters is used for Mactan Channel, which is primarily used for Fishery Water, Recreational water and Marshy and /or mangrove areas declared as fish and wildlife sanctuaries under DAO 2016-08. Measurement of the water quality in the four areas was conducted. Based on baseline survey, almost all parameters are within the standard except for BOD of Butuanon River (Downstream).

Based on the aquatic flora and fauna assessment, a total of four (4) seagrasses species were found at the two (2) sampling stations. In terms of percentage cover, both sites were categorized in “Poor” reef condition. As for sea weed resources, a total of six (6) algae species were found. In addition, a total of three (3) species of macro invertebrates were recorded.

-Air-

The climate in Metro Cebu belongs to the Type IV of the Modified Coronas Classification of Philippine Climates. It is relatively dry from November to April and wet during the rest of the year. Average annual rainfall in the PAGASA Airport Station is about 1,500 mm.

The construction of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road project has the potential to cause changes in Air Quality and noise level. Consumption of fuel will also result in Greenhouse gas (GHG) emission.

Measurement of the air quality in the three areas was conducted. The results reveal that almost all parameters passed within the standard limit set by DAO 2000-81, except for the analysis of Particulate Matter 10 conducted at Mandaue City Village/Social Housing Area.

Measurement of the noise quality in the three areas was conducted. Based on baseline survey, two areas resulted in noise values exceeding the noise standards, set by National Pollution Control Commission 1980. One of the sampling points is directly facing a light industrial area. It is expected that the proposed route will be a four-lane road the noise standard values will be increased. However, it can also be expected that higher noise values will be generated within these areas in the future.

-People-

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road project covered a number of barangays of Mandaue City and Lapu-Lapu City. As a result of the survey, it has been revealed that Mandaue City has the largest number of project-affected households (i.e. 69), persons (i.e. 243) and establishments/companies (i.e. 21) compared to Lapu-Lapu City, which has no individual household affected by the project yet two companies will most likely needed to be relocated. A Right of way Action Plan/ Resettlement Action Plan (RAP) are prepared to address compensation, replacement, relocation of affected households and establishments.

While there are some companies that have their structures “severely affected” (as defined under LARRIPP), those companies that have their main building affected are considered to be limited to two (2) companies both located in Lapu-Lapu City and possibly one more company located in Mandaue City.

The vulnerable groups have been defined in this survey to be the following groups of people: poor people whose combined income falls within the poverty threshold set by NEDA; female-headed households; elderly people; and persons with disabilities (PWD). Based on the results of the survey, the numbers of households that fall under these categories are: Poor (38), Female-headed (12), Elderly (7) and PWDs (0).

Based on initial investigation/inquiry, there are no Indigenous Peoples (IPs) in the area that will be affected by the project.

According to Comprehensive Land Use Plan (CLUP) of Mandaue City, there are still some small areas for fishing grounds and aquaculture farming in Mandaue City. However, based on the focus group discussion meetings for fisherman, this industry does not play a significant role in the local economy. According to the City Fishery Aquatic Resource Management Council (CFARMC) in Lapu-Lapu, along mainland Mactan Island particularly in places that are already considered as highly urbanized, some marginal fisher folks can be found, but in a minimal number where most of the fishing community and individual fisher folks are found.

Global City Mandaue Corporation and City Government of Mandaue (Joint Venture) plan to conduct “Mandaue Reclamation Project”. In addition, City Government of Mandaue also plans to redevelop the Umapad landfill site as “Eco Park”. The alignment of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road will pass the site of these projects.

There are no existing materials of cultural, historical nor archaeological significance present in the area that could be impacted by the project.

The traffic situation in Metro Cebu has deteriorated in recent years. Traffic congestion occurs on many roads and intersections not only during peak hours, but also off-peak hours, due to i) increase of traffic demand (population growth, economic development and motorization), ii) insufficient road network and public transport services, and iii) inadequate traffic management.

Environmental Impact Assessment and Mitigating Measures

A summary of the potential impacts of the project per project phase and the corresponding mitigation measures and enhancement, are presented in the following.

Impact Management Plan

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures
PRE-CONSTRUCTION		
LAND		
Geology	<ul style="list-style-type: none"> • Damage to components of the construction work (Ground shaking, ground rupture) 	<ul style="list-style-type: none"> • Undertake site-specific seismic risk characterization and estimates of how the ground beneath the structure will move; and Design and construct structures that will address seismic hazards
Soil pollution (near Umapad Dumpsite)	<ul style="list-style-type: none"> • Soil contamination due to excavation work near Umapad Dumpsite 	<ul style="list-style-type: none"> • Conduct a comprehensive soil quality survey in the DED and provide the results to the Mandaue City as a contribution to the rehabilitation of the dump site

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures
Terrestrial Flora and Fauna	<ul style="list-style-type: none"> •Removal of up to 1,800 trees (approx. 330 terrestrial trees possibly relocatable and approx. 700 mangrove trees and 800 terrestrial trees inevitably cut) •Possible relocation and removal of Molave (<i>Vitex parviflora</i>) classified under endangered category of the DAO No.1-2004 	<ul style="list-style-type: none"> •Compliance with the conditions stipulated in the permits / clearances (e.g. ECC, Tree Cutting Permit, etc.) issued for the Project •Providing a temporary fencing to vegetation for their protection to minimize clearing of vegetation as much as possible •Replantation of approx. 330 terrestrial trees, less than 1.5m height, including a threatened species 'Molave' •Compensatory plantation of mangrove and terrestrial trees in accordance with DENR relevant regulation(s) (Plant approx. 70,000 seedlings of mangrove and approx. 80,000 seedlings of other terrestrial tree species)
Protected Area/Terrestrial Flora and Fauna	<ul style="list-style-type: none"> •Disturbance to KBA 	<ul style="list-style-type: none"> •Conduct the Biodiversity Survey (detailed bird survey) at the early stage of Detailed Engineering Design as an input to the design of coastal road, interchange and bridge and for consideration of further measures to minimize the disturbance to IBA/KBA (i.e. development of wetland park and installment of bird-car collision prevention poles/fences)
Public Involvement	<ul style="list-style-type: none"> •Informed/empower the public to participate in the decision-making process 	<ul style="list-style-type: none"> •Transparent and participatory approaches and methodologies, Consideration of community needs/aspirations (Conduct of IEC, public consultations)
Loss of property & resettlement	<ul style="list-style-type: none"> •Loss of land, property and establishments along/within the ROW of Bypass road alignment 	<ul style="list-style-type: none"> •Resettlement, compensation, assistance and rehabilitation of affected residents (PAFs) & establishments; implementation of RAP
Living conditions	<ul style="list-style-type: none"> •Improvement of living conditions 	<ul style="list-style-type: none"> •Livelihood rehabilitation assistance in the form of skills training and other development activities shall be provided in coordination with other concerned government agencies if the present means of livelihood is no longer viable and the PAP will have to engage in a new income activity; and •Financial assistance to augment loss of income during initial months of relocation
Basic Service Utilities/Infrastructure	<ul style="list-style-type: none"> •Relocation of utilities (e.g. electric poles, water lines, communication lines, etc.) along right of ways 	<ul style="list-style-type: none"> •Necessary planning and coordination with concerned authority and local body; Prior notice to and consultation with concerned authority, local body and public to be affected so as to ensure that work does disrupt services
CONSTRUCTION: Site Preparation, Roadbed Preparation ,Installation of Structures, Temporary ancillary elements		
Land Use Pattern, Zoning	<ul style="list-style-type: none"> •Change/Disturbance in land use pattern due to road construction & ancillary facilities 	<ul style="list-style-type: none"> •Scheduling heavy construction works during the daytime; •Construction activities that necessitate utilizing portion of the road/street should be undertaken upon permission by the City Traffic MGT and outside of traffic rush-hours; •Construction activities should not be a hindrance to the operations in neighboring area.
Change in Land Use -Cumulative Impacts from Mandaue Reclamation Project	<ul style="list-style-type: none"> •Increased land use change, noise, water pollution, dust and emissions •Increased traffic by construction vehicles •Increased restriction of access to sea water by local fisher folks 	<ul style="list-style-type: none"> •Mitigation measures on air quality, noise level and water quality described in this EMP. •Implementation of the Traffic Management Plan (TMP) and rerouting plans in coordination with Mandaue Reclamation Project •Securing a route for small vessels of fisher folks during the bridge pier construction
Topo., Geology	<ul style="list-style-type: none"> •Alteration in topography due to site development (inland areas): clearing, backfilling, grading, foundation works, etc.: •Soil disturbance and loss of top soil due to excavation 	<ul style="list-style-type: none"> •Limiting land clearing and excavation within the affected areas of the primary impact area and excavating within the desired level only •Proper and appropriate excavation and embankment protection techniques, such as sand guards"Yaita"
Soil erosion	<ul style="list-style-type: none"> •Slope failure •Soil runoff due to cut and fill areas, and waste soil disposal sites •Movement of excavated soil to waterways 	<ul style="list-style-type: none"> •Take appropriate soil protection measures when doing excavation for foundation works •Ensure slope protection such as stone pitching or vegetation to prevent soil runoff •Keep excavated soil (road sub-base, base, foundation works for viaduct columns, etc) away from waterways •Provide drainage sump pits and silt traps

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures
Soil pollution	<ul style="list-style-type: none"> • Soil contamination due to excavation work near Umapad dumpsite • Soil contamination due to leaks and spills of fuels, lubricants, solvents • Endangerment of health and safety of worker and community by exposure to hazards 	<ul style="list-style-type: none"> • Establish and implement health and safety management plan and emergency and contingency plan in case of spills; • Excavation soil near Umapad Dumpsite will be separated from other excavation materials and followed the instruction of DENR-EMB, DGS and CENRO. • Store bulk hazardous chemicals in an impermeable area and with appropriate secondary containment; • Comply with environmental requirements for the storage, transport, treatment and handling of hazardous substances and wastes • Conduct a semi-annual soil quality monitoring
Construction Waste Disposal/ Mgt.	<ul style="list-style-type: none"> • Wastes generation, consisting of the following types: <ul style="list-style-type: none"> • Surplus and const. wastes: scrap metals, concrete rubble etc. (estimated volume: around 18,500 m³) • Domestic wastes (Biodegradable): food and kitchen wastes from temp. canteen • Sanitary wastes from office and workers toilets, bathrooms • Others (Packaging wastes such as plastics, wood pallets, crates, metal wires, cardboard, sacks, containers, etc.) 	<ul style="list-style-type: none"> • Detailed waste management program will be prepared by contractor including the following: <ul style="list-style-type: none"> • Solid wastes to be moved/transported to materials recycling facility (MRF) for sorting and diversion of wastes to recycles and re-utilization • Concrete rubbles and other excess materials to be reused for backfilling of the project sites/areas • Secure hauling permits and dispose excess earth materials to approved-suitable disposal sites • Residuals to be segregated into biodegradable, recyclable, residual, and special waste and disposed through the City garbage collectors • Temporary stockpiles of excavated materials from foundation works must be properly covered and regularly hauled to DENR-approved disposal sites; • No stockpiling of construction debris as these will not be utilized anyway; • Litters and other types of domestic garbage from construction sites and camps must be properly kept in trash bins and regularly disposed through the City garbage collectors
Terrestrial Flora and Fauna	<ul style="list-style-type: none"> • Small-scale loss of bird habitat such as mangrove, fishpond and tidal flat • Noise from construction work frightening migratory birds away from the IBA/KBA. 	<ul style="list-style-type: none"> • Conduct awareness campaign to all relevant construction workers about the careful consideration for IBA/KBA • Adoption of lower noise and vibration construction method and machines • Adoption of temporary jetty construction road to minimize adverse impacts on mangrove and tidal flat • Conduct semi-annual bird monitoring
Hydrology / Oceanographical Conditions	<ul style="list-style-type: none"> • Disruption of natural drainage pattern • Increase in run-off due to alteration of topography and reduction of infiltration resulting to localized flooding, 	<ul style="list-style-type: none"> • Setting the adequate drainage system such as the crossing drainage pipe; • Limiting the area of exposed soil, • Building of bund/dikes effectively enclosing water-areas prior to landfilling for coastal road • Implementation of erosion control measures including temporary diversion berms/sandbagging, drainage swales and siltation basins • Loose earth materials stockpile be kept away from banks and near waters (waterways, sea)
Water Quality & Marine Envi.	<ul style="list-style-type: none"> • Increase turbidity and sediment load due to transport of wastes and sediments to surface water, Mactan Channel, Cansaga Bay and Silot Bay, waters 	<ul style="list-style-type: none"> • Prepare temporary drainage plan with sump pits/sedimentation pond to trap sediments and wastes; • Use of silt fences and sediment traps, cover exposed earth especially before heavy rains are expected. • Conduct a quarterly Total Suspended Solids (TSS) level monitoring

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures
	<ul style="list-style-type: none"> • Pollution of receiving water bodies due to fuel and oil leaks from vehicles and other equipment • Further bacteriological contamination of the esteros due to improper management of domestic and solid wastes 	<ul style="list-style-type: none"> • Proper handling of oil and lubricants to prevent spillage and contamination of surface and ground waters; (Storage of oil and lubricants in secure areas/places) • Heavy equipment's and machineries shall be well-maintained to prevent discharges from engines and regularly checked for fuel and oil leaks. • During repair/maintenance of equipment and machinery, containers/drip trays shall be used to collect leakage • Paint residues and paint containers shall be handled & disposed properly and arrangement will be made with the suppliers to be return for their proper disposal • Conduct quarterly oil & grease content monitoring • Contractor/Project Management provides toilet/washroom facility for construction workers and require proper sanitation practices; • Provision of garbage bins at the construction areas; • Regular disposal of wastes generated by the personnel to city approved disposal sites; • Conduct weekly inspection of the construction areas to ensure proper management of the wastes generated by the construction personnel and • Conduct quarterly total coliform monitoring
Water Supply	<ul style="list-style-type: none"> • Wastage of water resource through improper usage during construction • Competing use with the community 	<ul style="list-style-type: none"> • Sourcing of water from outside of the communities within the project area • Implement water saving/conservation measures of water use for construction works/activities • Recycled water or water from waterways and marine waters shall be used for ground sprinkling or dust-suppression measures
Aquatic Flora and Fauna	<ul style="list-style-type: none"> • Removal of or direct physical injury to aquatic flora and fauna (e.g. seagrasses and sea weeds) through the construction of offshore viaduct and bridge • Vibration/disturbance from pile-driving 	<ul style="list-style-type: none"> • Monitor the distribution and health of surrounding intertidal habitats along or near the vicinity of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment. • Offsets to be implemented such as development of marine sanctuary, planting of mangroves in nearby available coastal areas (if applicable) • Position the water borne equipment in a manner that will minimize damage to identified fish habitat (mangrove, seagrasses, and coral reefs) • Avoid pile-driving methodology with sound & vibration impacts destructive to marine env/ habitats & disruptive to fish spawning • Coordinate with Bureau of Fisheries and Aquatic Resources (BFAR) on pile-driving schedule • Monitoring of sound and vibration level during driving any type of piles with in mind its impacts on fish and their habitat.
Air quality	<ul style="list-style-type: none"> • Movement of construction vehicles and equipment's will generate fugitive dusts • Exhaust emissions from construction machineries and equipment 	<ul style="list-style-type: none"> • Regular sprinkling of water of areas considered as dust generators • Use only new or properly maintained vehicles, equipment and conduct regularly check to regulate emissions within standard levels • Transport of excess materials should be undertaken during off-peak traffic periods • Hauling trucks should be covered with tarpaulin or canvass • Conduct quarterly TSP, PM10, NO2, SO2 level monitoring

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures
Noise and Vibration level	<ul style="list-style-type: none"> • Noise from movement of vehicles (trucks, cars) coming-in and out of the facility—disturbance to residents along Access St. • Noise from Pile driving activities 	<ul style="list-style-type: none"> • Provision of temporary noise barriers such galvanized iron sheets, particularly in noise-sensitive receptor areas • Schedule heavy noise generating activities from 7am-7pm. • Use only new or properly maintained vehicles, equipment • Minimize the use of impact devices • Installation of noise abatement devices such as mufflers and suppressors to all construction vehicles, machineries, and heavy equipment • Locate stationary equipment, such as compressors as far as possible from noise sensitive areas. • Avoid impact-type pile driving and employ appropriate pile-driving technology in noise-sensitive receptor areas and bird habitats • Conduct quarterly noise level monitoring at sensitive receptor areas
ROW Conflict on Fishery and its related industry	<ul style="list-style-type: none"> • Loss/limitations and hindrance of access by vessels to establishments with port/docking facilities 	<ul style="list-style-type: none"> • Bridge design to accommodate/consider higher clearance to allow vessels to access and dock to establishments, such as shipyards, oil depot/fuel terminals and other establishments with docking facilities
In-migration	<ul style="list-style-type: none"> • Construction workers and staff will require temporary housing 	<ul style="list-style-type: none"> • To the extent possible, local labor will be hired to minimize the need to provide housing for the construction crew.
Occupational Health and Safety	<ul style="list-style-type: none"> • Increased risk of accidents due to improper work ethics, which may threat health and safety of workers and local residents 	<ul style="list-style-type: none"> • Contractors shall submit an Occupational Health and Safety Management Plan prior to commencement of work • Appropriate personal protective equipment (PPE) must be provided to all construction workers • Safety guideline and signs will be prepared for workers • First aid stations supervised by the Environment and Safety Health Officer (ESHO) of the Contractor will be located within the construction site; and • Emergency vehicles will be on stand-by within the construction area at all times
	<ul style="list-style-type: none"> • Hazards of communicable and infectious diseases 	<ul style="list-style-type: none"> • Contractors shall submit an Occupational Health and Safety Management Plan. • Medical certificates will be requested to ensure workers are fit to work; • Appropriate sanitary facilities shall be provided at all construction sites.
Local economy (Employment and livelihood)	<ul style="list-style-type: none"> • Enhancement of employment and /or livelihood opportunity that will lead to economic growth. 	<ul style="list-style-type: none"> • Provide the priority for local hiring • Encourage patronage for local goods & services
Public Safety/ Transportation & Traffic	<ul style="list-style-type: none"> • Increase traffic density due to movement of vehicles/trucks hauling construction materials to site, causing traffic congestion along access roads • Safety of pedestrians, passersby, as well as residents 	<ul style="list-style-type: none"> • Strict implementation of the Traffic Management Plan (TMP) and rerouting plans; • Traffic flow restrictions will be minimized during daytime hours; • Schedule equipment move-in to blend with regular non-peak hour day-time vehicular traffic; • Placement of traffic decking will be done in stages; • Work will be performed during night time to the extent possible; • The minimum width of lanes will be maintained in accordance with the requirements of City Traffic MGT; • Parking time of idle dump trucks and the other construction vehicles along constricted areas will be limited; and • Well-trained traffic aides and flagmen duly deputized by City Traffic MGT will be designated at critical construction areas to direct traffic • All excavation sites and the storage site of hazardous substances will be enclosed with corrugated metal sheet barriers to limit access to public, especially children; • Installation of adequate lighting and reflectorized warning signs along the entire stretch of the construction site

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures
CONSTRUCTION: Demobilization/Clean up		
LAND		
Solid waste generation	<ul style="list-style-type: none"> Excess soil generation from earthwork activities such as excavation, backfilling and embankment Disposal of a total of around 18,500 m³ of construction debris 	<ul style="list-style-type: none"> Detailed waste management program and Demobilization plan for the construction yards will be prepared which including the following; Reuse excavated excess soil to backfill depressed areas within or nearby the area; Recycle construction debris through sorting and stockpiling; Take appropriate measures, such as covering hauling trucks with tarpaulin or canvass, in transporting excess/excavated earth materials to disposal site; and Take proper and diligent management of solid waste, such as covering temporary stockpiles of excavated materials and hauling regularly to DENR-approved disposal sites.
WATER		
Water quality	<ul style="list-style-type: none"> Further contamination of the waterways crossed by the alignments due to abandoned wastes and construction spoils 	<ul style="list-style-type: none"> All temporary sanitation facilities, especially the portable toilets are properly dismantled and no domestic wastes are abandoned; and Conduct a site inspection at the work sites to ensure that construction spoils/debris, solid, and domestic wastes are properly disposed to approved disposal sites and not abandoned in the construction areas
AIR		
Air quality	<ul style="list-style-type: none"> Dust re-suspension due to abandoned construction spoils/debris 	<ul style="list-style-type: none"> Conduct a site inspection at the work sites to ensure that construction spoils/debris are properly disposed to approved disposal sites and not abandoned in the construction areas
PEOPLE		
Social Service Utilities	<ul style="list-style-type: none"> Possible long-term interruption of basic social service utilities such as power and water supplies 	<ul style="list-style-type: none"> Contractors/Sub-Contractors must ensure that all affected service utilities are immediately and properly restored to their normal operation; and Conduct a joint site inspection involving the ESHO of the Contractors, leaders of affected barangays, and representatives of concerned utility companies to ensure immediate restoration of affected service utilities
Public Health	<ul style="list-style-type: none"> Possible spread of communicable diseases due to abandoned wastes 	<ul style="list-style-type: none"> Ensure that all temporary sanitation facilities, particularly portable toilets, are properly dismantled and all residual wastes are properly disposed to the disposal sites duly-approved by the DPS; and Conduct a joint site inspection at the work sites involving the ESHO of the Contractors, community leaders, and representatives of Health and Sanitation Office, DPS to validate compliance of the Contractor
OPERATION PHASE		
LAND		
Soil pollution	<ul style="list-style-type: none"> Soil contamination from accidental releases of chemicals, fuel, oil, lubricants will occur due to the maintenance work 	<ul style="list-style-type: none"> Immediately collect and contain spilled oil, lubricants and other chemicals Proper management of wastes Secure storage of oil, lubricants Proper handling and maintenance of equipment, machineries, vehicles
Terrestrial Flora and Fauna	<ul style="list-style-type: none"> Road kill of birds caused by car-bird collision especially at the interchange section in the vicinity of fishpond and mangrove forest Lighting in the interchange area may give adverse impacts on the mangrove forest facing the Cansaga Bay, which is considered a potential birds roosting area 	<ul style="list-style-type: none"> Install road sign warning with birds and KBA Install recessed lighting system at the interchange area near the mangrove forest Consider the installment of bird-car collision prevention poles/fences based on the results of the Biodiversity Survey (detailed bird survey) planned at the early stage of DD Consider the development of wetland park based on the results of the Biodiversity Survey (detailed bird survey) planned at the early stage of DD Conduct a semi-annual bird monitoring
Waste disposal (Roadside)	<ul style="list-style-type: none"> Pollution from littered uncollected garbage 	<ul style="list-style-type: none"> Improvement/enhancement of current wastes disposal practices and implementation of the Solid Waste Management (SWM) plan

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures
WATER		
Water Quality	<ul style="list-style-type: none"> • Accidental releases of fuel, oil, lubricant and other chemicals due to maintenance work finding its way to waterways • Wastewater from maintenance works 	<ul style="list-style-type: none"> • Proper handling of oil and lubricants to prevent spillage and contamination of surface and ground waters; (Storage of oil and lubricants in secure areas/places) • Paint cans, containers of oil, lubricants should be clean and chips, residues should be properly disposed
	<ul style="list-style-type: none"> • Contamination/degradation of water quality due to drainage outfall 	<ul style="list-style-type: none"> • Adequate maintenance of drainage line/canal (e.g. desilting) and putting-up of catch basins (silt trap) at regular interval. •
	<ul style="list-style-type: none"> • Contamination/degradation of water quality due to storm water run-off/dischage 	<ul style="list-style-type: none"> • Care and maintenance of greeneries, ground cover – specifically, those along the riverbanks and shorelines that would retard storm water run-off and screen discharge of pollutants to surface waters • Set up filters and catch basins for storm drains, to prevent possible pollutants from being flushed into the sea • Conduct a semi-annual water quality monitoring
Oceanography & Marine water quality	<ul style="list-style-type: none"> • Sedimentation of marine water • Contamination of marine water by pollutants 	<ul style="list-style-type: none"> • Regular maintenance of drainage system (e.g. desilting) • Care & maintenance of greeneries, ground cover – specifically, those along the shorelines that would retard run-off from flowing into open waters
Aquatic Flora and Fauna	<ul style="list-style-type: none"> • Lighting along the bridge may give adverse impacts on fish in the ocean • Deterioration of habitat due to release of contaminants, chemicals, liquid wastes, and sediment-laden run-off from uncleaned/dirty area of maintenance work sites 	<ul style="list-style-type: none"> • Set up a type of light which does not irradiate the sea surface and outside of the bridge • Proper handling of oil and lubricants to prevent spillage and contamination of sea water (i.e. storage of oil and lubricants in secure areas/places)
AIR		
Noise	<ul style="list-style-type: none"> • Traffic Noise 	<ul style="list-style-type: none"> • Installment of 2m-height noise barriers on the 1m height handrails
PEOPLE		
Public Health	<ul style="list-style-type: none"> • Health/Accident 	<ul style="list-style-type: none"> • Submission of medical certificate of workers to the contractors
Socio-Economics	<ul style="list-style-type: none"> • Enhance income-generation, livelihood opportunities for local residents 	<ul style="list-style-type: none"> • Continued employment of local people • Provision of livelihood assistance and training program for PAPs

1. BASIC PROJECT INFORMATION

1.1 Project Proponent Contact Detail

Project Title:	New Mactan Bridge Construction Project
Project Location:	Cities of Mandaue and Lapu-Lapu, Cebu
Proponent:	Department of Public Works and Highways
Contact Person(s):	Dir. Virgilio C. Castillo Project Director Roads Management Cluster I (Bilateral) - Unified Project Management Office (RMC-1-UPMO)
Address	Bonifacio Drive Port Area, 652 Zone 068, Manila, 1018 Metro Manila (02) 304-3750, (02) 304-3757, (02) 304-3679
Consultant:	Oriental Consultants Global Co., Ltd. in Joint Venture with Chodai Co., Ltd., Almec Corporation and Nippon Koei Co., Ltd
Project Ownership:	National Government

1.2 Project Background

The Project Area, Metro Cebu, belongs to the Central Visayas Region, on one of the Visayan Islands located in central Philippines and consists of 13 local governments including Cebu City. Metro Cebu is the second largest metropolitan area after Metro Manila with a population of 2.85 million in 2015. Numerous domestic and international companies are clustered in the area as a base of trade in central Philippines. Cebu Island is also a popular tourist destination in the Philippines. Out of the 4.86 million foreign tourists nationwide, Cebu Island accounted for 1.15 million.

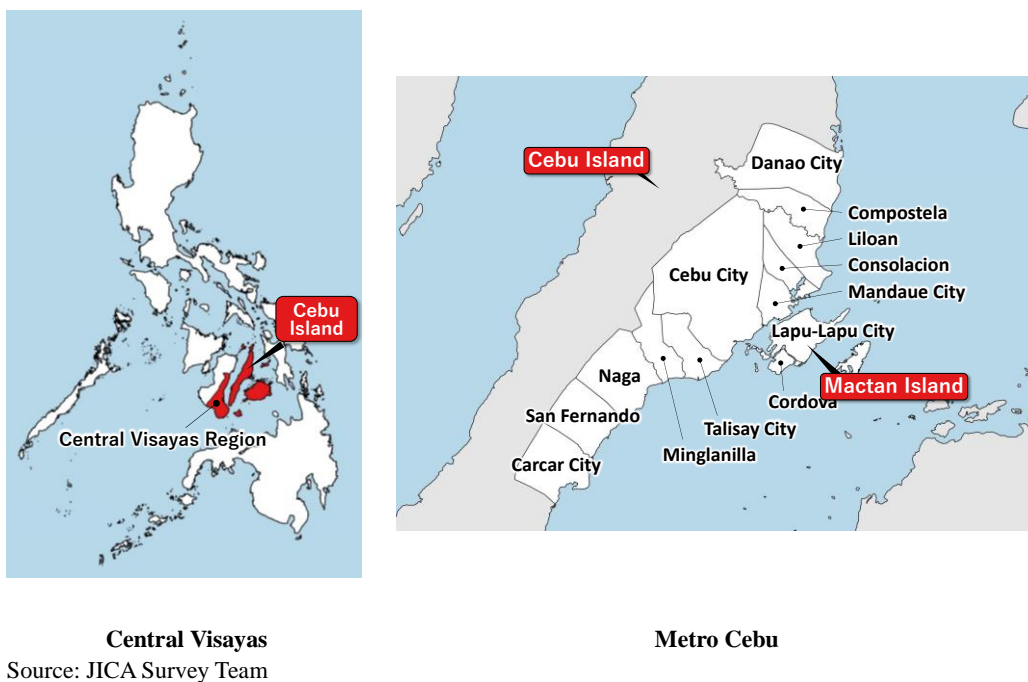


Figure 1.2.1 Project Location Map

The population of Metro Cebu increased at an annual average growth rate of 2.2% between 2010 and 2015 and is projected to reach around 3.8 million people in 2030. Road traffic congestion is expected to be more serious due to such rapid urbanization and population increase. Cebu Island, where houses, companies and population are concentrated, and Mactan Island, where Mactan-Cebu International Airport and industrial areas (Mactan Export Processing Zones) are located, are connected by two bridges, namely: 1st and 2nd Cebu-Mactan Bridges (or officially called as Sergio Osmeña Bridge and Marcelo Fernan Bridge). The traffic congestion at these bridges is getting worse every year due to traffic demand increase that exceeds traffic capacity of the bridges. This is considered to be a major obstacle to the future development of Metro Cebu. According to “The Roadmap Study for Sustainable Urban Development in Metro Cebu” conducted by the Japan International Cooperation Agency (JICA) from 2014 to 2015 (hereinafter referred to as “Roadmap Study”), economic loss due to traffic congestion in Metro Cebu is estimated to be 394 million Philippines Peso per day.

Under these circumstances, Philippine Government regards infrastructure development in urban and local areas as one of the top priority issues in “Philippines Development Plan 2017-2022” for sustainable economic growth and improvement of quality of life, with particular focus on the development of the Metro Cebu as the metropolitan area next to Metro Manila. According to “Regional Development Plan 2017-2022” in Central Visayas, reduction of traffic congestion is considered as a top priority issue with the New Mactan Bridge Construction Project which consists of the construction of a new bridge linking Cebu Island and Mactan Island as well as construction of a coastal road connecting to the bridge (hereinafter referred to as “the Project”) listed in the priority projects. The early implementation of the Project was recommended by the Roadmap Study and “Project on Master Plan Study and Institutional Development on Urban Transport System in Metro Cebu (MCUTMP)”. The feasibility of implementation of the Project was discussed in the Meeting of the Japan-Philippines Joint Committee on Infrastructure Development held in February, 2018. In June, 2018, the Department of Public Works and Highways of the Philippines (DPWH) issued a request for the feasibility study to be undertaken.

The JICA Study Team for the “Master Plan and Institutional Development of Urban Transport System in Metro Cebu” (abbreviated to MCUT), has identified the 4th Cebu-Mactan Bridge to be located on the Mandaue side in Brgy. Umapad, connecting with the Mandaue Coastal road. The Mandaue Coastal Road-a viaduct along the coastal-nearshore of Brgy. Looc, Opao, Umapad and Paknaan.



Source: MCUT, 2018

Figure 1.2.2 The MCUT Priority Projects 4th Cebu-Mactan Bridge and Coastal Road

JICA commenced the **Preparatory Survey for the New (4th) Mactan Bridge Construction Project** in December 2018 and the Oriental Consultants Global Co., Ltd., in joint venture with Chodai Co., Ltd., Almec Corporation and Nippon Koei Co., Ltd., have been appointed as the consultant team for the Survey.

1.3 EIA Project Categorization

The project includes: i) construction and eventual operations of the 4th Cebu-Mactan Bridge (total road length: 3.2 km; four-lane); and ii) development of Mandaue Coastal Road (total road length: 4.9 km; four/six-lane). Table 1.4.1.1 shows the classification of the project in accordance with the EMB Memorandum Circular 005 (2014). In order to obtain the ECC of this project, preparation and approval of EIS, that is, EIA report is required.

Table 1.4.1.1 EIA Project Type Categorization Parameters/Criteria

Projects/Description	Covered (Required to secure ECC)			Not Covered (may secure CNC)
	Category A: Environmentally-critical Projects (ECP)	Category B: Non-ECP		Category D
	EIS	EIS	IEE Check list	Project Description
Bridges and viaducts (including elevated roads), new construction	≥10.0 km	≥5km but <10.0 km	≥ 50m but <5.0 km	≤ 50m
Roads, new construction	NATIONAL ROAD: ≥20.0 km (length with no critical slope) OR ≥10.0 km (length with critical slope)	PROVINCIAL ROAD and OTHER TYPES OF ROADS ≥20.0 km (length with no critical slope) OR ≥10.0 km (length with critical slope)	ALL TYPES OF ROADS: ≥2km but <20km (length with no critical slope) OR ≥2km but <10km (length with critical slope)	≤2km

Source: JICA Survey Team based on EMB Memorandum Circular 005 (2014)

The 4th Cebu-Mactan Bridge with a length of 3.2 km – which is within the parameter of >50m but <5.0km, will be within the Category B: Non-ECP¹, will be required to prepare/submit an IEE-Checklist to the Environmental Management Bureau-Regional Office 7 (EMB7) as requisite for the issuance of the project’s Environmental Compliance Certificate (ECC). The Mandaue Coastal Road (Viaduct) with a length of 4.9 km, while on the same category with the 4th Cebu-Mactan Bridge, will be required to prepare/submit an Environmental Impact Statement (EIS).

Given that the 4th Cebu-Mactan Bridge could not be operational without the coastal road, the EMB would most likely require that the bridge and the coastal road will be considered as one project and be covered by one EIS (to be issued an ECC). In this regard, the primary consideration/parameter for EIA categorization was the total length of 8.1 km, which already qualify the entire project as an EIS category of Bridges & Viaducts.

¹ ECP-Environmentally Critical Project

1.4 Legal and Institutional Framework

1.4.1 Legal Framework

Environmental related laws in the Philippines are composed of under the Presidential Decree (PD) No.1151 as environmental policy and PD No. 1152 as environmental regulation in relation to the national policy and regulation. Other major environmental laws are established for natural resources, protection of wild life and bio-diversity, forest resources, mining, coastal and marine, ambient air, water quality, waste and disposal, land use and resettlement, conservation of historical and cultural assets, environmental assessment, and national integrated protected area system. Major environmental related laws and decrees in the Philippines are summarized in Table 1.4.1.1, and relevant international treaties, agreements and protocols that the Government of the Philippines has ratified in Table 1.4.1.2.

Table 1.4.1.1 Environment-related Laws and Regulations in the Philippines

Category	Title	Outline
Environmental Basic Act	Presidential Decree (PD) No. 1151	Environmental policy
	Presidential Decree (PD) No. 1152	Environmental regulation
Natural Resource	Constitution Article 12/Clause 2.	Investigation of natural resources, development use
	Presidential Decree (PD)/No.1198	Protection of natural environment
Wildlife and Ecosystem	Republic Act No. 7586: National Integrated Protected Areas System (NIPAS) Act 1992	Designation and management of national integrated protected areas
	Republic Act No. 11038: Expanded National Integrated Protected Areas System (eNIPAS) (2018)	Expansion of national integrated protected areas
	Republic Act No. 9147: Wildlife Resources Conservation and Protection Act (2001)	Conservation of wildlife and habitat
	Republic Decree No. 826	Preservation of Natural parks and establishment of wildlife protection committee
	Republic Decree No.1086 (1954)	Prohibition of capture of Mindoro buffalo (Tamaraw)
	Republic Decree No.6147	Preservation of Monkey Eating Eagle
	Statement No. 2141	Preservation of wilderness region
	Administrative Order	No.243(1970) Prohibition of slaughter for buffalo
Forest Resources	Presidential Decree (PD) No. 209	Encourage of common forest project
	Presidential Decree (PD) No. 278	Encourage of report on offender against forest law
	Presidential Decree (PD) No. 331 (1973)	Procedural regulation on development application for forest resources and forest land development use
	Presidential Decree (PD) No. 389	Sustainable forest development Forest resources
	Presidential Decree (PD) No. 705 (1975)	Regulation on forest recovery
	Presidential Decree (PD) No. 865	Export of lumber (selective deforestation)
	Presidential Decree (PD) No. 953	Request of forestation
	Presidential Decree (PD) No. 1153	Decree of forestation
	DENR Memorandum No.8 (1986)	Full prohibition of log export
	Notification No. 818	Diminution of forest
Marine	Forest Development Bureau Circular No. 13 (1986)	Full prohibition of land possession within mangrove area, river area, preservation area, wilderness area, National park, wildlife reserve, experimental forest and etc.
	Presidential Decree (PD) No.600 (1974)	Prevention of marine pollution
	Presidential Decree (PD) No. 979	Establishment for oil pollution management center
Ambient Air	Presidential Decree (PD) No. 602 (1974)	Prevention of ocean pollution
	Republic Act No. 8749	National Ambient Air Quality Standards for Source Specific Air Pollutants
	Republic Act No. 3931	Establishment of National air, water pollution control committee, definition of pollution and penalty
	Presidential Decree (PD) No.1181	Air pollution regulation on incidence origin of travelling
Water quality	Presidential Decree (PD) No.1160	Barangay captain Community leader on implementation of law on prevention of public nuisance
	Republic Act No.3931	Establishment of National committee for ambient air pollution management
	Presidential Decree (PD) No.600	Establishment of Philippine coastal guard, measure for marine pollution
	Presidential Decree (PD) No.1252	Establishment of foundation for treatment of mining discharge water
	Presidential Decree (PD) No.602 (1974)	Establishment of National oil pollution management center
	DENR Decree No. 34	Classification of water and use
Waste disposal	DENR Decree No. 35	Regulation on discharge water for Industrial and urban drainage
	Republic Act (RA) 6969 (1990)	An Act to Control Toxic Substances and Hazardous/Nuclear Wastes,

Category	Title	Outline
	Republic Act (RA) 9003	Providing Penalties for Violations thereof, and for their Purposes Ecological and Solid Waste Management Act
	Presidential Decree (PD) No. 825 (1975)	Penalty regulation on illegal dump of disposal, dirt and other wastes
	Presidential Decree (PD) No. 826 (1975)	Regulation on treatment responsibility of solid and liquid wastes by local government
	Presidential Decree (PD) No.1152 (1977)	Regulation on treatment method and treatment management for wastes
	DAO 36 Series of 2004 (DAO 04-36)	DAO 04-36 is a procedural manual of DAO 92-29, a comprehensive documentation on the legal and technical requirements of hazardous waste management
	DAO 98-49	Technical Guidelines for Municipal Solid Waste Management
	DAO 01-34	Implementing Rules and Regulations (IRR) of RA 9003

Source: JICA Survey Team

Table 1.4.1.2 International Environmental Agreements made by the Philippines

No.	Name of International Agreements	Year
1	Washington Treaty Convention on the international trade in endangered species of wild flora and fauna	1981
2	International tropical timber agreement	1983
3	United Nations convention on the law of the sea	1984
4	World heritage convention concerning the protection of the world cultural and natural heritage	1985
5	Montreal Protocol on substances that deplete the Ozone layer	1991
6	Vienna convention for the protection of the ozone layer	1991
7	Convention on biological diversity	1993
8	Basel convention on the control of trans-boundary movement of hazardous wastes and their disposal	1993
9	Ramsar convention on wetlands of international importance, especially as waterfowl habitat	1994
10	Framework convention on climate change	1994
11	Kyoto protocol	1998
12	Cartagena protocol on bio-safety to the convention on biological diversity	2000
13	Stockholm convention on persistent organic pollutants	2001

Source: JICA Survey Team

1.4.2 EIA System in Philippines

Any private or public projects or activities which are likely to have foreseeable adverse effects on the natural and social environment are required to conduct an Environmental Impact Assessment (EIA) in accordance with the Philippine Environmental Impact Statement System (PEISS). Some of the most important laws and guidelines related to PEISS are shown in Table 1.4.2.1.

Table 1.4.2.1 Important Laws and Manuals of PEISS

Laws and Manuals	Description
Presidential Decree No. 1152 (1977)	Philippines' Environmental Code. Comprehensive environmental management with mitigation measures were addressed and concept of the environmental impact assessment was introduced for the first time.
Presidential Decree No. 1586 (1978)	PEISS was established to conduct EIA study for the environmentally critical projects and the projects in the environmentally critical areas.
Presidential Proclamation No. 2146 (1981) and No. 803 (1996)	Proclaiming Environmentally Critical Areas and types of projects as Environmentally Critical Projects and within the scope of PEISS establish under PD No. 1586.
DENR Administrative Order No. 30 Series of 2003 (DAO 03-30)	Providing the implementing rules and regulations for the Philippine Environmental Impact Statement (EIS) System of PD No. 1586.
DENR Administrative Order No. 2017 15	Guidelines on Public Participation under the Philippine Environment Impact Statement System
EMB Memorandum Circular 2007-002	Revised Procedural Manual for DAO 03-30
DENR Memorandum Circular 2010-14	Standardization of Requirement and Enhancement of Public Participation in the Streamlined Implementation of the PEISS
EMB Memorandum Circular 2010-002	Clarification to DENR Memorandum Circular No. 2010-14 and Other EIS System Policy Issuances
EMB Memorandum Circular 2010-004	Guideline for Use of Screening and Environmentally Critical Area (ECA) Mapping Systems
EMB Memorandum Circular 2011-005	Incorporating Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) concerns in the PEISS
EMB Memorandum Circular 2014-005	Guidelines of Coverage Screening and Standardized Requirement under the PEISS amending relevant portions of EMB MC 2007-002

Source: JICA Survey Team

1.4.3 Roles and Responsibilities of the Relevant Agencies

As mentioned above, the Project is required of an EIA by the project proponent (DPWH) to secure ECC. Environmental Impact Statement (EIS) that are prepared based on EIA study is reviewed by EMB. ECC is issued by the Director of EMB Central office (CO EMB) and by DENR Secretary, while logistical arrangements in the project area such as arrangement of public consultation are conducted by the EMB Regional Office (RO EMB). Roles of the relevant agencies for EIA in the project are show in Table 1.4.3.1.

Table 1.4.3.1 Roles and Responsibilities of Concerned Government Agencies on EIA

Relevant Agency		Roles and Responsibilities
Department of Public Works and Highways (DPWH)		As the project proponent, DPWH plays roles as shown below; <ul style="list-style-type: none"> • Holding of a meeting for Information, Education and Communication (IEC) • Holding a meeting for Public Scoping for EIA • Preparation & submission of project description for scoping (PDS) and Environmental Impact Statement (EIS) • Payment of EIA review support fund • Making the necessary logistical arrangements for public consultation • Submission of final EIS
Department of Environment and Natural Resources (DENR)	CO EMB	Responding to the application from the proponents, management of EIA review committee (EIARC) and the Director of EMB will issue the environmental compliance certificates (ECCs) for the port project Detailed roles are shown below; <ul style="list-style-type: none"> • Facilitating of EIA Review Committee (EIARC) (scoping stage and substantive review stage) • Scoping • Procedural screening of EIS • Conduct of public consultation • Preparation of decision document • Approval of ECCs from EMB Director / DENR Secretary
	RO EMB	Supporting of EIA process in the project area; <ul style="list-style-type: none"> • Participation of public scoping facilitated by proponent of the project • Making the necessary arrangements for EIARC site validation and public consultation

Source: JICA Survey Team

1.4.4 Other Permits and requirements for the Project Implementation

The Project is required the following permits for the implementation.

Table 1.4.4.1 Required Environmental and Social Permits

Name of Permits	Laws and Regulations	Rationale	Issuing Agency	Application Procedure
Zoning Certificate (see Annex-1)	Republic Act (RA) 7160 Local Government Code	Check the compatibility with the land use plan/zoning ordinance of LGUs)	LGUs (City Planning/Development Office)	To be obtained in planning/FS stage
Locational Clearance (if necessary)	Republic Act (RA) 7160 Local Government Code	Proposed project is allowed in a particular zone/district	LGUs (City Planning/Development Office)	To be obtained in planning/FS stage
Certificate of non-overlap (CNO)	Republic Act (RA) 8371 Indigenous People Rights Act	The project site is not overlapping with the IPs ancestral domain claim	National Commission for Indigenous Peoples (NCIP)	To be obtained in planning/FS stage
Certification for non-coverage of National Cultural Treasure (NCT)/ Important Cultural Property (ICP)	Republic Act No. 10066 National Cultural Heritage Act	The project site is not overlapping with the IPs ancestral domain claim	National Commission for Culture and Arts (NCCA)	To be obtained in planning/FS stage
Waste Management Plan (WMP) (*to be stipulated in ECC)	Republic Act (RA) 6969 (1990) Republic Act (RA) 9003 Ecological and Solid Waste Management Act	Plan on how the project would manage solid, hazardous, and liquid waste generation.	DENR EMB Regional EMB National Capital Region LGUs	X months prior to the construction (*depending on the condition stipulated in ECC)
Foreshore Lease Agreement	DAO 2004-04 City Charter Republic Act 5519	An agreement executed by and between the DENR and the applicant to occupy, develop, utilize and manage the foreshore lands	DENR	
Special Land Use Permit/Forest Land Agreement (SLUP/FLAg)	DAO 2004-59 DENR Memorandum Order April 2006	A contract between the government and a second party to temporarily occupy, manage and develop in consideration of a government share, any forestland of the public domain for specific use	DENR	
Tree Cutting and/or Tree Earth Balling Permit (*to be stipulated in ECC)	Presidential Decree (PD) No. 953-	Removal of trees Plant of tree	DENR CENRO, PENRO, Region	
Development/Building Permit	Republic Act (RA) 6541 Act to Ordain and Institute a National Building Code Local Ordinances of concerned LGUs	Authority to start construction	LGUs (Office of Building Official)	To be obtained after DD stage
Traffic Impact Assessment (TIA) (If necessary)	Local Ordinances of concerned LGUs	Plan on how the project control/manage the traffic concerns due to the project implementation	LGUs	To be obtained after DD stage
Quarry permit	Republic Act (RA) 7942 Philippine Mining Act	The permits for quarry to contractor	LGUs	Before the construction

Source: JICA Survey Team

2. DESCRIPTION OF THE PROJECT'S EIA PROCESS

2.1 Terms of Reference of the EIA Study

2.1.1 Guidelines, Laws and Regulations to be followed

Accordance of EIA project category(Described in Chapter 1.3), the 4th Cebu-Mactan Bridge Construction Project shall be prepared a required type of EIA report (EIS). For preparation of EIS, the Guidelines, Laws and Regulations to be followed are shown below;

- Relevant Laws, Guidelines, Regulations, etc. of the Government of the Republic of the Philippines (Described in Chapter 1.4)
- JICA's Guidelines for Environmental and Social Considerations (April 2010)
- World Bank Operational Policies, OP 4.01 (January 1999) and Involuntary Resettlement Policy, OP 4.12 (December 2001)
- International Finance Corporation, Performance Standard 6 'Biodiversity Conservation and Sustainable Management of Living Natural Resources' (January 2012)

2.1.2 Coverage of EIA study

The EIA study for the 4th Cebu-Bridge Construction Project includes the following items:

- EIA system, environmental related laws and guidelines and EIA-related organizations in the Philippines
- Environmental and social considerations of the Project area
- Scoping
- Environmental condition evaluation and forecast of future impacts of the project
- Undertakings of public consultations and hearings
- Environmental impact assessment of alternatives which include zero-option
- Environmental mitigation measures
- Preparation of Environmental Management Plan and Monitoring Plan and other necessary documents
- Public Participation (Stakeholders Meetings/Public Consultation)

2.1.3 EIARC Technical Scoping

As an EIS project type-the undertaking for the EIA study, review and approval process will subscribed to EMB guidelines/standards and procedural requirements, such as the following:

- Public Participation guidelines (DAO 2017-15), which requires the undertaking of perception survey, public consultation/scoping, and public hearing (to be hosted by the EMB legal department)
- Conduct of technical scoping and review by an EIA Review Committee (EIARC)-comprising of external specialists and technical resource persons (DAO 2003-30 Revised Procedural Manual)
- To be processed in the DENR-EMB regional office and will be approved by the EMB-7 Regional Director (with the recommendations/endorsements of the results of the review/evaluation by the EIARC);

EMB7 formed the EIARC for the 4th Cebu-Mactan Bridge-Mandaue Coastal Road project and conducted the Technical Scoping at the DPWH7 office last March 6, 2019. The output of the technical scoping was the Scoping Checklist (see Annex-2).



Figure 2.1.1 Technical Scoping Meeting with the EMB/EIARC

2.1.4 JICA Environmental Advisory Committee’s Review

Environmental and Social Considerations (ESC) are *sine qua non* for JICA’s assistance. If a significantly adverse impact on the environment or society has been identified during JICA-assisted project planning, JICA will take the necessary measures to ensure that the appropriate ESC will be given. When JICA reviews a project proposal and finds that the project could have a negative impact on the environment or society, JICA advises the project proponents to provide appropriate ESC. If the negative impact of the project cannot be avoided or mitigated to an acceptable level, JICA will not support its implementation. According to the basic principle behind the JICA ESC Guidelines, JICA Environmental Advisory Committee reviewed the EIA study of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road project.

Table 2.1.4.1 Scoping Matrix Based on the PEISS (DAO 03-30) and JICA Guidelines

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation on the Scoping by EIARC	JICA Guide line	Evaluation on the Scoping		Countermeasures for filling gaps	
				Pre/During Construction	Operation		
1. The Land	1.1	Land use and Classification		Land use and utilization of local resources	B-	B-	
	1.1.1	Change/Inconsistency in land use	LS				
	1.1.2	Encroachment in Protected Area under NIPAS	LI				
	1.1.3	Encroachment in other Environmentally Critical Areas (ECAs)	LS	Ecosystem	B-	B-	
	1.2	Geology/Geomorphology		Topography and Geology	B-	D	
	1.2.1	Change in surface landform/topography/ terrain/slope	LS				
	1.2.2	Change in sub-surface/underground geomorphology	LS				
	1.2.3	Inducement of landslides or other natural hazards	LI				
	1.2.4	Inducement of subsidence	LI	Ground subsidence	D	D	
	1.3	Pedology		Soil pollution	B-	D	
	1.3.1	Soil erosion	LS				
	1.3.2	Change in soil quality	LI				
				Bottom sediment	B-	D	
	1.4	Terrestrial Ecology		Ecosystem	B-	B-	
1.4.1	Vegetation removal and loss of	LS					

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation on the Scoping by EIARC	JICA Guide line	Evaluation on the Scoping		Countermeasures for filling gaps	
				Pre/During Construction	Operation		
	habitat						
1.4.2	Threat to existence and/or loss of important local species	LS					
1.4.3	Threat to abundance, frequency and distribution	LS					
1.4.4	Hindrance to wildlife access	LS					
2. The Water	2.1 Hydrology/Hydrogeology		Hydrology	B-	B-		
	2.1.1	Change in drainage morphology					LS
	2.1.2	Change in stream, lake water depth					NR
	2.1.3	Reduction in stream volumetric flow					NR
	2.1.4	Inducement of flooding/	LS	Water usage	B-	D	
	2.1.5	Water resources competition	LI				
	2.1.6	Reduction/Depletion of ground water flow	LI				
	2.2 Oceanography		Hydrology	B-	B-		
	2.2.1	Change/disruption in circulation pattern					LS
	2.2.2	Change in bathymetry	LS				
	2.3 Water Quality		Water Quality	B-	B-		
	2.3.1	Groundwater pollution					LI
	2.3.2	Stream water pollution					NR
	2.3.3	Lake water pollution					NR
	2.3.4	Marine water pollution	LS				
	2.4 Freshwater Ecology		Ecosystem	B-	B-		
	2.4.1	Threat to abundance, frequency and distribution of species					NR
	2.4.2	Loss of important species					NR
2.5 Marine Ecology							
2.5.1	Threat to abundance, frequency and distribution of species	LS					
2.5.2	Loss of important species	LS					
2.5.3	Loss of habitat	LS					
3. The Air	3.1 Meteorology/Climatology		The impacts to transboundary or global issues	B-	B+		
	3.1.1	Change in the local climate, e.g., local temperature					LS
	3.1.2	Contribution to Global greenhouse gas	LS				
	3.2 Air Quality (and Noise)		Air Quality	B-	B-/B+		
	3.2.1	Air Pollution					LS
	3.2.2	Increase in noise	LS	Noise and vibrations	B-	B-/B+	Add survey
			Offensive odors	B-	D	Add survey	

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation on the Scoping	JICA Guide line	Evaluation on the Scoping		Countermeasures for filling gaps	
				Pre/During Construction	Operation		
4. The People	4.1.1	Displacement of settler/s	LS	Resettlement	A-	D	
	4.1.2	Change in land ownership	LS				
	4.1.3	Displacement of properties	LS				
	4.1.4	Right of way conflict	LS	Local Institutions, decision making	B-	D	
				Misdistribution of benefits and damages	D	D	
				Local conflicts of interest	B-	D	
				Existing social infrastructures and services	B-	B-	
	4.1.5	In-migration (Proliferation of informal Settlers)	LS	Poor	B-	D	
	4.1.6	Presence of Indigenous Peoples	LI	Indigenous, or ethnic people	C	C	
	4.1.7	Cultural change	LI	Cultural heritage	B-	B-	
				Landscape	C	C	
	4.1.8	Threat to public health	LS	Infectious diseases such as HIV/AIDS	B-	B-	
				Working conditions (Health)	B-	D	
4.1.9	Local benefits from the project	LS	Local economies, such as employment, livelihood, etc.	B-/B+	B-/B+		
			Working conditions (Health)	B-	D		
			Existing social infrastructures and services	B-	B-		
4.1.10	Threat to delivery of basic services	LS	Water usage	B-	D		
4.1.11	Traffic congestion	LS	Accidents (Safety)	B-	B-		
			Gender	B-	B-	Add survey	
			Children's rights	C	D	Add survey	
5. Other	Abandonment	-	Waste	B-	D		
Note1: Relevance based on PD and Project Location LS: Likely Significant LI: Likely Insignificant NR: Not Relevant			Note 2: Rating based on JICA ES Guideline A±: Significant positive/ negative impact is expected. B±: Some positive/ negative impact is expected. C: Extent of positive/ negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses.) D: No impact is expected. IEE/ EIA is not necessary.				

Source: JICA Survey Team

2.2 Outlines of EIA Study

2.2.1 EIA Team

The conduct of this EIA study for the 4th Mactan Bridge project is in collaboration with the JICA Survey Team and the local consultant- T&M Consultancy and Allied Services with the following team members:

Table 2.2.1.1 EIA Study team

Professional/Specialist	Name
Project EIA/RAP Team Leader	Andres E. Muego, Civil Engineer & Environmental Planner, Master's Degree in Urban Environmental Management
Geologist	Abraham R. Lucero, Jr. M.S. Geologist, B.S. Geology
Air pollution/GHG Emissions Specialist	Aiza Cortes, PhP, Energy-Environmental Engineering, Master's Degree-Environmental Engineering, BS Biology
Flora & Fauna & Marine Resource Inventory Team	Rey O. Nunez, Forester Solon D. Bagalihog, Coastal/Mangrove & Marine Rafael Olodin, Avifauna Aimefer P Gomex, Biologist Alex Selor, Jr. GIS Technologist
Project Liason/Support Staff	Gleena Lyrad Quilat, Chemical Engineer Joan Crujido, Industrial Engineer Jeffbeck Coca, LLB, Political Science

2.2.2 EIA Study Schedule

The undertaking of activities for the EIA study, review and approval process started in December 2018 during the coordination-consultation meetings between JICA representative, JICA Survey Team, DPWH, MCDCB, DENR/CENRO/ EMB and the LGUs of Mandaue and Lapu-Lapu Cities.

Table 2.2.2.1 Schedule of EIA Activities

Project Phases/ Activity	Dec '18	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sept	
		1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2	1	2
1.0 Prelim. Activities, IEC, Perception Survey																			
Coordination Meetings																			
Preliminary Survey/Data gathering																			
Site Visits and Consultation Meetings with Barangay																			
2.0 Scoping																			
Public Scoping-Mandaue City (3/6/19)																			
Public Scoping-Lapu-Lapu (4/12/19)																			
Public Scoping-Mandaue (4/26/19)																			
Technical Scoping with the EIARC (3/6/19)																			
3.0 EIA Study/Preparation of EIS & RAP																			
EIA Data Base Assembly. Collection of secondary data, Terrestrial and Aquatic (Marine) flora and fauna inventory, Air/Noise & Water sampling-lab analysis																			
RAP Census/perception survey, Report preparation & Review																			
4.0 Public Hearings in Mandaue & Lapu-Lapu																			
5.0 Additional data gathering, Internal Review & Refinement of EIS-Draft Report																			
6.0 Submission of EIS-Draft Report to EMB, EIARC Review, EIARC technical Meeting & Evaluation																			
7.0 EMB/EIARC Final Review & issuance of Recommendations																			

Source: JICA Survey Team

2.2.3 EIA Study Area

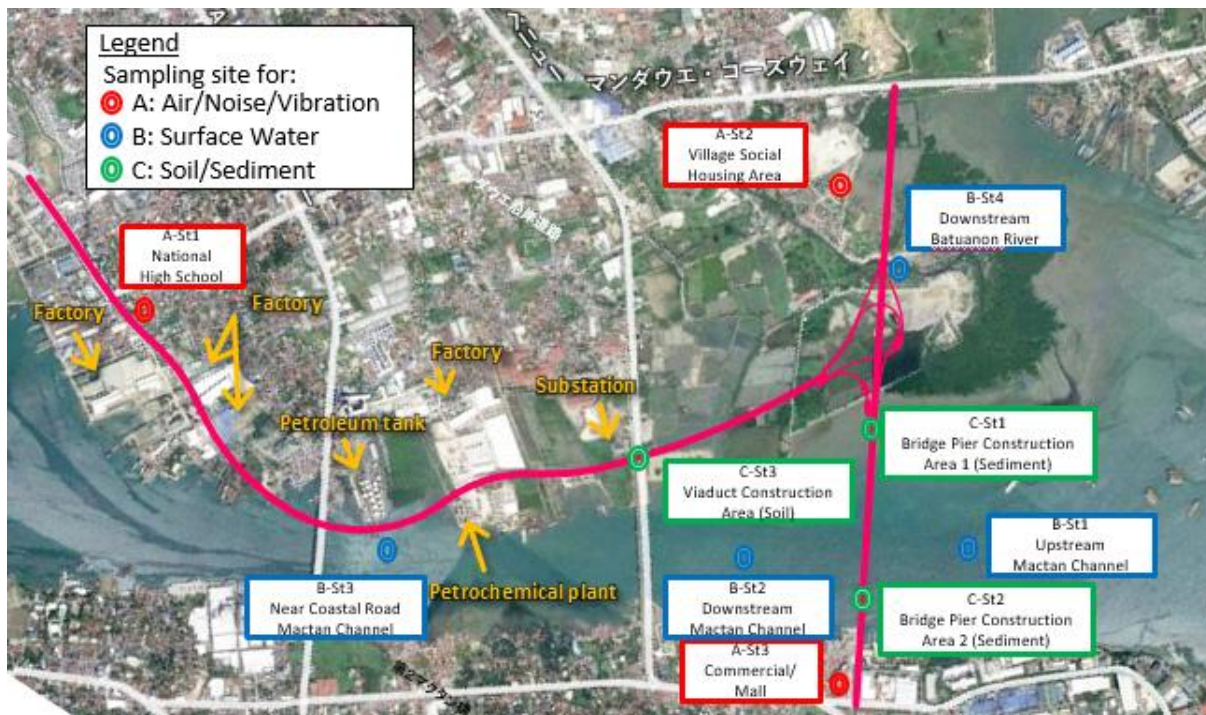
The EIA study area covers the areas along the route alignment of the Mandaue Coastal Road and the 4th Mactan Bridge located in the affected barangays of Mandaue and Lapu-Lapu Cities, which is categorized into Primary and Secondary Impact Areas. Bases for delineation of the direct and indirect impact areas were the definition given by the Revised DAO 03-30 procedural manual, as follows:

- | |
|---|
| <p>a) Direct impact area (DIA) is initially delimited during the Pre-EIA Study Stage as the area where ALL project facilities are proposed to be constructed/situated and where all operations are proposed to be undertaken For most projects, the DIA is equivalent to the total area</p> |
|---|

- applied for an ECC.
- b) Indirect Impact Area (IIA) during the pre-EIA Study can only be assumed or qualitatively estimated but may be guided by secondary data and information from key interviews of reliable local authorities, e.g. Based on a NAMRIA topographic map, an IIA can be the stretch of the river/s OUTSIDE the project area but draining the project site which can potentially transport Total Suspended Solids and other discharges from the project towards downstream communities.
 - c) On the other hand, the regional impact zone (RIZ) pertains more to the general area where the impact of the project would be felt, such as the entire municipality, province or region.

Given the above-reference, the Primary or Direct Impact Areas (DIA) are areas to be directly affected by the project's alignment/ROW where acquisition of private properties for the ROW and displacement of residential and commercial/industrial structures/establishments will be required.

On the other hand, the Secondary or Indirect Impact Areas (IIA) are those to be indirectly affected by the noise and vibration disturbance, air pollution, and inconvenienced due to various construction activities during the project implementation. Within this secondary impact areas, sensitive receptors to noise, air, soil and water pollution were identified-such as schools, residences/village. These receptors were also the basis for identifying sampling sites for air, noise, water and soil testing/analysis (as shown in the figure below).



Source: JICA Survey Team

Figure 2.2.1 EIA Survey Map

2.2.4 EIA Methodology

The scoping checklist that was the primary output of the Technical Scoping with the EMB/EIARC served as the Terms of Reference (TOR) for the conduct of the EIA study. The scoping checklist provides the parameters for land, water, air and people that will be sampled and analysis. The following table exhibits the parameters (impacted items) and the measurement methodology including measuring equipment, methods of analysis and analytical instruments information in the implementation plan.

Table 2.2.4.1 Baseline Survey Items and Methodology

Impacted Item on JICA Guidelines <Item in Philippine Laws>	Survey Item and Methodology		Forecast Methodology
Air pollution <Air quality & noise>	(1) Site measurement : 3 points (2) Item: CO, NO ₂ , SO ₂ , PM10, PM2.5 (3) Frequency: Once (24-hour sampling) Note) Utilize secondary data, if any		Quantitative forecast (Puff Model) or refer to other example cases
Water pollution <Water Quality>	(1) Site measurement : 4 points (2) Item: Chromium, Cadmium, Lead, BOD, COD, Oil and Grease, pH, TSS, Total Nitrogen, Total Phosphorus, Turbidity, Temperature, Salinity (3) Frequency: Once Note) Utilize secondary data, if any		Quantitative forecast
Waste <Abandonment>	(1) Site survey: 1 point (Land fill site near the project site) (2) Item: Summary of the site, Waste to be generated by the project, Construction-derived soil (3) Frequency: Once Note) Utilize secondary data, if any		Quantitative forecast (Calculation based on design drawing and construction plan)
Soil contamination <Soil Quality / Fertility>	Refer to Sediment quality		Qualitative forecast
Noise and Vibration <Noise>	<p>Noise</p> <p>(1) Site measurement: 3 points Note) In the selection of the measurement location, priority is given to the sensitive receptors (e.g. school and residential area).</p> <p>(2) Item: Ambient Noise: L_{Aeq}, (Continuous 24hr/weekday) Traffic volume and speed</p> <p>(3) Frequency: Once Note) Utilize secondary data, if any</p>	<p>Vibration</p> <p>(1) Site measurement: 3 points Note) In the selection of the measurement location, priority is given to the sensitive receptors (e.g. school and residential area)</p> <p>(2) Item: Ambient Vibration: L_{v10} / 24hr/weekday</p> <p>(3) Frequency: Once Note) Utilize secondary data, if any</p>	Quantitative forecast (Traffic noise L _{Aeq} dB(A) on road boundaries and at points where consideration is required)
Ground subsidence <Subsidence >	Literature review		Qualitative forecast
Odor	Refer to design in relation to major activities at candidate sites for base camps		Qualitative forecast
Sediment quality <Soil Quality>	(1) Site Survey: 3 excavation points (2) Item: Cadmium, Cyanide, Chromium, Lead, Phosphorus, Arsenic, Mercury, Copper and Selenium (3) Frequency: Once Note) Utilize secondary data, if any		Qualitative forecast
Protected area <Environmentally Critical Areas (ECAs)> Ecosystem <Terrestrial Biology Freshwater or marine ecology>	<p>Site Survey</p> <p>(1) 500m each side along the bridge and road alignment. For birds, investigate visually the area of about 1 km using binoculars.</p> <p>(2) Item: Fauna and flora, ecosystem, considerable species such as listed species on IUCN Red list. Fauna: Mammals, Birds, Reptiles, Amphibians, Aquatic life (including fish), Insects and Benthos Flora: Land Plants and Aquatic Plant (including mangrove)</p> <p>(3) Frequency: One time (bird migration season is desirable) Note 1) For survey on birds, consider the results of the initial</p>	<p>Interview Survey to Experts</p> <p>(1) Discussion points - Possibly affected items - Extent of impact - Mitigation measures - His/her opinion on whether the project is implementable</p> <p>(2) Interviews to at least 2 experts are necessary.</p>	Qualitative forecast

Impacted Item on JICA Guidelines <Item in Philippine Laws>	Survey Item and Methodology	Forecast Methodology
	environmental condition survey conducted in December 2018. Note 2) Utilize secondary data, if any	
Hydrology <Hydrology and oceanography>	Literature review	Qualitative forecast
Topography and geology <Geography, topography and landslides>	Literature review	Qualitative forecast
Involuntary resettlement <People>	Utilize the results of RAP Survey (The number of PAPs identified based on census, socioeconomic survey, and inventory of loss)	Quantitative forecast
The poor <People>	Utilize the results of RAP Survey (The number of PAPs below poverty line identified based on census, socioeconomic survey, and inventory of loss survey)	Quantitative forecast
Indigenous and ethnic people <Indigenous people (IPs)>	- Interview survey with and request for relevant documents to LGUs - Utilize the results of RAP Survey (Check if ethnic and religious minorities and indigenous people exist based on census and socioeconomic survey)	Qualitative forecast
Local economy such as employment and livelihood <People>	Utilize the results of RAP Survey (Professions identified based on census, socioeconomic survey, and inventory of loss survey. In case that fishing/aquaculture /broom-making ground are affected, ratio of affected people and extent of impact on their revenue)	Qualitative forecast
Land use and utilization of local resources <Land use and classification>	- Review of Comprehensive Land Use Plan prepared by the concerned LGUs - Utilize the results of RAP Survey (Change in land use of affected lands identified based on census, socioeconomic survey, and inventory of loss survey)	Qualitative forecast
Water usage <Hydrology / Hydrogeology/ Water quality>	Literature review	Qualitative forecast
Existing social infrastructures and services <People>	(1) Site survey: 1,000m range along the bridge, approach road and coastal road (2) Item: - Distribution of school, hospital, religious place, community center, and power plant etc. - Vessel traffic in the Mactan channel and type of vessels, etc. (including interview survey) (3) Frequency: Once Note) Utilize secondary data, if any	Qualitative forecast
Social institutions such as social infrastructure and local decision making institutions <People>	Utilize the design and construction plan within the range of bridges, approach roads, guide banks and revetments (From the viewpoint of splitting of communities, check the road crossing structure, functional maintenance points etc.)	Qualitative forecast (check on design drawing, etc.)
Misdistribution of benefit and damage <People>	Utilize the results of stakeholder meetings for EIA and coordination with PAPs for RAP (Based on the opinion of the residents regarding the impacts expected in this project, understand the level of residents' interest in these items)	Qualitative forecast
Local conflict of interests <People>		Qualitative forecast
Cultural heritage <People>	(1) Site survey: Interview with local authority in charge of Bantayan Sa Hari (2) Item: - Possibly affected items - Extent of impact - Mitigation measures (3) Frequency: Once Note) Utilize the results of RAP survey and stakeholder meetings	Qualitative forecast
Landscape	(1) Site survey: Major points commanding a view of bridge, approach road, approach roads, guide banks and revetments (2) Item: Photograph (3) Frequency: Once	Qualitative forecast
Gender	Utilize the results of stakeholder meetings and focus group	Qualitative

Impacted Item on JICA Guidelines <Item in Phillipine Laws>	Survey Item and Methodology	Forecast Methodology
<People>	discussions (Understand the opinions of women group on gender gap)	forecast
Right of children <People>	- Confirmation of Philippine law concerning children's rights and child labor - Interview survey with the Philippine government on the issues including, but not limited to, child labor in construction work around the project site	Qualitative forecast
Infectious diseases such as HIV/AIDS <People>	Utilize the results of RAP survey and stakeholder meetings	Qualitative forecast
Labor environment <People>	Confirmation of labor-related Philippine laws and international standards (IFC)	Qualitative forecast
Accidents <Traffic Situation>	(1) Site survey: Interview with police station and LGUs (2) Item: Number of traffic accident and reasons for accidents (3) Frequency: Once	Qualitative forecast
Cross boundary impacts and climate change <Meteorology / Climatology>	Utilization of traffic volume prediction results to be included in the Survey (Checking CO ₂ emission factor by year, vehicle type and speed, and CO ₂ emissions by structure, etc.)	Quantitative forecast

Source: JICA Survey Team

2.3 Public Participation

2.3.1 Basic Rules

With the issuance of the DENR Administrative Order No. 2017-15 (dated May 02, 2017) “Guidelines on Public Participation under the Philippine Environmental Impact Statement (EIS) System” the public involvement in the ‘scoping, review and approval process is strengthened/enhanced through the mandatory requirement of undertaking the IEC, public scoping/consultation and public hearing.

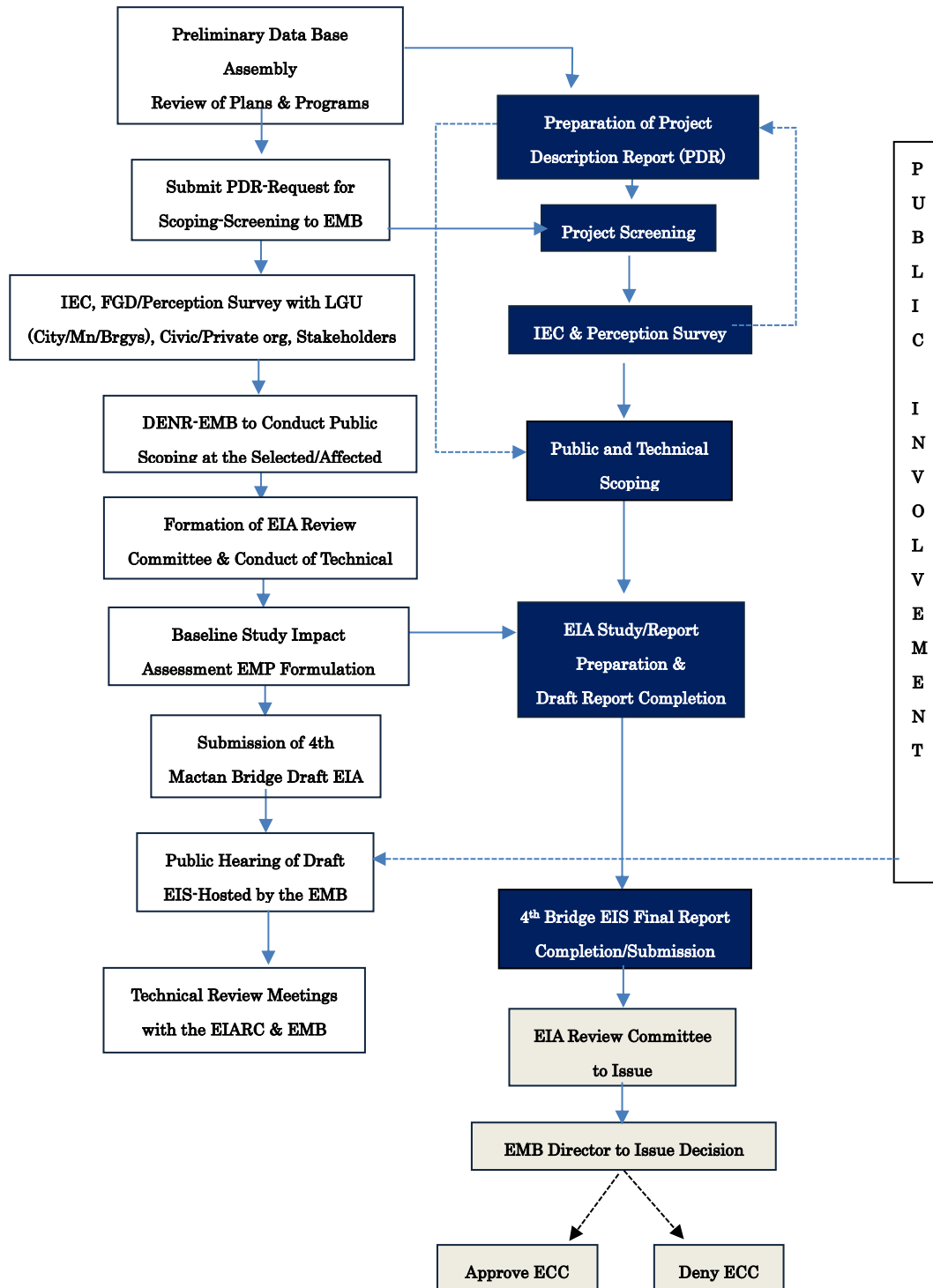


Figure 2.3.1 Updated (Incorporating the Public Participation Guidelines) Philippines EIA System Process Flow Chart for the Preparation of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road Project

2.3.2 Information, Education and Communications (IEC)

There are two types of information, education and communications (IEC) activities for this project: 1) IEC during the undertaking of the EIA study, review and approval process and, 2) After the issuance of the ECC-where the project's ECC conditions and the Project's Environmental Management Plan (EMP) will be communicated to the stakeholders and the surrounding communities.

Prior to commencement of the survey, activities for IEC on the project had commenced. The 4th Cebu-Mactan Bridge was identified as one of the priority projects in two previous JICA studies (i.e. the Roadmap Study and the MCUTMP). Therefore, the 4th Cebu-Mactan Bridge was included in the presentation and discussions during the stakeholders meetings that took place in these two related studies.

To officially set the scene for commencement of the feasibility study, a coordination meeting was undertaken from January 23 to 24 with JICA representatives, DPWH, JICA Survey Team, representatives from the Cities of Mandaue and Lapu-Lapu and the Metro Cebu Development and Coordinating Board (MCDCB). IEC meetings undertaken are shown in the table below.

Table 2.3.2.1 Summary of IEC Meetings

Date and Time	Target Organization	Agenda	Participants	
			by Affiliation	by Sex
December 11, 2018	DENR-CENRO Region VII	Introduction to the project plan/feasibility study and discussion	CENRO: 3 JICA ST: 2	Male: 4 Female: 1
December 12, 2018	Metro Cebu Development and Coordinating Board (MCDCB)	Introduction to the major plans and undertakings in the Metro Cebu	Cebu Cordova Link Expressway (CCLEX): 1 DPWH Region VII: 1 Others: Many JICA ST: 2	Male: 4 Female: 0
December 12, 2018	Cebu Port Authority	Introduction to the project plan and feasibility study	Cebu Port Authority: 2 JICA ST: 2	Male: 4 Female: 0
January 24, 2019	LGUs, MCDCB, NEDA	Introduction to the Project Coordination/ kick-off meeting	DPWH Region VII: 3 Mandaue City: 1 Lapu-Lapu City: 2 MCDCB: 2 NEDA: 3 JICA: 1 JICA ST: 6	Male: 13 Female: 5
January 25, 2019	Coast Guard Cebu	Introduction to the Project Coordination Meeting	Coast Guard: 1 JICA ST: 6	Male: 7 Female: 0
March 27, 2019	Mandaue City Planning and Development Office	Introduction to the Project Coordination Meeting with City's Zoning Board	Private: 5 Government: 3 LGU: 10 Survey Team: 2	Male: 13 Female: 7
April 11, 2019	Lapu-Lapu City Engineering Office	Introduction to the Project Coordination Meeting	Government: 5 LGU: 3 Survey Team: 3	Male: 5 Female: 6
April 13, 2019	Barangay Opao	Introduction to the Project Coordination Meeting	Local: 14 LGU: 5 Survey Team: 5	Male: 14 Female: 10
April 16, 2019 (10:00-11:00)	Barangay Umapad	Introduction to the Project Coordination Meeting	LGU: 7 Survey Team: 3	Male: 6 Female: 4
April 16, 2019 (11:00-12:00AM)	Barangay Paknaan	Introduction to the Project Coordination Meeting	LGU: 10 Survey Team: 3	Male: 9 Female: 4
April 16, 2019 (1:00-2:00PM)	Barangay Pusok	Introduction to the Project Coordination Meeting	LGU: 3 Survey Team: 3	Male: 2 Female: 4

Date and Time	Target Organization	Agenda	Participants	
			by Affiliation	by Sex
April 16, 2019 (2:00-3:00 PM)	Barangay Ibo	Introduction to the Project Coordination Meeting	LGU: 2 Survey Team: 3	Male:2 Female: 3
April 17, 2019	Barangay Centro	Introduction to the Project Coordination Meeting	LGU: 10 Survey Team: 3	Male: 10 Female: 3
May 27, 2019	Regional Development Council-Economic Development Committee (RDC-EDC)	Presentation of the project and comments/discussion	Cebu Chamber of Commerce & Industry Mactan Chamber of Commerce & Industry Dept. of Trade and Industry Dept. of Agriculture Bureau of Fisheries and Aquatic Resources-Dept. Agri. Dept. of Tourism Dept. of Science and Technology Dept. of Environment and Natural Resources and line bureau Land Bank of the Philippines Others	N/A

Source: JICA Survey Team

Note) Attendance list of this meetings is shown in Annex-3.1



Source: JICA Survey Team

Figure 2.3.2 Coordination Meeting with Government Officials (Kick-off Meeting)

The JICA Survey Team, aside from the public consultations/scoping required as part and parcel for the EIA study and the review and approval process for the project’s ECC application requirement, conducted a series of small-group discussions and coordination meetings with the city and barangay officials as well as with individual stakeholders and companies. In these meetings, while seeking the cooperation of the local officials and to coordinate the EIA and RAP activities, the survey team presented and thereby disseminated information about the project and at the same time, collected comments and inputs from local officials and stakeholders including the companies located along the planned alignment.



Source: JICA Survey Team

Figure 2.3.3 Coordination Meeting with Mandaue City Zoning Board



Figure 2.3.4 Coordination/Consultation Meetings with Barangay Officials

2.3.3 Public Scoping

(1) Outline of the Pre-Scoping/ Public Scoping Stakeholder Consultation

There was a pre-scoping stakeholder consultation held on March 6, 2019, and two ‘public scoping’s’, or stakeholder meetings carried out at the scoping stage of the survey in; 2) Lapu-Lapu City on April 12, 2019; and 3) Mandaue City on April 26, 2019.

The pre-scoping stakeholder consultation in Mandaue City was mostly attended by barangay officials and representatives of private companies/establishments expected to be affected by the project.

The public scoping in Mandaue City was therefore carried out to supplement the first meeting with a focus on individual household residents although most of the companies expected to be affected were also at present. The program/agenda of the meetings were generally as follows:

- Project background/overview and rationale/objectives of the project: DPWH Region VII;
- Background of the EIA system, public participation in the review and approval process, and purpose/objective of the public scoping and public hearing: EMB Region VII;
- Details of the project, comparison of project (i.e. alignment) alternatives, and environment and social considerations including objectives of the RAP: JICA Survey Team; and
- Questions and answers session often referred to in the Philippines as the “open forum”: EMB Region VII

Table 2.3.3.1 Summary of Public Scoping Meetings

Date and Time Venue	Target	Agenda	Language	Participants	
				Total	Character
March 6, 2019 Social Development Center in Mandaue City	Barangay officials and representatives of private companies/establishments who will be affected by the Project in Mandaue City	<ul style="list-style-type: none"> • Project outline • Comparison of alternatives for the route location • Expected negative and positive impacts on the natural and social environment, • The tentative survey schedule, opinions 	Local language (Visayas).	39	by Affiliation Local People: 4 Private Company: 7 Government Officials:12 LGUs: 10 Survey Team: 6 by Sex Male: 27 Female:12 (Female: 30.8%)
April 12, 2019 Lapu-Lapu City Session Hall in Lapu-Lapu City	Barangay officials, representatives of private companies/establishment and individual households who will be affected by the Project in Lapu-Lapu City		Local language (Visayas).	37	by Affiliation Local People: 12 Private Company: 1 Government Officials:8 LGUs: 11 Survey Team: 5 by Sex Male: 18 Female:19 (Female: 51.4%)
April 26, 2019 the Mandani Bay Boardroom in Mandaue City	Barangay officials, representatives of private companies/establishment and individual households who will be affected by the Project in Mandaue City		Local language (Visayas).	118	by Affiliation Local People 54 Private Company29 Government12 Officials10 LGUs:2 Media:2 Unanswered:7 Survey Team:4 by Sex Male: 67

Date and Time Venue	Target	Agenda	Language	Participants	
				Total	Character
					Female:51 (Female: 43.2%)

Source: JICA Survey Team

Note) Attendance list of this meetings is shown in Annex-3.2

(2) Pre-Scoping Stakeholder Consultation in Mandaue City

Prior to the public scoping/stakeholder meeting that are to be held in the scoping stage, a consultation meeting was held from 2 to 4 pm on March 6, 2019 at the Mandaue City Office-Social Development Center in Mandaue City. People that attended this meeting were mostly owners of land and companies that use the land as tenants along the route alignment of the Mandaue Coastal Road. DPWH, with assistance of Survey Team, explained the project outline to the attendees and heard their opinions and concerns about the project. There was no notable objection from the participants regarding project implementation.

The venue and date of the pre-scoping stakeholder consultation were notified in advance by sending or handing invitations to companies and individuals who own a plot of land in and around the project site, or by contacting by telephone.

Main contents of the discussions are summarized in the Table 2.3.3.2

Table 2.3.3.2 Questions and Answers at the Pre-Scoping Stakeholder Consultation

No.	Comments, Questions and Suggestions	Answers	Reaction by Questioner
1	Question Is coastal road planned at grade? Will the access to structures such as factories be secured? (Individual owner of land that is affected/Male)	Viaduct is planned and access to existing structures will be secured as much as possible. (DPWH)	Understood.
2	Request It is planned that a viaduct will be constructed between the anchorage area and the oil tank. Since the oil tank is a facility that handles combustibles, safety measures are necessary in both the construction and operation phases. We would like you to discuss with our technical team. (Business entity (Petron) that use the land affected/Male)	Understood. We will discuss with your technical team. (DPWH/JICA Survey Team)	-
3	Comment The structures to be affected in the San Miguel factory site are the office and factory buildings. (Business entity (San Miguel) that uses the land affected by the route alignment/Male)	We plan to assess the price appropriately at the market price and compensate for the relocation costs. (DPWH)	Understood.

Source: JICA Survey Team



Figure 2.3.5 Pre-Scoping Stakeholder Consultation in Mandaue City

(3) Public Scoping held in Lapu-Lapu City

Public scoping at the scoping stage, also considered the stakeholder meeting in accordance with the JICA Guidelines, was held on April 12, 2019 in Lapu-Lapu City.

The venue, date and objectives of the public scoping in Lapu-Lapu City was widely notified in advance on local newspaper in English and Visaya. A tarpulin about the notification of the public scoping was also posted at each barangay office. Invitation letters were handed directly by the Survey Team to all the companies and individuals who own a plot of land in and around the project site.

Main contents of the discussions are summarized in the Table 2.3.3.3.

Table 2.3.3.3 Questions and Answers at the Public Scoping in Lapu-Lapu City Public Scoping

Comments, Questions and Suggestions	Answers
Reclamation plans and its purpose were asked by a resident of Barangay Ibo.	It was clarified by the JICA Survey Team that reclamation of area is not part of the project. DPWH-Region VII added that the reclamation area in the presentation will be done by the Mandaue City government and not part of the project.
A resident of barangay Pusok asked for the specific location of the project and the specific lots to be affected.	<p>DPWH-Region VII presented the option one alignment which leads to the Airport Road. S/he cited the vicinity near Marina Mall along the Airport Road and other establishments that will be directly affected by the bridge. On the other side of the Airport Road, the lot owned by General Milling Corporation (GMC) will also be acquired for the blue line alignment.</p> <p>The judicial boundaries between barangays Ibo and Pusok were clarified by Lapu-Lapu City's Planning Office.</p>
<p>Clarifications regarding the blue line alignment as raised by a representative from a private company, whether the road be elevated or on the ground.</p> <p>S/he also asked if the team can provide him/her with a detailed design/description at this stage of the survey of the alignment as s/he will forward this to their management.</p>	<p>It was clarified that it will be elevated and will connect to the existing road by DPWH-Region VII.</p> <p>JICA Survey Team explained that the design that will be sent to the company would be a tentative design since it is still in its F/S stage.</p> <p>*There was an exchange of email address for the request to be done within the day. Site visit would then be arranged tentatively before the holy week starts.</p>
The consideration of an underground tunnel among the options of the 4th Cebu-Mactan Bridge was asked by a representative from a private company which would have less level of impact on the stakeholders.	It was clarified by the JICA Survey Team whether a road bridge or an underground tunnel, more or less the same stakeholders would still then be affected because of the location of the connection of the bridge/tunnel to the mainland. Furthermore, the cost and duration of construction would be doubled compared to the bridge.
The second bridge, Marcelo Fernan Bridge, has truck load limits that is not consistent as commented by a representative from a private company. The capacity of the new bridge was being asked whether it would also have a higher load limit.	The load limits of the new bridge would have no restriction as long as it follows the governing laws on load limits that are consistent with the national road.
The presence of a UMRT line on the bridge was asked.	The bridge for which the F/S is being carried out is a road bridge only.
The exact location of the blue line alignment was clarified by residents of Barangay Pusok to identify whether the present stakeholders' lots would be affected or not.	<p>It was reiterated that the vacant lot owned by a private company would be directly affected by the blue line alignment.</p> <p>The residential lots near Island Central Mall were clarified that they would not be affected.</p>
Surveys regarding compensation for the affected lots was raised by a resident of Barangay Pusok.	Affected households/structures need to be identified first. There would be a comprehensive survey afterwards which includes questions with regards to livelihood, types of house, number of households and so on. The value of the replacement cost is the current market value as discussed by DPWH-Region VII.

Source: JICA Survey Team



Source: JICA Survey Team

Figure 2.3.6 Public Scoping in Lapu-Lapu City

(4) Public Scoping in Mandaue City

The 2nd Mandaue City Public Scoping was held at the Mandani Bay Boardroom on April 26, 2019 8:00-11:00AM.

The venue, date and objectives of the public scoping in Mandaue City was widely notified in advance on local newspaper in English and Visaya, as well as on local television program in Visaya. A tarpulin about the notification of the public scoping was also posted at each barangay office. Invitation letters were handed directly by the Survey Team to all the companies and individuals who own a plot of land in and around the project site. After carrying out IEC meeting with Barangay captain and officials, they visited and handed leaflets to all the potentially affected informal settlers.

Main contents of the discussions are summarized in the Table 2.3.3.4.

Table 2.3.3.4 Questions and Answers at the Second Public Scoping in Mandaue City

Comments, Questions and Suggestions	Answers
<p>A member of a sectoral organization in Paknaan expressed their worries on the project as they are located in the mangrove area which is directly hit by the coastal road. It is also where they soak the brooms which are their source of livelihood of broom making and weaving. S/he inquired where their livelihood would be relocated if the construction takes place.</p> <p>It was asked if the area of the stakeholder concerned was surveyed and informed by a resident of the barangay.</p> <p>The stakeholder responded that no surveyors yet in the area however there was already information from the barangay about the project.</p>	<p>The public was informed by a representative of JICA Survey Team that surveys are now being conducted for the affected families and establishments. S/he requested them to cooperate and fill out/answer the questionnaire forms properly in order to estimate/determine properly the replacement cost. The purpose of the survey is also to relocate/resettle the PAPs where they will have better security compared to the mangrove area owned by the government.</p> <p>DPWH Region VII reiterated for the need to cooperate by answering and providing the data needed in the survey forms to help the team know the value in the assessment</p>
<p>A member of the Urban Poor in Barangay Paknaan shared his view that in their area, approximately 500 households may be affected who mostly live near the</p>	<p>DPWH Region VII reiterated that of the compensation program as long as it will qualify to the laws, directives and orders by the national government. The stakeholders</p>

mangrove area. S/he had the same concern as the previous stakeholder with regards to livelihood and relocation.	would also be paid of the current market value of the affected resources.
A private company commented that the area of interchange falls mainly within their property and his/her concern is about their operation, if it is a viaduct still, they will be trapped by the said project. S/he also suggested for the interchange to be on-grade rather than an elevated road.	The suggestion was considered as said along with other possibilities to minimize the impact of the project since it is still in the F/S stage, which is before the detailed design stage where adjustments may be made.
A representative from a shipyard company asked for the team to include in the design of the project, the plans and operations of their shipyard to minimize the disturbance of the project in their operation.	DPWH Region VII suggested for a consultation meeting with the owners of the shipyards with DPWH and JICA Survey team.
A representative from another person also expressed the same concern with the shipyard. They requested the height of the viaduct to accommodate the height of the ships and barges that are needed to make use of the wharf.	The suggestion was taken into consideration.
A representative from a private company shared that during the site visit on their location, one of the JICA Survey Team members mentioned of a 5.2 m vertical clearance of the viaduct. S/he suggested for at least 7 m.	The suggestion was taken into consideration.
The resident, who lives beside the Cansaga Bridge, asked if they can go back to the area after the construction of the project.	It was stated that the decision will depend on Mandaue LGU if they can go back to the area after the construction and that affected lots/alignment within the mangrove areas will be acquired by the government.
A representative from a private company noticed that in the project there is only one entry and exit or access point in Bai Hotel. S/he suggested creating another access points along Zuelig Avenue to decongest the access point in Bai Hotel.	DPWH Region VII shared that the original route was on the Zuelig road. But after coordinating with Mandaue City based on their revised CLUP, the aforementioned road will not be a truck corridor and will cater to the incoming opening of Mandani Bay which is one of their biggest stakeholders.
DENR CENRO shared that their office has been attending since the previous meetings and asked if they can have the copy of the final alignment or the plan of the project for their office to create a land status of the project.	JICA Survey Team is still finalizing the alignment and they will submit such relative documents after.
A representative of a private company asked for the contact persons and the corresponding contact numbers for scheduling of consultation meetings.	The contact persons and contact numbers were displayed on the screen.
A farmer from Barangay Opao, inquired about the cut-off date for he is planning to make shanties for his goat raising and also asks if he can still use/access the sea water for his fish pond after construction.	It was clarified that goats are not included in the RAP survey (*It is movable and hence not subject to compensation). In general, if the livelihood is affected by the project, it would be considered.
A resident from Barangay Centro asked of the arrangement of the maintenance of the project once the project is completed. Would it be JICA or DPWH? S/he further asked how much the project costs and how long the Philippine government will pay for the project.	Responded that once they have become a national government structure, it will be under DPWH Region VII 6th Engineering District Office to be responsible for its maintenance. With regards to the cost, it will be determined in the detailed engineering design stage and a loan arrangement will be made later on.
It was concluded by a summary of the comments by a representative from DENR-EMB Region VII. The stakeholders were also informed that after a public scoping, a public hearing will be carried out.	

Source: JICA Survey Team



Figure 2.3.7 Public Scoping Meeting at Mandaue City

2.3.4 Public Hearing/Consultation

(1) Outline of the Public Hearing/Consultation

Public Hearings were held in the morning on June 4, 2019 for Lapu-Lapu City (i.e. Lapu-Lapu City Session Hall) and in the afternoon of that day in Mandaue City (Barangay Paknaan Gymnasium), where the project background, design, results of the EIA and RAP studies including the compensation policy and entitlement matrix were presented followed by the open forum (i.e. Q&A session). Except for the presentation of project design, all presentations and exchange of opinions were done in local language (i.e. Visayas).

Table 2.3.4.1 Summary of Public Hearing/Consultation

Date and Time Venue	Target	Agenda	Language	Participants	
				Total	Character
June 4, 2019 a.m. Lapu-Lapu City Session Hall in Lapu-Lapu City	Barangay officials, representatives of private companies/establishment and individual households who will be affected by the Project in Lapu-Lapu City	<ul style="list-style-type: none"> • Preliminaries • Presentation of Project Background and Project Design • EIA and RAP Studies • Open Forum 	Local language (Visayas).	77	by Affiliation Local People:44 NGO:1 Private Company:9 Government Officials:12 LGUs:3 Media:2 Survey Team: 6 by Sex Male: 48 Female:29 (Female: 37.7%)
June 4, 2019 p.m. Barangay Paknaan Gymnasium in Mandaue City	Barangay officials, representatives of private companies/establishment and individual households who will be affected by the Project in Mandaue City		Local language (Visayas).	187	by Affiliation Local People:139 NGO:1 Private Company:30 Government Officials:7 LGUs:4 Survey Team:6 by Sex Male: 69 Female:118 (Female: 63.1%)

Source: JICA Survey Team

Note) Attendance list of this meetings is shown in Annex-3.3

(2) Public Hearing/Consultation in Lapu-Lapu City

The venue, date and objectives of the public hearing in Lapu-Lapu City was widely notified in advance on local newspaper in English and Visayas. A tarpaulin about the notification of the public scoping was also posted at each barangay office. Invitation letters were handed directly by the Survey Team to all the companies and individuals who own a plot of land in and around the project site. Leaflets were also distributed by barangay officials to all the potentially affected informal settlers.

The agenda of the public hearing/consultation in Mandaue City is as follows: i) EIA overview, ii) IEC and stakeholder meetings, iii) technical/public scoping meetings, iv) survey results on terrestrial flora and fauna, water and air, v) preliminary result of RAP, vi) impacts and mitigation measures, and vii) open forum. The summary of open forum is shown in Table 2.3.4.2.

Table 2.3.4.2 Results of Public hearing in Lapu-Lapu City

Comments, Questions and Suggestions	Answers
A small business owner in Barangay Pusok confirmed whether her commercial building will be affected which is located directly under the skywalk before going to the airport road. The mentioned establishment will not be affected.	JICA Survey Team clarified that the establishment will not be affected.
Hundreds of workers will be displaced as caused by the project as raised by United Taxpayers for Reform. The mitigations and concrete plans for the affected workers were asked.	The Legal Division of DPWH Region VII assured that the matter is being considered in the study. As by the Labor Code of the Philippines, there would be a separation payment for the labor loss caused by the project. The matter is also still being considered also by DPWH UPMO. The participant highlighted the benefits of the project to the residents of Lapu-Lapu City.
A resident from Barangay Pusok clarified whether his household and lot, located at the back of the vacant lot owned by a private company, would be affected.	It was clarified from Lapu-Lapu City that only the vacant lot would be affected and no households in Lapu-Lapu City would be demolished. The project is minimizing its effects to structures especially households. DPWH Region VII added that a more detailed survey will be done on the vicinity of the affected areas on the next stage which is the Detailed Engineering Design.
Clarifications regarding the three options of the new Mactan Bridge was raised by Island Central Mall IT Complex, whether options 2 and 3 be considered for another study. The meetings for these options were also inquired.	JICA Survey Team explained that in each option, several factors such as constructability, project cost, natural environmental impact and social environmental impact were taken into account through which option one was considered as the most preferable option especially from the point of view of its accessibility to the airport road. Added that the three options presented were based on the previous JICA study for a Mactan Bridge near the Cansaga Bay. The selection of the first option was done during meetings with the Lapu-Lapu City's Planning and Engineer's Office, JICA Survey Team, DPWH Planning and other technical group members of the survey.
The process of having a position paper on their stand on the project was asked by a representative of Senior Citizen Association in Barangay Paknaan in Mandaue City.	Replied that companies affected had been sending position papers to the team, furthermore, comments, suggestions and recommendations made in the meetings are being noted and can be considered as position papers. It was clarified by the Survey Team that the structure of Island Central Mall will not be affected. The factory of another private company will be affected based on the plan.
Businesses located near bridges and flyovers will have negative economic impact, as raised by a representative of Senior Citizen Association in Barangay Paknaan in Mandaue City.	The height of the bridge will be enough for the customers on cars to access the mall vicinity as explained by JICA Survey Team. DPWH Region VII commented that as practiced by other countries and in Ayala Road Access, there will be no negative economic impact on the businesses located near bridges/flyovers once the construction is done. However, there would be disturbances caused during the construction period.

	It was also stated by JICA Survey Team that the Marina Seaview Restaurant and the nearby port facility will not be affected.
The same sentiments were shared by another private company with regards to the effects of the project to the businesses. S/he appreciated the Survey Team and the government of the project since it is highly beneficial to the stakeholders. On the other hand, 33% of their total mall area will be demolished. The design of the loop with regards to its traffic scheme was asked if it would not generate more traffic in the mall hub of Lapu-Lapu City.	Stated that the comment was noted.
Compensation for establishments affected during the 5-7 years of construction of the project. S/he further asked what would happen to the tenants with a 5-20 years contract with them. Lastly, as representing the relevant group of companies as its owners, they preferred the alignment in Option 2 and 3 as they move away the traffic from their establishments.	DPWH Region VII assured that the matter is being considered in the study.
Another commendation was given to the team from Philippine Economic Zone Area (PEZA) stating that the project will address the traffic congestion in Lapu-Lapu City. At the same time, the team was asked to take into consideration the matters of relocating establishments. PEZA is operating under the RA 7916, the Economic Zones Act of the Philippines wherein establishments within these zones cannot just be relocated anywhere but in areas declared as economic zones, otherwise the relocators would lose its incentives (e.g. tax exemptions).	DPWH Region VII stated that the comment was noted.
A stakeholder from Pusok asked if after the construction of the 4 th Cebu-Mactan Bridge and as discussed by EMB, would their houses be located on the easement near the new bridge be demolished.	DENR-EMB explained that it is not part of this project but the matter will be dealt in coordination with the LGU.
The announcement as to what option would be finalized and be used in the project was asked.	DPWH Region VII clarified that Option 1 is already finalized and is the most recommended option for the 4 th Cebu-Mactan Bridge

Source: JICA Survey Team

(3) Public Hearing/Consultation in Mandaue City

The venue, date and objectives of the public hearing in Mandaue City was widely notified in advance on local newspaper in English and Visayas. A tarpaulin about the notification of the public scoping was also posted at each barangay office. Invitation letters were handed directly by the Survey Team to all the companies and individuals who own a plot of land in and around the project site. Leaflets were also distributed by barangay officials to all the potentially affected informal settlers.

The agenda of the public hearing/consultation in Mandaue City is as follows: i) EIA overview, ii) IEC and stakeholder meetings, iii) technical/public scoping meetings, iv) survey results on terrestrial flora and fauna, water and air, v) preliminary result of RAP, vi) impacts and mitigation measures, and vii) open forum. The summary of open forum is shown in Table 2.3.4.3.

Table 2.3.4.3 Results of Public Hearing in Mandaue City

Comments, Questions and Suggestions	Answers
<ul style="list-style-type: none"> A resident of Paknaan inquired if the project already started since there is already an ongoing reclamation within their area. S/he also asked if DENR knew of such activity that is affecting the mangroves. 	<ul style="list-style-type: none"> It was clarified that the project still is in the F/S stage and no physical activities yet being commenced. DENR recommended that such activity be documented to file a complaint to the barangay and will be soon coordinated with the City Environment & Natural Resources Office (CENRO). The resident responded that the barangay already filed a complaint of the said activity to City CENRO. S/he also shared that the area has 3-4 claimants as lot owners and each with documents and for this matter it will be in coordination with Mandaue City's Planning.
<ul style="list-style-type: none"> A representative from Barangay Paknaan commended the project since it considers the welfare of the informal settlers. He further asked as to what roles the barangay can do in support of the project. A representative from the Senior Citizen's Association in Paknaan, shared that there was no public hearing of the mentioned project currently happening in the mangroves. The residents are also experiencing floods when it rains due to the said activity. 	<ul style="list-style-type: none"> It was reiterated that the mentioned project is not part of the meeting currently happening and the agency concerned for the said matter is DENR-CENRO and not DENR-EMB which is handling this project. There would be coordination with the LGUs to identify the true owner of the lot and development.
<ul style="list-style-type: none"> The Drainage Master Plan of Mandaue City was asked if it was considered by the proponents for this project. A resident in Paknaan recommended that their relocation site would be near their livelihood in the mangroves. 	<ul style="list-style-type: none"> The possible relocation sites presented by the Housing and Urban Development Office (HUDO) to the informal settlers were Danao City and in Mactan Island. The proponent will be coordinating with other agencies such as NHA, DPWH and other LGUs to determine the qualified informal settlers, the relocation sites and the compensation that will be given.
<ul style="list-style-type: none"> A local resident shared that with the Cansaga Bridge project, the cost determined by DPWH as compensation for them was not followed wherein they received lesser. 	<ul style="list-style-type: none"> It was clarified that the payment before was based on zonal which means DPWH cannot pay beyond what is determined by the law. The New Right of Way Law which this project follows, offers the fair market value in acquiring the land.
<ul style="list-style-type: none"> A representative from Senior Citizen's Association, expressed his concern with the ongoing project of DPWH in Tayud, Consolacion. As the unfinished project causes more traffic congestion. 	<ul style="list-style-type: none"> DPWH clarified that the said project is not included in this project. However, the said concern will be raised to the appropriate proponents.
<ul style="list-style-type: none"> Utilities such as water and electricity as part of the compensation were asked by a resident of Umapad. 	<ul style="list-style-type: none"> Such costs will be included as well as the transportation costs in the replacement costs given to the informal settlers.
<ul style="list-style-type: none"> Prioritization of employment of affected households during construction of project was stated. A stakeholder asked if the president of the Philippines knew of this project. A resident of Barangay Umapad requested for the names of the affected households to know if they would still be affected after the changing of alignment. 	<ul style="list-style-type: none"> In the next part of the program (i.e. Part II FGD), we will discuss in more details of the affected households of the new alignment.

Source: JICA Survey Team

2.3.5 Focus Group Discussions for Sectoral Groups

(1) Outline of the Focus Group Discussions for Sectoral Groups

Two rounds of focus group discussions were held for the project during the survey for PWDs, women, senior citizens and fisheries in both Mandaue City and Lapu-Lapu City as they are considered to potentially have a specific stake and opinion on the project as they may be affected by the project differently from other people.

The first round has been completed on May 21 and May 23, 2019. The second round of FGDs was carried out on June 4, 2019 for Mandaue City and on June 11, 2019 for Lapu-Lapu City.

Table 2.3.5.1 Summary of Focus Group Discussions

Date and Time Venue	Target	Agenda	Language	Participants	
				Total	Character
May 21, 2019 The City Social Welfare Office Building in Mandaue City (Mandaue 1 st FGD at the scoping stage)	PWDs, Women, senior citizens and fisheries in Mandaue City	<ul style="list-style-type: none"> • General Information • Perceived Impacts of the Project • Opinions and Requests 	Local language (Visayas).	60	<u>by Affiliation</u> Fisherman:7 Women's' Group:17 Person with Disability:11 Senior Citizen:12 Barangay Staff:2 LGUs:3 Government Official:2 Survey Team:6 <u>by Sex</u> Male: 16 Female:44 (Female: 73.3%)
May 23, 2019 City Tourism Office Building in Lapu-Lapu City (Lapu-Lapu 1 st FGD at the scoping stage)	PWDs, women, senior citizens and fisheries in Lapu-Lapu City	<ul style="list-style-type: none"> • General Information • Perceived Impacts of the Project • Opinions and Requests 	Local language (Visayas).	70	<u>by Affiliation</u> Fisherman:16 Women's' Group:6 Person with Disability:12 Senior Citizen:25 LGUs:2 Government Official:2 Survey Team:7 <u>by Sex</u> Male: 30 Female:40 (Female: 57.1%)
June 4, 2019 Barangay Paknaan Gymnasium in Mandaue City (Mandaue 2 nd FGD at the draft final report stage)	PWDs, Women, senior citizens and fisheries in Mandaue City	<ul style="list-style-type: none"> • Consideration of their opinions and requests raised <ul style="list-style-type: none"> - Loss of Income - Fishing ground - Disturbance - PWD Friendly sidewalk 	Local language (Visayas).	8	<u>by Affiliation</u> Fisherman:2 Women's' Group: 1 Senior Citizen:1 Government Official:2 Survey Team:2 <u>by Sex</u> Male: 3 Female: 5 (Female: 62.5%)
June 11, 2019 ABC Building in Lapu-Lapu City	PWDs, women, senior citizens and fisheries in Lapu-Lapu City	<ul style="list-style-type: none"> • Consideration of their opinions and requests raised <ul style="list-style-type: none"> - Loss of Income 	Local language (Visayas).	33	<u>by Affiliation</u> Fisherman:3 Women's' Group:3 Person with

Date and Time Venue	Target	Agenda	Language	Participants	
				Total	Character
(Lapu-Lapu 2 nd FGD at the draft final report stage)		- Fishing ground - Disturbance			Disability: Unknown Senior Citizen:1 Local People: 22 (affiliation not listed) LGUs:1 Government Official:1 Survey Team:2 <u>by Sex</u> Male: 22 Female:11 (Female: 33.3%)

Source: JICA Survey Team

Note) Attendance list of this meetings is shown in Annex-3.4

For the socially vulnerable including PWDs, women and senior citizens, special considerations were taken as follows:

i) Direct prior notification

Local staffs explained the objectives of the stakeholder meetings and focus group discussions to the leaders of the women association, the disable association as well as the senior citizen association, and handed over to them the invitation letters with asking them to attend the meetings.

ii) Convenient venue

The venues are chosen with the criteria of accessibility and usability for the social vulnerable.

For Mandaue City, the first round of FGDs was held at the City Social Welfare Office Building, in which the mentioned associations have ever held the meetings. The second round of FGDs was held at the Barangay Paknaan Gymnasium adjoined to the office of Barangay Paknaan and the Social Welfare Office, where many of PAPs live around. For Lapu-Lapu City, the first round of FGDs was held at the City Tourism Office Building adjoined to the Lapu-Lapu City Hall, where it is located at the center of the town, and citizens including the mentioned associations have ever held meetings. The second round of FGDs was held at the ABC Building where public hearing meetings are often held and the decent space is able to be prepared.

iii) Meeting facilitation for the equal opportunity to express views

In the FGDs, the explanation of the project objectives and exchange of opinions were done in local language (i.e. Visayas) by local staff. While exchange of opinion session, local staffs provided the equal opportunity for all attendances to express their views.

(2) Focus Group Discussions in Mandaue City

The first round of FGDs was held in Mandaue for PWDs, women, senior citizens and fisheries on May 21, 2019 at the City Social Welfare Office Building in Mandaue City. The table below shows the comments and suggestions made by the groups.

Table 2.3.5.2 Comments and Suggestions from PWDs in Mandaue City during First FGD

Topics	Comments, Opinions and Suggestions
General	• PWD organizations are active and operative in all Barangays of Mandaue.

Information	<ul style="list-style-type: none"> • Most of the offices are also located inside their respective Barangay halls. • They collect monthly dues mostly PhP 20. • Members are I.D holders (issued by City’s Office of the Differently-Abled Persons Affairs (ODAPA) to be used/presented in availing discounts same with senior citizens. • Members are entitled to claim PhP 5,000/year financial assistance from the City Government and PhP 5,000 Mortuary assistance. • Qualified members are, but not limited to, the following: PWD inborn, polio, injured, stroked, psycho social, discriminated, visually impaired, deaf, mute and others. • Dialysis patient and cancer survivors are considered for I.D purposes only (no more financial assistance unlike before) to avail discounts as PWD. • They are in need of donations in form of supplies like wheelchairs, canes, scratches and others.
Perceived Impacts of the Project	(Negative Impact) <ul style="list-style-type: none"> • changes in traffic conditions during construction • noise and air pollution in the residents near the project area • resettlement of informal settlers
	(Positive Impact) <ul style="list-style-type: none"> • decongestion of traffic
Opinions and Requests	<ul style="list-style-type: none"> • Consideration of a PWD-friendly bridge. • Sidewalks where wheelchairs can pass in case of emergency • Sidewalks for joggers, walkers and so on just as the first and second Cebu-Mactan Bridges.

Source: JICA Survey Team

Table 2.3.5.3 Comments and Suggestions from Women’s Group in Mandaue City during First FGD

Topics	Comments, Opinions and Suggestions
General Information	<ul style="list-style-type: none"> • Women and senior citizens organizations are active and operative in all barangays within Mandaue City. • Most of the offices are also located inside their respective Barangay halls. • They collect dues mostly PhP 150/month. • Members are I.D holders (issued by City’s Office of the Senior Citizens Affairs (OSCA)) to be used/presented in availing discounts same with senior citizens. • Members are entitled to claim PhP 8,000/year financial assistance from the City Government and Mortuary assistance. • Qualified members are any women in Mandaue (for women groups) and any person at least 60 years of age and above. • They are in need of donations in forms such as wheelchairs, canes, pain relievers liniment/haplas and others.
Perceived Impacts of the Project	(Negative Impact) <ul style="list-style-type: none"> • mud flow during construction especially during typhoon or high tide • changes in traffic conditions during construction • noise and air pollution in the residents near the project area • resettlement of informal settlers
	(Positive Impact) <ul style="list-style-type: none"> • decongestion of traffic
Opinions and Requests	<ul style="list-style-type: none"> • employment priority for Mandauehanons, if qualified • commencement of the project to be as soon as possible • sidewalks where wheelchairs can pass in case of emergency • sidewalks for joggers, walkers and so on just as the first and second Cebu-Mactan Bridges

Source: JICA Survey Team

Table 2.3.5.4 Comments and Suggestions from Fisheries in Mandaue City during First FGD

Topics	Comments, Opinions and Suggestions
General Information	<ul style="list-style-type: none"> • Most of the fisherfolks and gleaners in Mandaue City are part time. • Not all are registered. • There are fisher folks organizations in the project area (Umapad Fisher folks Organization). • There is an existing organization called Bantay Digit or sea guard and most of them are fishermen. (Mandaue Bantay Dagat). • There are existing Illegal fishing ordinances that are in accordance with the national law. • Fishing gears used are hook and line and gillnet, others are gleaning and push net or sudsod and

some gleaners use iron bar or kabilla to collect shellfishes.

- They can do fishing even if not registered as long as they do not employ illegal methods of fishing.
- They have other sources of income other than fishing such as laborers, mason, carpentry, construction works, store vending and others.
- The major fishing ground is the sea area and the tidal flat next to Cansaga Bay, while they can do sometimes fishing in the Mactan Channel depending on the currents of water.



- They need to secure a permit from the LGU where they intend to catch fish, except Lapu-Lapu coastal area as it is considered their shared fishing grounds within the channel.
- They share the same fishing grounds (i.e. Mactan Channel) with Lapu-Lapu fishermen.
- Their total catch (includes anything like fish, crab, shrimp and others) per day and per fisherman will average into a Minimum of 5 kg and maximum of 10 kg with a value of PhP 1000 to 2000 more or less and PhP 300 for the expenses.
- They sell the catch to their neighbors only and not in the public markets or restaurants.
- Fish types are bangus/milk fish, tilapia/cat fish, shrimps, crabs, seaweeds and others.
- They use pump boats and ordinary Bangka/boat with bugsay (motorized and non-motorized).

Fishpond Operations

- According to a sea guard, only one aquaculture farm/fish pond (i.e. Batiller Fish Pond) is operating within the coastal area.



- Some fish ponds are converted to warehouses, reclaimed for other development and some are sold to private entities.
- According the City Agriculture Office (CAO), the area is no longer suitable for aquaculture operation due to contaminations/seepage from the closed garbage dumpsite and from other sources (e.g. industries).
- Bangus/milk fish, tilapia/cat fish, shrimps, crabs, seaweeds and others are grown.
- An affected stakeholder from Barangay Opao (veterinary doctor and former City Veterinary) who owns a fishpond within Opao shore (after VM Cabahug Shipyard property) and is still planning to revive his operation through modern method/technology not the conventional way.

Perceived Impacts of the Project

(Negative Impact)

- During the construction, there may be changes/limitation in: fishing grounds; fish catch; and access to certain fishing grounds.
- In addition, the following concerns were raised although they are not directly related to the

	<p>project)</p> <ul style="list-style-type: none"> • Dynamited/blasted fishing (very rare these days because of Bantay Dagat/sea guard) • Chemical/cyanide fishing • Liba-liba (use of small fishnets) • Illegal fishers that come from other nearby towns and provinces • Compressor fishing (not illegal fishing but considered as health hazard and recommended by the City Fishery Aquatic Resource Management Council (CFARMC) to be prohibited through an ordinance to be enacted by the LGU law making body). • fewer employment in the fisheries sector
	<p>(Positive Impact)</p> <ul style="list-style-type: none"> • development of the City for the benefit of the public
Opinions and Requests	<ul style="list-style-type: none"> • Any development is welcome as long as the fishermen will not be displaced

Source: JICA Survey Team




Source: JICA Survey Team

Figure 2.3.8 First Round of FGDs for PWDs, Women, Senior Citizen and Fishermen in Mandaue City

The second round of FGDs was held in Mandaue City for PWDs, women, senior citizens and fisheries on June 4, 2019 at the Barangay Paknaan Gymnasium in Mandaue City. The table below shows the comments and suggestions made by the groups.

Table 2.3.5.5 Comments and Suggestions from the Second FGDs in Mandaue City

Topics	Women, Senior Citizens PWDs and Fisheries Sectors
Matters raised during the 2 nd FDG meeting	<p>(Discussion relative to the 1st FDG)</p> <ul style="list-style-type: none"> • Consideration of the comments and suggestions raised during the Focus Group Discussion held last May 21, 2019 in Mandaue City’s Social Welfare Services Session Hall were presented to the sectoral groups. • Survey Team explained that, during construction, accessibility to the major fishing ground (i.e. Cansaga Bay) will be secured by making an access channel between bridge piers. • A representative from the Senior Citizen’s clarified that for Mandaue City’s concern on fishing, aside from the usual fishing by boat, they use fish traps within the mangroves area (as shown as an area in orange in the map below) to catch crabs, fish and shrimps. • It was clarified that the location of the fish traps would not be affected by the project by showing the map. However, it may cause some disturbances during construction.

	
	<p>(Negative Impacts)</p> <ul style="list-style-type: none"> • Fishing ground disturbance • Loss of income <p>(Positive Impact)</p> <ul style="list-style-type: none"> • Public purpose to decongest traffic
<p>Opinions, Responses and Request</p>	<ul style="list-style-type: none"> • They recommended that the team would hire contractors with new and well-maintained machines to minimize the noise created so as not to disrupt the fishes, and the Survey team accepted the recommendation. • As for their suggestion of a sidewalk or a pedestrian lane on the new Mactan Bridge, it was not considered in this project due to safety reasons. <p>(Responses)</p> <ul style="list-style-type: none"> • However, if there would be a high demand of pedestrian lanes on the bridge during the next stages, then it would be considered.

Source: JICA Survey Team

(3) Focus Group Discussions in Lapu-Lapu City

The first round of FGD was held at the City Tourism Office Building in Lapu-Lapu City on May 23, 2019 for PWDs, women, senior citizens and fisheries.

The comments and suggestions made by the groups are presented in the table below.

Table 2.3.5.6 Comments and Suggestions from Women’s Senior and PWD groups in Lapu-Lapu City during First FGD

Topics	Comments, Opinions and Suggestions
<p>General Information</p>	<ul style="list-style-type: none"> • Women and Senior Citizens organizations are active and operative in all Barangays of Lapu-Lapu. • Most of the offices are also located inside their respective Barangay halls. • They collect monthly dues mostly 150 pesos. • Members are I.D holders (issued by City OSCA) to be used/presented in availing discounts same with senior citizens. • Members are entitled to claim 8000 pesos yearly financial assistance from the City Government and Mortuary assistance. • Qualified members are any women in Mandaue (for women groups) and any person at least 60 years of age and above. • They are in need of donations in form of supplies like wheelchairs, canes, pain reliever liniment/haplas and others.
<p>Perceived Impacts of the Project</p>	<p>(Negative Impact)</p> <ul style="list-style-type: none"> • During the construction there will be changes in traffic conditions • Noise and air pollution for the residents near the project area • Resettlement for the informal settlers <p>(Positive Impact)</p>

	<ul style="list-style-type: none"> • Public purpose to decongest traffic
Opinions and Requests	<ul style="list-style-type: none"> • Next meeting to be held at a more PWD-friendly venue • Commencement of the project to be as soon as possible • Sidewalks where wheelchairs can pass in case of emergency • Sidewalks for joggers, walkers and so on just as the first and second Cebu-Mactan Bridges

Source: JICA Survey Team



Source: JICA Survey Team

Figure 2.3.9 First Round of FGDs for PWDs, Women, Senior Citizens and Fishermen in Lapu-Lapu City

Table 2.3.5.7 Comments and Suggestions from Fisheries in Lapu-Lapu during First FGD

Topics	Comments, Opinions and Suggestions
General Information	<ul style="list-style-type: none"> • There are full time and part time fishermen including gleaners. • Not all are registered. • No existing organizations Pusok fishermen (Mactan channel Lapu-Lapu side). • Existing Bantay dagat/ sea guard organization (Mactan channel Lapu-Lapu side). • Existing Illegal fishing ordinances in accordance with the national law. • Fishing gears used are hook and line and gillnet, others are gleaning and push net or sudsod and some gleaners use iron bar or kabilla to collect shellfishes. • They can do fishing even if not registered as long as they will not employ illegal methods of fishing. • They have other sources of income other than fishing like labourers, mason, carpentry, construction works, store vending and others. • Their main fishing ground is located near the marine sanctuary at the north east side of the Mactan Island. They sometimes use the areas within the Mactan channel and Cansaga bay, depending on the currents of water. <div style="text-align: center;"> </div> <ul style="list-style-type: none"> • They need to secure a permit from the LGU where they intend to catch fish, except

	<p>Mandaue Coastal area as it is considered as their shared fishing grounds within the channel.</p> <ul style="list-style-type: none"> • Their total catch (includes anything like fish, crab, shrimp and others) per day and per fisherman will average into a Minimum of 5 kilos and maximum of 10 kilos valued at PhP 1,000 to 2,000 more or less and PhP 300 for the expenses. • They will sell it to their neighbor-customers not in the public markets or restaurants. • Bangus/ milk fish, tilapia/cat fish, shrimps, crabs, seaweeds and others. • They use pump boats and ordinary Bangka/boat with bugsay (motorized and non-motorized). <p>Fishpond Operators</p> <ul style="list-style-type: none"> • According to [REDACTED] (fishermen), there is no existing fishpond operation within the project and its adjacent areas.
Perceived Impacts of the Project	<p>(Negative Impact)</p> <ul style="list-style-type: none"> • During the construction of the 2nd Mactan Bridge, the accessibility to the fishing ground on the north east side of the Mactan Island was limited. There are concerns among the fisher folks that there may be the same limitations. <p>->Survey Team explained that, during construction, accessibility to the major fishing ground (i.e. north east part of Mactan Island) will be secured by making an access channel between bridge piers.</p> <ul style="list-style-type: none"> • Noise disturbance from construction machines are expected. <p>(Positive Impact)</p> <ul style="list-style-type: none"> • Development of the City for the benefit of the public.
Opinions and Requests	<ul style="list-style-type: none"> • Any development is welcome as long as the fishermen will not be displaced • Access should be secured to move to the major fishing ground, the north east part of the Mactan Island, during construction (i.e. no blockage of the Channel)

The second round of FGDs was held in Lapu-Lapu City for PWDs, women, senior citizens and fisheries on June 11, 2019 at the ABC Building in Lapu-Lapu City. The table below shows the comments and suggestions made by the groups.

Table 2.3.5.8 Comments and Suggestions from the Second FGDs in Lapu-Lapu City

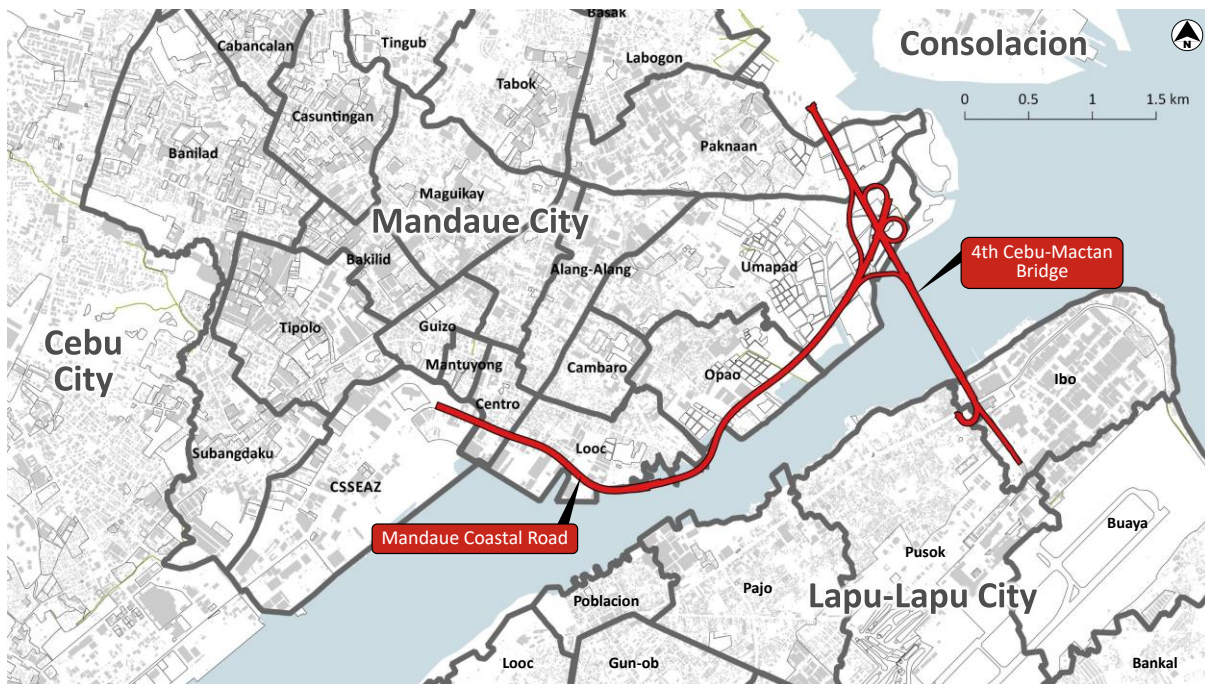
Topics	Women, Senior Citizens, PWDs and Fisheries Sectors
Matters raised during the 2nd FDG meeting	<p>(Questions/Comments)</p> <ul style="list-style-type: none"> • A fisherman asked about what the status would be for those fishermen who will suffer loss of income as a result of the project during the construction. • Local residents are concerned about the gleaners at nighttime and other groups in the area, if they will still be allowed to enter their fishing ground during the construction. • They hope local residents will be given the priority in terms of employment during the construction.
Responses and Discussion/ Opinions	<ul style="list-style-type: none"> • JICA Survey Team explained that there will be a replacement cost if fishermen cannot anymore do fishing activities in the area because of the project. Livelihood is one of the options and possible employment of the said project, for there must be a replacement of what will be lost from you. They will coordinate with JICA and assure that the latter would always see to it that the plan must be implemented, as it is very strict in terms of fulfillment/compliance. • JICA Survey Team mentioned that they would inform the management or their security guards about the fishing activity in the area within a specified time, so that fishermen will not be prohibited from entering the fishing ground. • JICA Survey Team explained that local residents will be given priority as what other company did as long as they are qualified. • JICA Survey Team further informed them that, the team will be giving notices through publication in the newspapers, leaflets and tarpaulins to be posted in public places. Together with the Survey Team's contact numbers for them to coordinate or for their suggestions and complaints.

Source: JICA Survey Team

3. PROJECT DESCRIPTION

3.1 Project Location and Area

The project area is located in the Province of Cebu in the Central Visayas (Region VII), Philippines. The 4th Cebu-Mactan Bridge with the Mandaue City Coastal Road is located in the Cities of Mandaue and Lapu-lapu, Cebu, Philippines. The coastal road alignment traverses six (6) barangays in Mandaue City, namely: North Reclamation Area/CEPZ, Centro, Looc, Opao, Umapad and Paknaan. While in Lapu-lapu City it covers the Barangays of Pusok and Ibo.



Source: JICA Survey Team

Figure 3.1.1 Project Location Map

3.2 Project Rationale/Objective

Metro Cebu has been suffering from serious traffic congestion causing economic, social and environmental losses. Due to the drastic increase in the number of registered vehicles (doubled from 1993), physical improvements of road network are required in addition to traffic management improvements. While existing 1st and 2nd Cebu-Mactan Bridges are vital links to sustain economic growth of Metro Cebu, the traffic volume of the 1st Bridge already exceeds its 2-lane traffic capacity.

JICA has conducted Roadmap Study (2013-2015) and Urban Transport Master Plan Study (2017-2019) for Metro Cebu and has proposed several priority projects including 4th Cebu-Mactan Bridge. In February 2018, 4th Philippines-Japan High-Level Joint Committee Meeting discussed about the implementation of the Project. In June 2018, Government of the Philippines through DPWH requested Government of Japan for conducting Feasibility Study on the Project. In December 2018, JICA and DPWH commenced Feasibility Study for construction of 4th Cebu-Mactan Bridge and Mandaue Coastal Road.

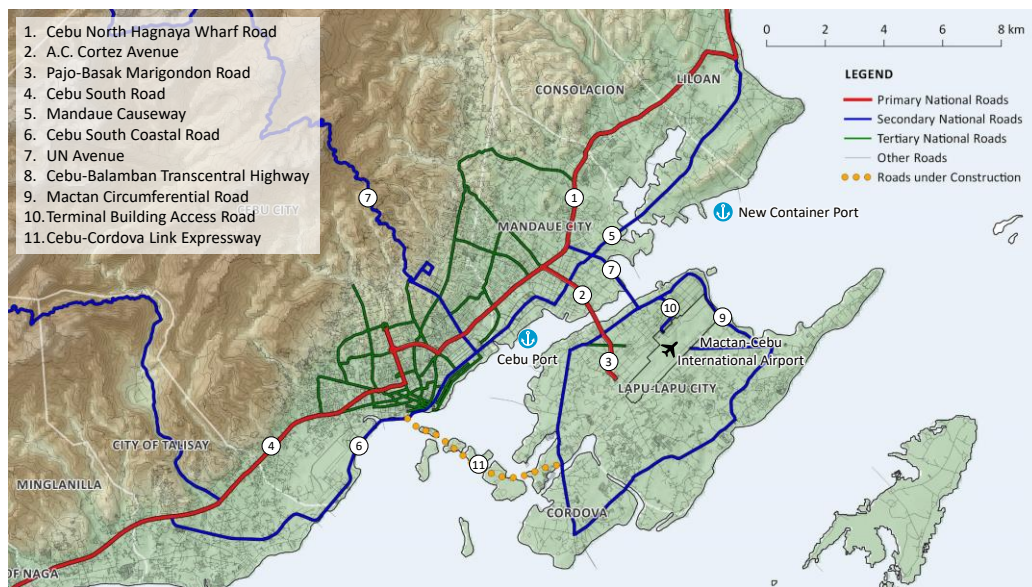
This project aims to decongest traffic in the Project Area by i) increase traffic capacity across Mactan Channel between mainland Cebu and Mactan Island (4th Cebu-Mactan Bridge) and ii) divert through traffic from the city center of Mandaue City (Mandaue Coastal Road).

3.3 Current Situation of Road Network and Traffic

(1) Current Road Network in Metro Cebu

The main island of Cebu Province stretches 225 km from north to south and is surrounded by 167 neighboring smaller islands that includes Mactan Island. The terrain of the island is dominated by rugged mountain ranges that constraint urban expansion. The urban core of Cebu Province is Metro Cebu, which is located along the central eastern portion of the province and includes the nearby Mactan Island. Cebu, Mandaue, and Lapu-Lapu Cities are highly urbanized central areas of Metro Cebu.

The total length of the road network in Metro Cebu including the local roads (i.e. city, municipal, and barangay roads) is 1,398.2 km and the national roads account for 30% of the total network (Primary National Road: 121.0 km, Secondary National Road: 191.0 km and Tertiary National Road: 105.6 km). Most roads are generally narrow with two (2) lanes and a few of the roads are four (4) lanes in the urban core areas. Moreover, the traffic capacities of these roads are decreased by roadside and on-road activities such as jeepneys' or taxis' waiting for or loading/unloading passengers. 46% of roads are not paved, which are mostly barangay roads.



Source: JICA Survey Team

Figure 3.3.1 Current Road Network in Metro Cebu

Currently, there are two (2) bridges linking between Cebu Island and Mactan Island. The 1st bridge (or called Sergio Osmeña Bridge) is a truss bridge built in 1973. The 2nd bridge (or called Marcelo Fernan Bridge) is an extradosed bridge built in 1999.



Sergio Osmeña Bridge



Marcelo Fernan Bridge

Source: JICA Survey Team

Figure 3.3.2 Existing Cebu-Mactan Bridges

Currently, 3rd Cebu-Mactan Bridge, which is called Cebu-Cordova Link Expressway (CCLEX), is under construction at the west side of Mactan Island. This bridge is designed as a cable-stayed bridge with its main span of 390 m. The construction of the 3rd Cebu-Mactan Bridge is expected to be completed by 2022.

(2) Current Road Traffic Situation

The traffic situation in Metro Cebu has deteriorated in recent years. Traffic congestion occurs on many roads and intersections not only during peak hours, but also off-peak hours, due to i) increase of traffic demand (population growth, economic development and motorization), ii) insufficient road network and public transport services, and iii) inadequate traffic management.

According to the final report of “Project for Master Plan Study and Institutional Development on Urban Transport System in Metro Cebu” (or called Metro Cebu Urban Transport Master Plan: MCUTMP), the majority of the traffic through 1st Cebu-Mactan Bridge was the trips from/to Cebu City or Mandaue City. The majority of the traffic through 2nd Cebu-Mactan Bridge was the trips from/to Mandaue City, Cebu City and Liloan.

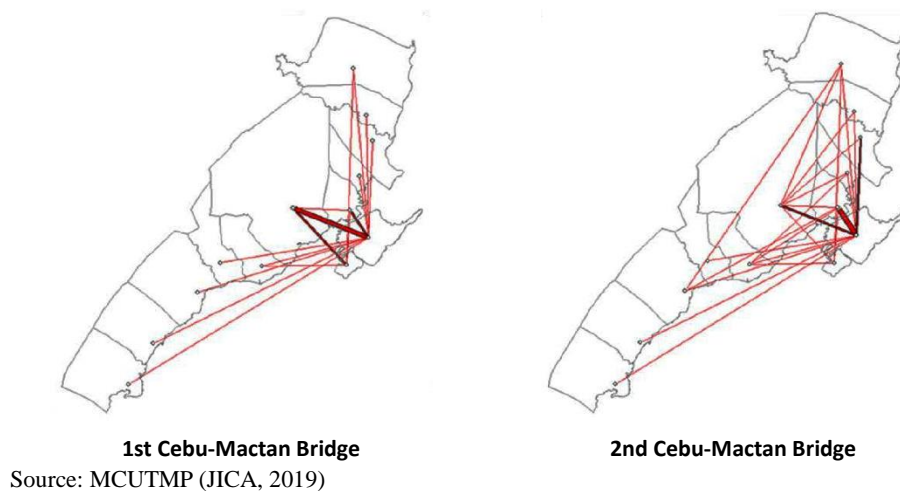


Figure 3.3.3 Trip Distribution

The available mode of public transportation in Metro Cebu are jeepneys, buses, taxis, and tricycles and the majority of them are jeepneys that are technically registered as public utility vehicles (PUV). There are also the "trisikads" from areas where there is demand for public transportation, but are not registered as PUVs. Another service that later emerged is the motorcycle-for-hire or “habal-habal.” Like the "trisikads", the service is illegal but thrive to cater to the mobility requirements of people outside the formal public transport service areas. Urban rail transit does not exist in Metro Cebu although this has been considered since 1990s. A Bus Rapid Transit (BRT) system is currently being implemented for Cebu City, but suffered some delays.

(3) Related Development Plans

There are three (3) manufacturing special economic zones in Lapu-Lapu City. Mactan Export Processing Zones (MEZ) 1 and 2 have 119 ha and 63 ha of lands respectively and these have been fully occupied by 158 and 54 companies. Cebu Light Industrial Park is relatively new economic zone with 63 ha of land and currently 35 companies are located but it is expected that this economic zone will be fully occupied within 5-6 years.

Several residential and mixed use developments are also planned in central Metro Cebu. Development of Mandaue Global City, which will be a 130 ha reclamation project, is planned within the vicinity of

the Project site. For finalization of the road alignment of the Project Road, coordination with the reclamation project may be necessary depending on the position of the alignment.

Cebu is a historical port city where the port supports its local economy. Cebu International Port is the main domestic shipping port in the Philippines and home to about 80% of domestic and international shipping operators and shipbuilders. Due to its shallow depths, the average overseas ship size is severely restricted to 11,929 (GRT). Despite such capacity constraint, container traffic has steadily increased by 8.1% per annum since 2012. In order to meet the increasing international container movement and to decongest the existing Cebu International Port, development of a new international container port in the Municipality of Consolacion was approved by the national government. The new port is proposed to be on a 25 ha reclaimed island designed to handle 500,000 twenty-foot equivalent units (TEU).

The Mactan-Cebu International Airport (MCIA) located in Lapu-Lapu City is recognized as the southern air transport hub of the Philippines. The terminal, which was originally designed for 4.5 million passengers per annum, was renovated to handle 8 million as response to the rapid increase in passengers. An additional new international terminal opened in July, 2018 to accommodate a total of 12.5 million passengers per annum. Plans for the construction of a second runway has been discussed, but stands as an unsolicited proposal and has not been made official. The proposed location of the second runway is north east of the existing airport where Mactan Export Processing Zone 1 (MEZ1) is located. This indicates that the proposed second runway may be constructed by demolishing many factories and warehouses are currently built in MEZ1.

(4) Road Network Development Plan

Majority of the current traffic issues stem from the road network includes the following:

- Congestion is primarily caused by weak road network, particularly limited construction of new roads. The drastically increasing number of vehicles cannot be accommodated;
- New roads are not adequately planned in accordance with the appropriate land use plan formulated under a long-term vision;
- Inefficient use of roads by the current public transport system that requires higher capacity;
- Many vehicles on the roads are inadequately maintained, particularly buses, jeepneys, and trucks. These vehicles contribute to the deterioration of air quality because of poorly controlled emissions; and
- In addition to the lack of infrastructure development, traffic management to utilize the existing infrastructure capacity to the maximum extent to mitigate traffic congestion is not sufficient.

In order to solve these issues, a series of studies, such as Metro Cebu Land Use and Transportation Study (MCLUTS), JICA's Roadmap Study and MCUTMP, has been conducted. MCUTMP proposed medium- and long-term road transport development plan in order to achieve the following targets:

- To reduce through traffic from northern to southern area of Metro Cebu;
- To increase road network capacity and travel speed would be increased at 10 km/h;
- To make an alternative route to prevent unnecessary intrusion to central Metro Cebu from northern and southern part of Metro Cebu;
- To provide safe, convenient, and comfortable access for pedestrians and bicyclists; and
- Smooth connection to and from Mactan Island through the bridges across Mactan Channel.

The basic concept of strategic urban road network plan in Metro Cebu is to establish an outer diversion road connecting to the coastal road at the central area of Metro Cebu that suffers from serious traffic congestion. It is expected that the proposed three roads, namely Metro Cebu Circumferential Road, Mandaue-Liloan Diversion Road and Mandaue Coastal Road, will form the proposed the outer diversion road. In addition to the new road construction, road widening and improvement of existing

intersections are also proposed to mitigate traffic congestion. Table 3.3.1 summarizes the proposed medium- to long-term road development projects in Metro Cebu. Out of these proposed projects, the following two road projects are evaluated as the high priority road projects by MCUTMP:

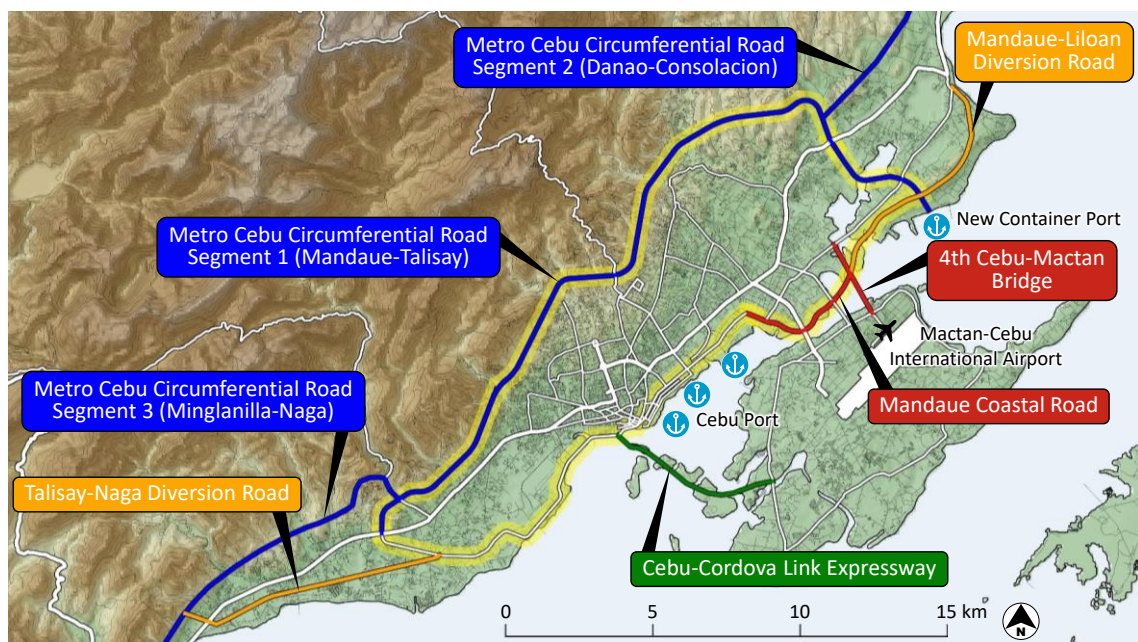
- 4th Cebu-Mactan Bridge with Mandaue Coastal Road
- Metro Cebu Circumferential Road

Therefore, undertaking of feasibility study on construction of the 4th Cebu-Mactan Bridge with Mandaue Coastal Road were requested from the Government of the Philippines through DPWH to the Government of Japan.

Table 3.3.1 Proposed Medium-Term to Long-Term Road Projects in Metro Cebu

	Medium-Term Plan Toward Year 2030	Long-Term Plan Toward Year 2050
Road Projects	<ul style="list-style-type: none"> • Metro Cebu Circumferential Road • Talisay-Naga Diversion Road • Mandaue-Liloan Diversion Road • Cebu Arterial Road Widening • Cebu Coastal Road Widening • Mactan Circumferential Road Widening • Metro Cebu Intersection Improvement 	<ul style="list-style-type: none"> • Metro Cebu Coastal Road Expressway • Metro Cebu Circumferential Expressway
Bridge Projects	<ul style="list-style-type: none"> • Cebu-Cordova Link Expressway (on-going) • Mandaue Coastal Road (viaduct) • 4th Cebu-Mactan Bridge • Replacement of 1st Cebu-Mactan Bridge 	

Source: MCUTMP (JICA, 2019)



Source: Prepared by JICA Survey Team based on MCUTMP (JICA, 2019)

Figure 3.3.4 Proposed Future Road Network in Metro Cebu

3.4 Project Alternatives/Options

3.4.1 Objectives of the Consideration of Alternatives

In order to determine the optimum project scope, analysis on selection of optimum route was conducted from “no-project” option to alternative route options for 4th Cebu-Mactan Bridge and Mandaue Coastal Road.

3.4.2 Analysis on Alternatives

(1) ‘No-project’ Option

In order to analyze the traffic situation at the vicinity of the Project site, traffic demand forecasts were carried out. Figure 3.4.1 shows the comparison of future traffic situation between the existing road network and proposed road network by 2030. If there will be no improvement of road network, traffic situation in Metro Cebu will be getting worse and the most of the arterial roads would be chronically congested. But if the proposed projects including 4th Cebu-Mactan Bridge and Mandaue Coastal Road will be implemented, the future traffic situation would be drastically improved.

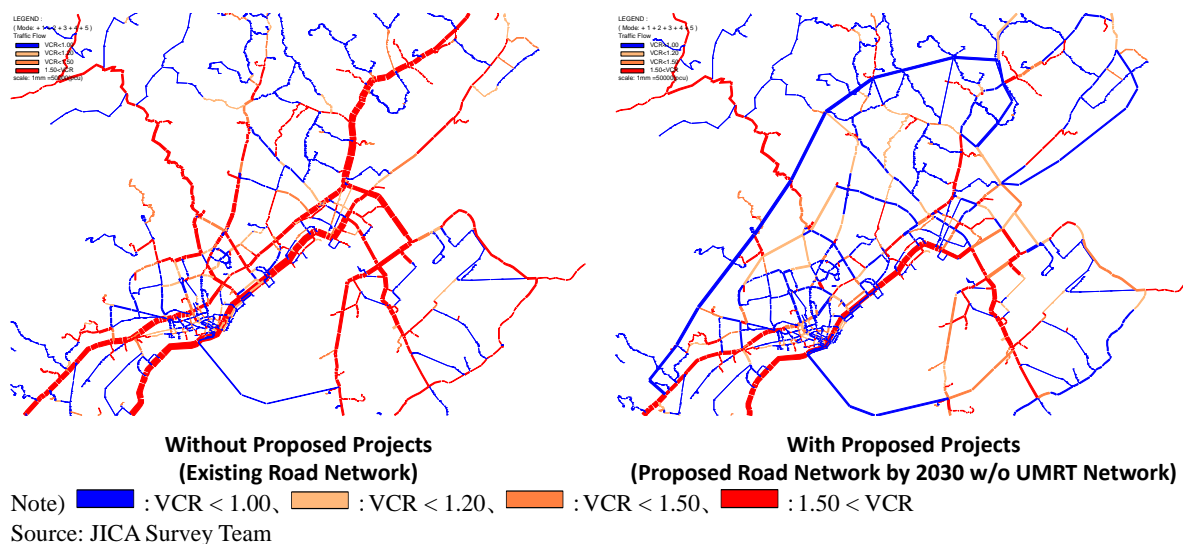


Figure 3.4.1 Result of Traffic Demand Forecast (in Year 2030)

Traffic volume across Mactan Channel in 2017 was 99,000 PCU/day which already exceed existing two bridges capacity. This volume is expected to double to 273,000 PCU/day in 2030 leading to further congestion. Even though, the 3rd Cebu-Mactan Bridge (four-lane road) is currently under construction at approximately 7.5 km west of the 1st Cebu-Mactan Bridge, this bridge is expected to meet the traffic demand from the west side of Cebu Island and it is not enough to meet the demand from the east side of the island or from the international airport located in the east side of Mactan Island. Another bridge needs to be constructed in the east side to meet such needs.

As a result of these population growth and urbanization coupled with geographical constraints, Metro Cebu has been facing traffic congestion chronically and the economic loss from congestion is estimated to have reached JPY 840 million in 2014 (JICA Roadmap Study). In particular, traffic is concentrated on the two bridges (i.e. 1st and 2nd Cebu-Mactan Bridges) that connect Cebu and Mactan Island. This has become a bottle neck for the social and economic development of Metro Cebu where the service sector such as tourism plays an important role.

In order to meet the growing demand for transportation, it is necessary to disperse the traffic within the two islands by connecting the islands through a new bridge. It is also important to develop a

transportation mode in a way that does not put additional pressure on the urban center in Cebu Island. The subject project aims to provide a bypass route in a way that makes use of the existing road network and thereby meets the demand for transportation while minimizing the environmental impact and scale of resettlement. In case the project did not take place, road will be further congested burdening not only Metro Cebu but also the Philippines as a whole economically. In addition, air pollution and stress caused by the traffic jam will increase the environmental and social costs of the society. For these reasons, the 'no-project' option is not recommended.

(2) Project Option

The project is composed of two components: a) developing a new bridge (i.e. 4th Cebu-Mactan Bridge); and b) developing Mandaue Coastal Road. The study has compared different options for both of these components.

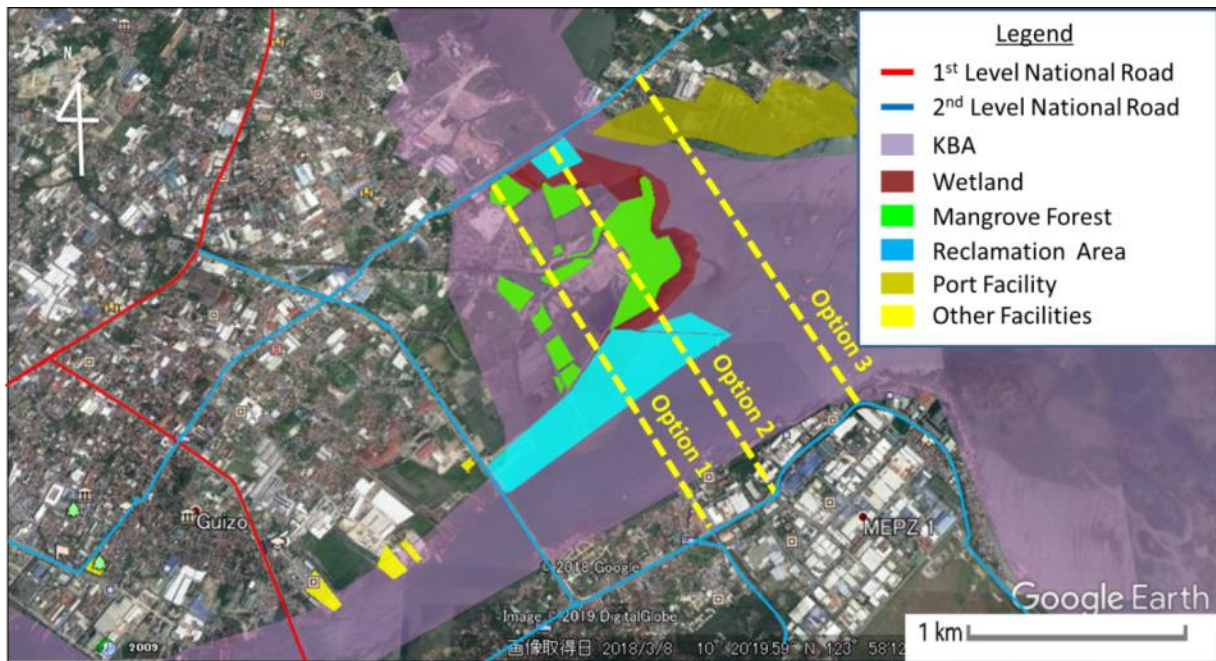
4th Cebu-Mactan Bridge

Location of the bridge was considered from the area east of the 2nd Cebu-Mactan Bridge for the following reasons (refer to Figure 3.1.1 for a map that shows the location of this project in relation to the 1st, 2nd and 3rd bridge).

- The channel at the west side of the 1st Cebu-Mactan Bridge needs to maintain a navigational clearance of 40m above sea level in order to allow bigger ships transportation. On the other hand, structures cannot be built any higher than 45m from the runway level of Mactan-Cebu International Airport due to its aviation limit.
- The distance between the 1st and 2nd Cebu-Mactan Bridges is 1.4km but port facility is located within this area making it difficult to secure enough space for bridge construction.
- The 1st and 2nd Cebu-Mactan Bridges are expected to meet the traffic demand from the center of Cebu City and Mandaue City while the 3rd Bridge is expected to meet that from the western side of Cebu Island. The 4th Cebu-Mactan Bridge is therefore expected to meet the demands from the eastern side of the main land Cebu.
- Although, there was a recommendation that 4th Cebu-Mactan Bridge should be constructed at the symmetric position against the 3rd Cebu-Mactan Bridge, the idea was rejected because of the aviation limit of Mactan-Cebu International Airport and the navigational clearance of new container port to be constructed in Consolacion.

Based on this understanding, the Study Team compared the following three alternative options.

- Option 1: Connect with Mactan Circumferential Road and airport access road
- Option 2: Connect with Mactan Circumferential Road at the entrance of an economic zone
- Option 3: Connect with Mactan Circumferential Road at the east end of Mactan Island



Source: JICA Survey Team based on Google Earth

Figure 3.4.2 Alternative Options for Bridge Location (4th Cebu-Mactan Bridge)



*HH: household

Source: JICA Survey Team based on Google Earth

Figure 3.4.3 Approximate Location and Number of Project-affected Households (4th Cebu-Mactan Bridge)

As a result of a comparison on the three options above mentioned, Option 1 was considered most suitable. The result of comparison is shown in Table 3.4.1 below.

Table 3.4.1 Comparison of Bridge Location (4th Cebu-Mactan Bridge)

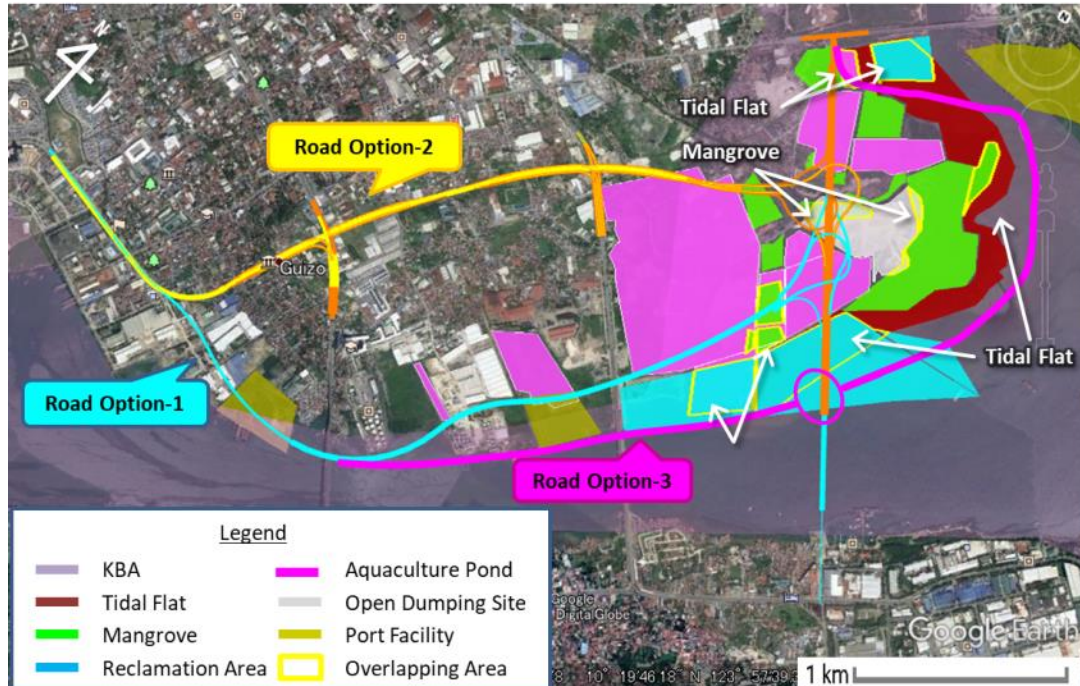
Evaluation Criteria		Option 1	Option 2	Option 3
Construction Cost		low because the length built in the sea is shorter (land: 1.6 km; sea: 1.0 km)	low because the length built in the sea is shorter (land: 1.6 km; sea: 1.0 km)	high because the length built in the sea is longer (land: 0.6 km; sea: 2.0 km)
KBA		affected area: approx. 5.7 ha (2.3 km x 25m)	affected area: approx. 5.7 ha (2.3km x 25m)	affected area: approx. 5.0ha (2.0 km x 25m)
Situation in Cebu Island	Mangrove Forest	affected area: approx. 0.75 ha (300m x 25m)	affected area: approx. 0.85 ha (350m x 25m)	affected area: none (0m x 25m)
	Tidal Flat	affected area: approx. 0.5 ha (200m x 25m)	affected area: approx. 0.6 ha (250m x 25m)	affected area: none
	Housings	approx. 10 houses (50 people) will be affected	approx. 10 houses (50 people) will be affected	approx. 20 houses (100 people) will be affected
	Reclamation Plan ※	passes at one location	passes at two locations	no interference
	Port Facilities	no interference	no interference	interferes
Situation in Mactan Island	Companies	no interference	affects one company	no interference
	Number of Lane sat the Crossing with Mactan Ring Road	6	4	4
	Access Roads	2 nd grade national road	road inside economic zone	no road
Evaluation and Reasons		<p>Recommended</p> <ul style="list-style-type: none"> • There are relatively few resettlement (approx. 50). • The impacts to mangrove forest, tideland and reclaimed land are also limited. • There is no impact to private companies and harbor facilities. • Construction cost is relatively low. • The connection to an airport is good. 	<ul style="list-style-type: none"> • There are relatively few resettlement (approx. 50). • The project will cause negative impacts to mangrove forest, tideland, reclaimed land. • The facilities of private companies are also affected. • Construction cost is relatively low. 	<ul style="list-style-type: none"> • There are relatively much resettlement (approx. 100). • The harbor facilities are also affected. • Because of the length of bridge on the sea, the project will cause negative impacts to marine environment. • It is difficult to connect with coastal road(Need to construct the junction facility on the sea). • Construction cost is relatively high.

※There is an city development plan involving reclamation in the area around the subject coastal road (i.e. east of 2nd Bridge). This is included in the Comprehensive Land Use Plan (CLUP) of Mandaue City and private companies are expected to implement the plan. According to Mandaue City, an Environmental Compliance Certificate (ECC) is requested for the plan. Since Mandaue City is giving top priorit to the new Cebu-Mactan Bridge and Coastal Road Construction Project, it is willing to coordinate with the city development plan in case the project interferes with the project.

Mandaue Coastal Road

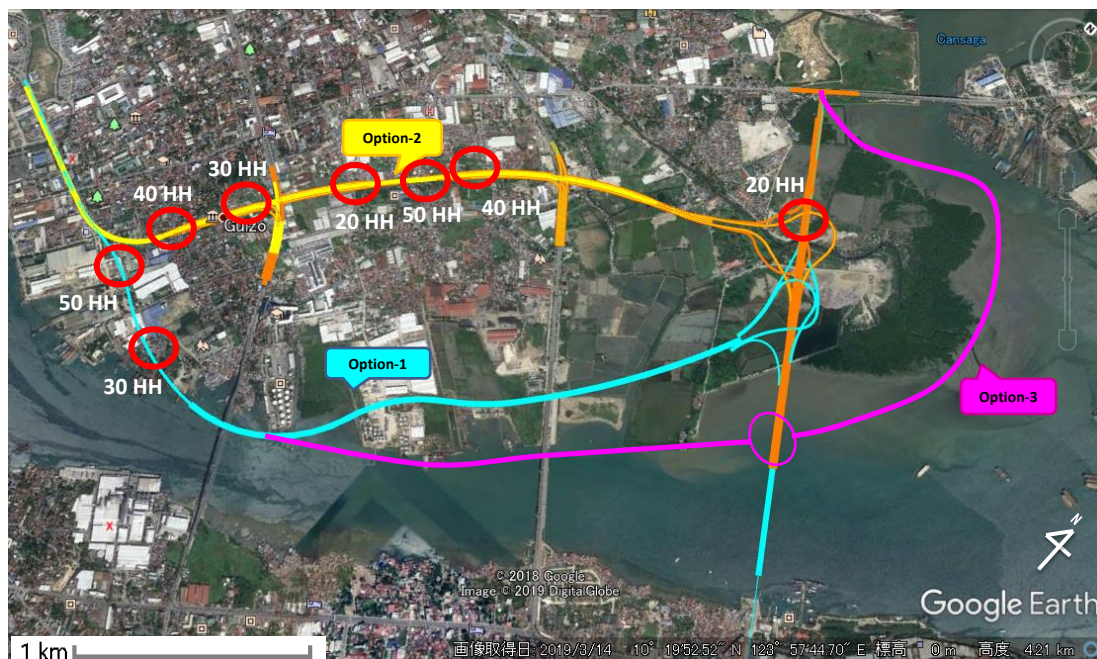
For the Mandaue Coastal Road, the following three route options were compared and analyzed.

- Option 1: route recommended in the JICA M/P Study but modified to avoid the impact on tidal flats and to reflect the results of the discussions made with the stakeholders and municipalities
- Option 2: route that passes through the city center
- Option 3: route recommended in the JICA M/P Study



Source: JICA Survey Team based on Google Earth

Figure 3.4.4 Alternative Options for Route Selection (Mandaue Coastal Road)



*HH: household

Source: JICA Survey Team based on Google Earth

Figure 3.4.5 Approximate Location and Number of Project-affected Households (Mandaue Coastal Road)

The three options were compared and analyzed leading to the conclusion that Option 1 was most suitable. The results of the comparison is shown in Table 3.4.2.

Table 3.4.2 Comparison of Route Alignment (Mandaue Coastal Road)

Evaluation Criteria		Option 1	Option 2	Option 3
Road Length	Approach	0.25 km	0.25 km	0.25 km
	Bridge	5.12 km	4.37 km	6.97 km
	Total	5.37 km	4.62 km	7.22 km
Function	Balance in Traffic Flow (PCU/day)*1	1st Bridge 95,000 (45%) 2nd Bridge 46,200 (22%) 4th Bridge 71,300 (34%)	1st Bridge 83,100 (39%) 2nd Bridge 75,000 (35%) 4th Bridge 54,300 (26%)	1st Bridge 95,000 (45%) 2nd Bridge 46,200 (22%) 4th Bridge 71,300 (34%)
	Traffic Alleviation *	Cebu N Road: -42% Mandaue Causeway: -56%	Cebu N Road: -42% Mandaue Causeway: -59%	Cebu N Road: -42% Mandaue Causeway: -56%
	Cost	Construction (ratio)	1.50 (steel plate deck box girder bridge)	1.00 (PC-I Girder bridge)
	Land Acquisition (excluding compensation)	Mandaue City owns relatively large area of land. Hence, cost is lower than Option 2 but larger than Option 3.	large cost is required as much of the area is private land	cost is low as a large part of the area is above the channel
Accessibility to Bridges	1 st Bridge	grade separation (direct connection with IC lump) only access to western side *1 st Bridge is expected to be replaced by 2030	grade separation (direct connection with IC lump)	grade separation (direct connection with IC lump) only access to western side *1 st Bridge is expected to be replaced by 2030
	2 nd Bridge	None	grade separation (direct connection with IC lump)	None
	3 rd Bridge	grade separation (full junction)	grade separation (full junction)	grade separation (full junction)
Workability	Construction Period (excl. time for land acquisition)	5 years construction of an elevation bridge in the sea will take longer time than bridge construction on land	3 years	5 years construction of an elevation bridge in the sea will take longer time than bridge construction on land
	Site Accessibility	temporary works such as jetty and barges construction are necessary	access is preferable as there are many cross roads	temporary works such as jetty and barges construction are necessary
	Traffic flow during construction	traffic can be controlled relatively easily as there are limited numbers of cross roads	there are more cross roads than Option 1	traffic can be controlled relatively easily as there are limited numbers of cross roads
Natural Environment	KBA	areas such as the interchange area falls within a KBA	areas such as the interchange area falls within a KBA	In addition to the interchange area, a section crossing the sea (approx. 3km) falls within a KBA
	Mangrove Forest	affected area: approx. 0.7 ha	affected area: approx. 2.0 ha	affected area: none
	Tidal Flat	affected are: none	affected are: none	affected are: approx. 1.25 ha (500 m x 25 m)
Social Environment	Housing	number of PAPs is relatively low (approx. 80 houses; 400 people)	number of PAPs is high (approx. 200 houses; 2,000 people*2)	number of PAPs is relatively low (approx. 80 houses; 400 people)
	Factories	6 factories will be affected within a distance of approx. 0.55 km	10 factories will be affected within a distance of approx. 0.60 km	6 factories will be affected within a distance of approx. 0.55 km
	Port Facilities	coordination is necessary with a port facility (distance affected: approx. 0.5 km)	coordination with a port facility is not necessary.	coordination is necessary with a port facility (distance affected: approx. 1.92 km)
	Reclamation Plan*3	Coordination with a reclamation plan is not necessary.	Coordination with a reclamation plan is not necessary.	coordination is necessary with a reclamation plan (distance affected: approx. 1.5 km)
	Air, Noise and Vibration	no residential land is located along the road and hence the impact is limited	residential land is located along the road and hence the impact is high	no residential land is located along the road and hence the impact is limited
Evaluation and Reasons		Recommended The negative impacts to the	There is a large size of	The impacts to the PAPs

Evaluation Criteria	Option 1	Option 2	Option 3
	PAPs (approx. 400) is the minimum. The impacts to reclaimed land are also limited. Construction cost is moderate.	resettlement (approx. 2,000), and the impact to the surrounding area (residential area) is relatively high. The project will cause negative impact to mangrove forest of the widest range. Construction cost is the lowest.	(approx. 400) is limited. The impacts to private companies are also limited. The impacts to tideland, reclaimed land and harbor facilities are relatively high. Because of the length of bridge on the sea, the project will cause negative impacts to marine environment. Construction cost is the highest.

- *1 Results of comparison between existing major cross roads in 2030 and the road networks under the premise that all priority projects recommended in the M/P Study have been realized
- *2 Based on experience of a past census survey carried out in the area, it is possible that two households live within one building (e.g. one household on the first floor and another household on the second floor) in the urban area. Household size in these urban areas was therefore estimated to be double the size of the areas where informal settlers are considered to reside.
- *3 An urban development is planned near the coastal road (east of the 2nd Bridge). This is included in the Comprehensive Land Use Plan of Mandaue City and it is expected to be implemented using private fund. According to Mandaue City, an ECC is currently been requested for the project. Mandaue City gives the highest priority to the subject new Cebu-Mactan Bridge and coastal road construction project and hence in case the project interferes with the urban development plan, Mandaue City is willing to make necessary coordinations and implement both projects.

Source: JICA Survey Team

3.5 Project Components

The project includes: i) construction and eventual operations of the 4th Cebu-Mactan Bridge (total road length: 3.2 km; four-lane); and ii) development of Mandaue Coastal Road (total road length: 4.9 km; four/six-lane), Interchanges and Intersections in Mandaue and Lapu-Lapu area.

Source: JICA Survey Team

Figure 3.5.1 Alignment of 4th Mactan Bridge and Mandaue Coastal Road

Table 3.5.1 Summary of Project Description of the Project (To be update)

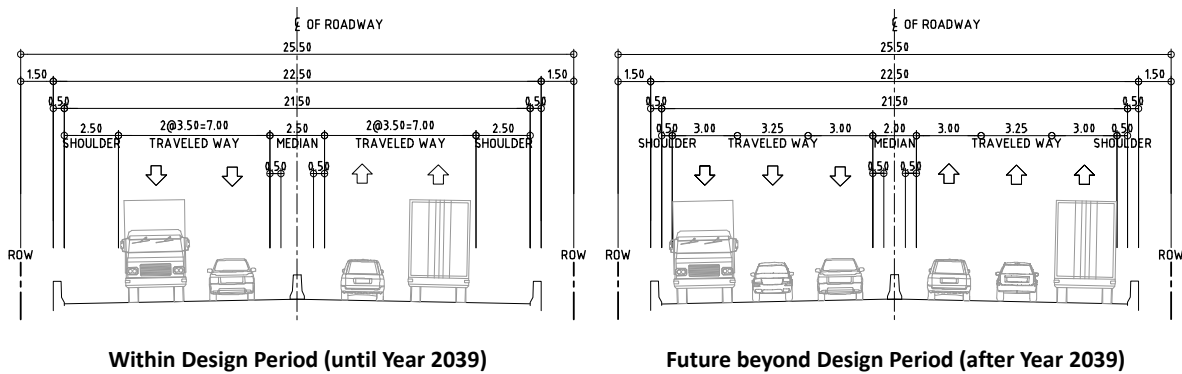
Total Length	8.2 km
4th Cebu-Mactan Bridge	3.3 km
Mandaue Coastal Road (approach viaduct and Mandaue Coastal Road Viaduct)	4.9 km
No. of lanes for Main Bridge	4
No. of lanes for Viaduct	4
Roadway width	22.5-29.5 m
Median Island	1.5 m
Interchanges	2
Viaduct length	8.2 km
Implementation Period	67 years
Detailed Engineering Design	15 months
Land Acquisition	Start 2019
Civil works construction	36-42 months
Target Start of operation	2026

Source: JICA Survey Team

3.5.1 Design of 4th Cebu-Mactan Bridge

(1) Typical Cross Sections

As mentioned earlier, the cross section width of the 4th Cebu-Mactan Bridge was determined in consideration of the possibility to expand the number of lanes from 4-lane to 6-lane in future (beyond the design period of the Project). Although the width of each cross section elements in future would become narrow, the widths are still within the minimum requirement of design standard.



Source: JICA Survey Team

Figure 3.5.2 Typical Cross Sections of 4th Cebu-Mactan Bridge

(2) Horizontal Alignment

Based on the selected alignment of the 4th Cebu-Mactan Bridge described in Chapter 2, the details of the alignment was adjusted in consideration of the control points summarized in Table 3.5.2.

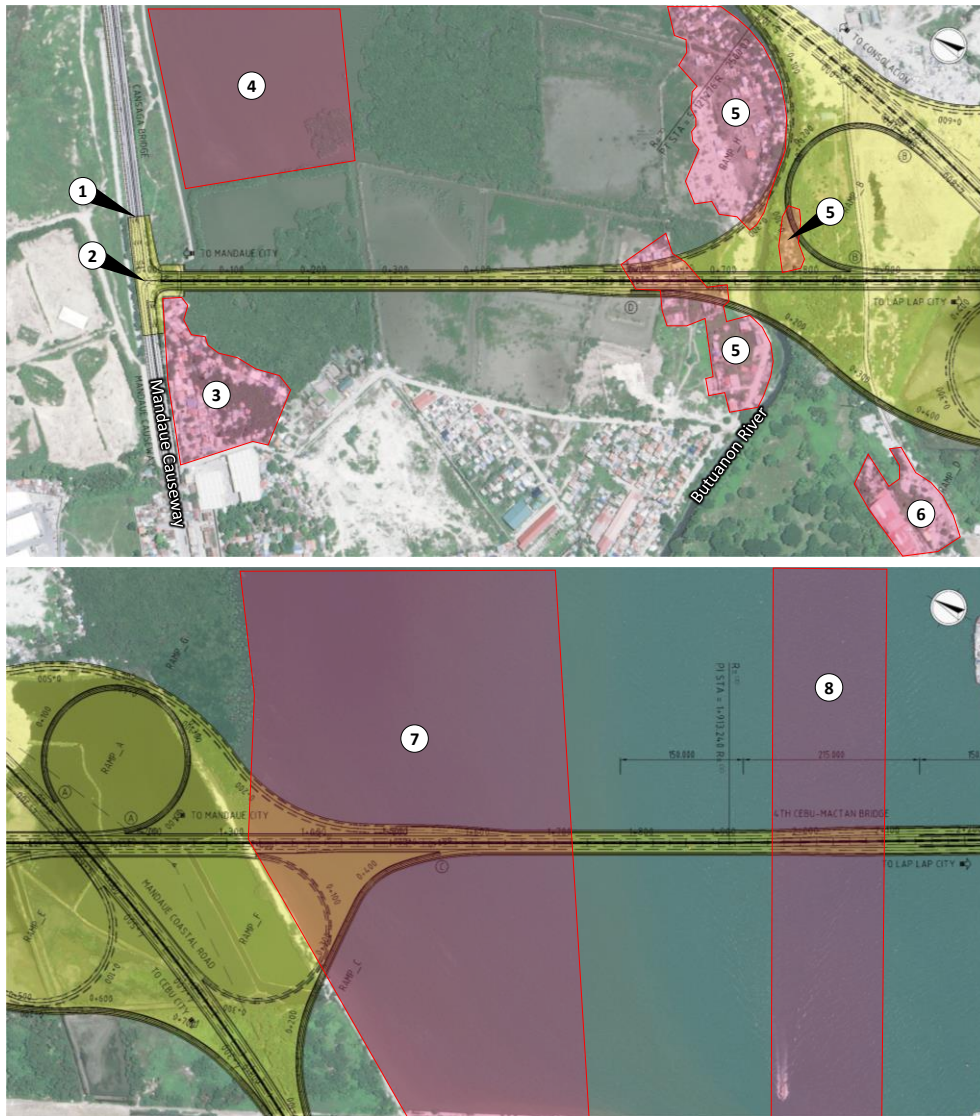
Table 3.5.2 Control Points for Horizontal Alignment of 4th Cebu-Mactan Bridge

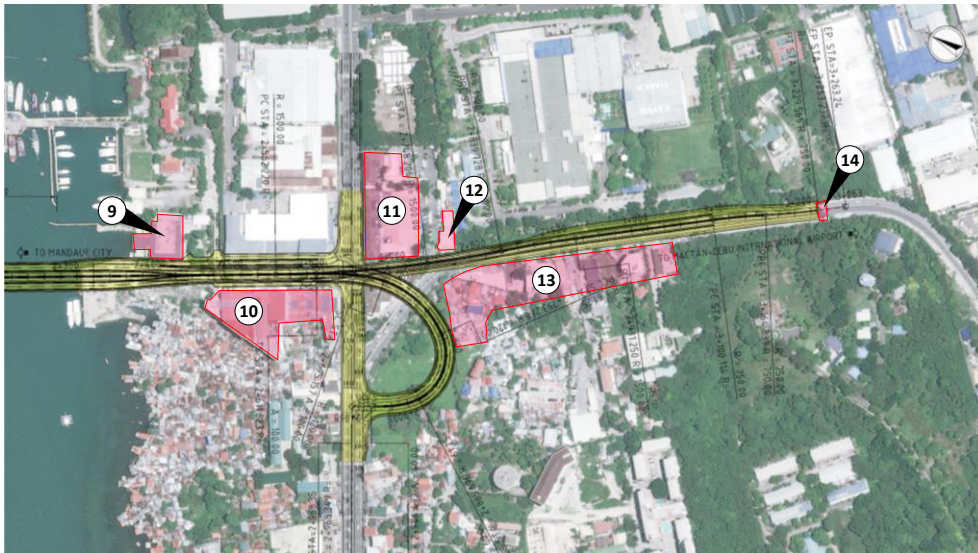
No.	Control Point	Description
1	Cansaga Bay Bridge	Widening of road for the intersection design should start from the existing abutment of the Cansaga Bay Bridge in order not to reconstruct the bridge.
2	Mandaue Causeway	At-grade intersection with its angle of 83°.
3	Residential houses	Avoid as much as possible.
4	Reclamation Project (Mandaue Global City)	Avoid
5	Informal settlers located near Butuanon River	Avoid as much as possible.
6	Small community at Umapad Dumping Site	Avoid

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7	Reclamation Project (Mandaue Global City)	Minimize the effect
8	Navigable waterway	143 m width and 22.86 m above mean water level
9	Cebu Yacht Club	Avoid
10	Shopping Mall (Island Central Mactan)	Avoid
11	Complexed building (Marina Mall)	Avoid
12	Complexed building	Avoid
13	Buildings and parking spaces	Avoid
14	Airport Security Gate	Avoid

Source: JICA Survey Team





Source: JICA Survey Team

Figure 3.5.3 Control Points for Horizontal Alignment of 4th Cebu-Mactan Bridge

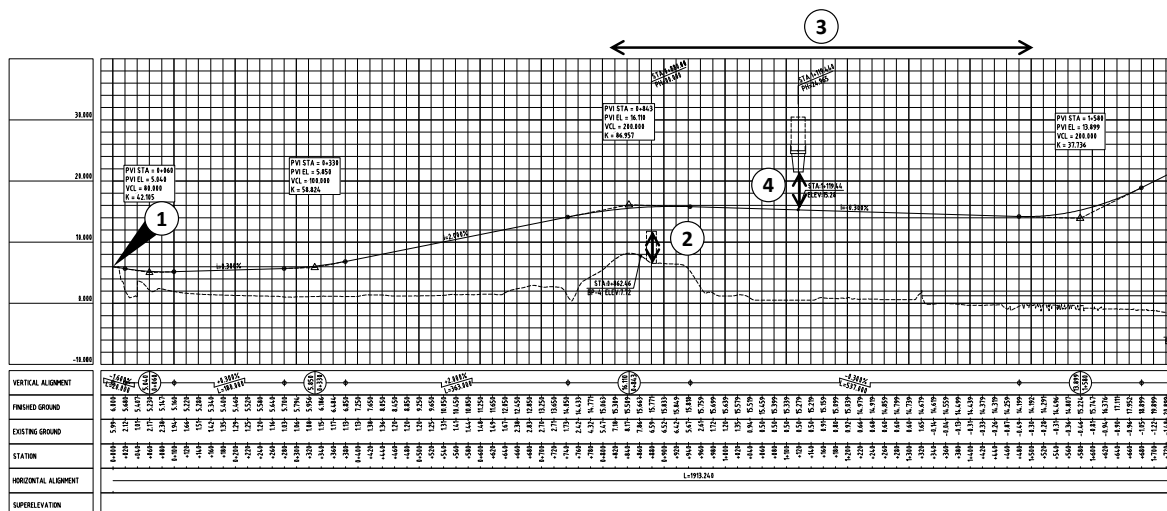
(3) Vertical Alignment.

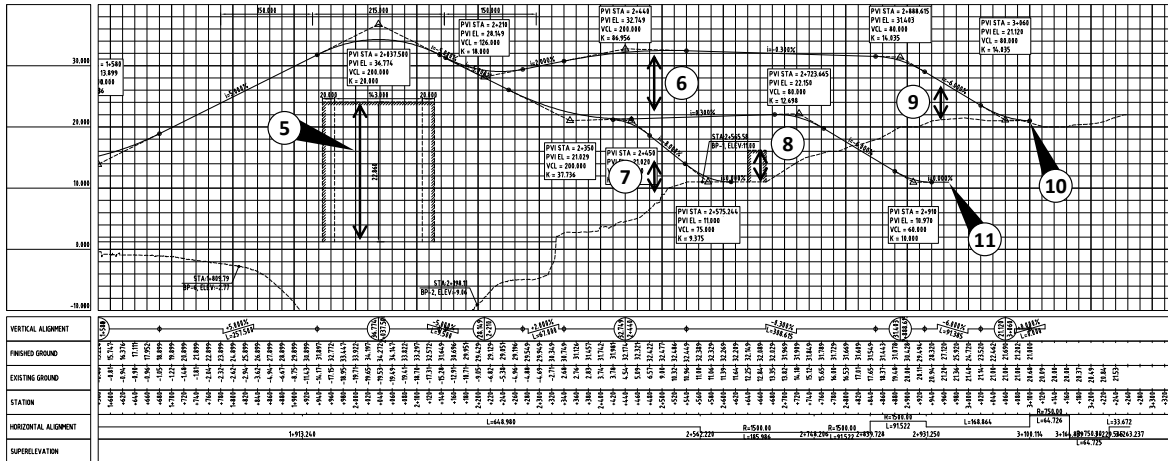
Table 3.5.3 summarizes the control points for vertical alignment of the 4th Cebu-Mactan Bridge.

Table 3.5.3 Control Points for Vertical Alignment of 4th Cebu-Mactan Bridge

No.	Control Point	Description
1	Mandaue Causeway	At-grade intersection
2	Umapad Road	Grade separation (vertical clearance: 5.2 m)
3	Mandaue Interchange	Gentle slope is preferable in interchange section
4	Mandaue Coastal Road	Grade separation
5	Mactan Channel (Navigable Waterway)	Navigational clearance: 22.86 m above mean water level for the width of 183 m (20 m margin + 143 m waterway + 20 m margin).
6	Double deck	9 m
7	Access road to Yacht Club	Grade separation (vertical clearance: 5.2 m)
8	Mactan Circumferential Road	Grade separation (vertical clearance: 5.2 m)
9	Airport Bldg. Access Road	Grade separation (vertical clearance: 5.2 m)
10	Airport Bldg. Access Road	At-grade connection
11	Mactan Circumferential Road	At-grade intersection

Source: JICA Survey Team





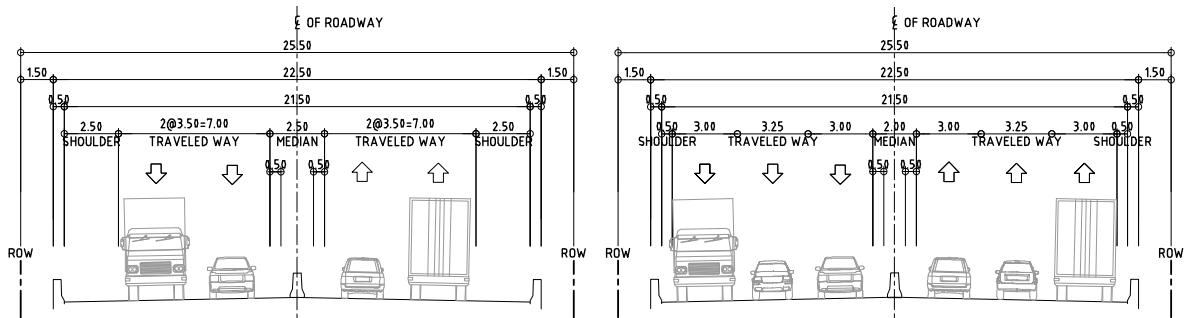
Source: JICA Survey Team

Figure 3.5.4 Control Points for Vertical Alignment of 4th Cebu-Mactan Bridge

3.5.2 Design of Mandaue Coastal Road

(1) Typical Cross Sections

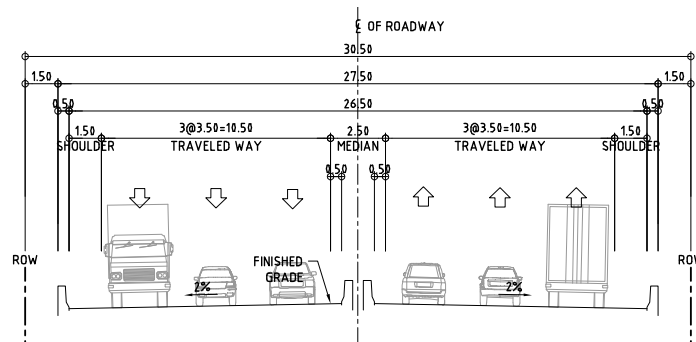
The cross section width of Mandaue Coastal Road was also considered the possibility to expand the number of lanes from 4-lane to 6-lane in future (beyond the design period of the Project). However, the expansion from 6-lane to 8-lane was not considered because of the width of the existing road to be connected with Mandaue Coastal Road does not have such wide space.



Within Design Period (until Year 2039)

Future beyond Design Period (after Year 2039)

Section from 1st Cebu-Mactan Bridge to 4th Cebu-Mactan Bridge



Section from Beginning Point to 1st Cebu-Mactan Bridge

Source: JICA Survey Team

Figure 3.5.5 Typical Cross Sections of 4th Cebu-Mactan Bridge

(2) Horizontal Alignment

Based on the selected alignment of Mandaue Coastal Road described in Chapter 2, the details of the alignment was adjusted in consideration of the control points summarized in Table 3.5.4.

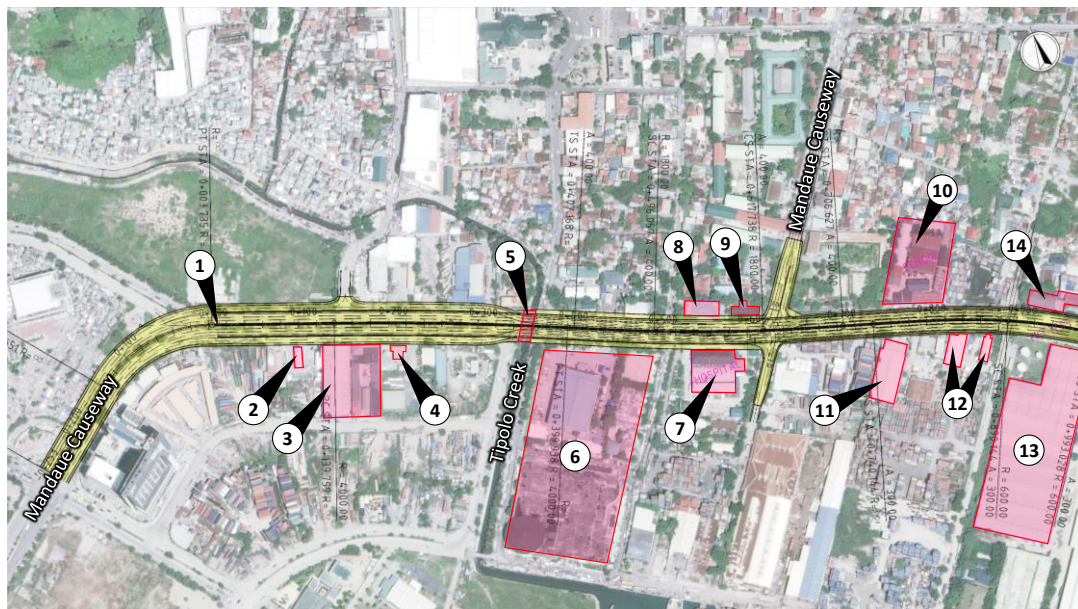
Table 3.5.4 Control Points for Horizontal Alignment of Mandaue Coastal Road

No.	Control Point	Description
1	Mandaue Causeway	The beginning point of Mandaue Coastal Road should start from the tangent section.
2	Petron Petrol Station	Avoid building
3	Factory	Avoid building
4	Mandaue City Hospital	Avoid building
5	Ouano Bridge	Utilize as it is
6	New Mandaue City Government Office (Plan)	Avoid building
7	Mandaue City Hospital	Avoid building
8	Tourism Infrastructure and Enterprise Zone Authority (TIEZA)	Avoid building
9	Office	Avoid building
10	Mandaue City Comprehensive National High School	Avoid

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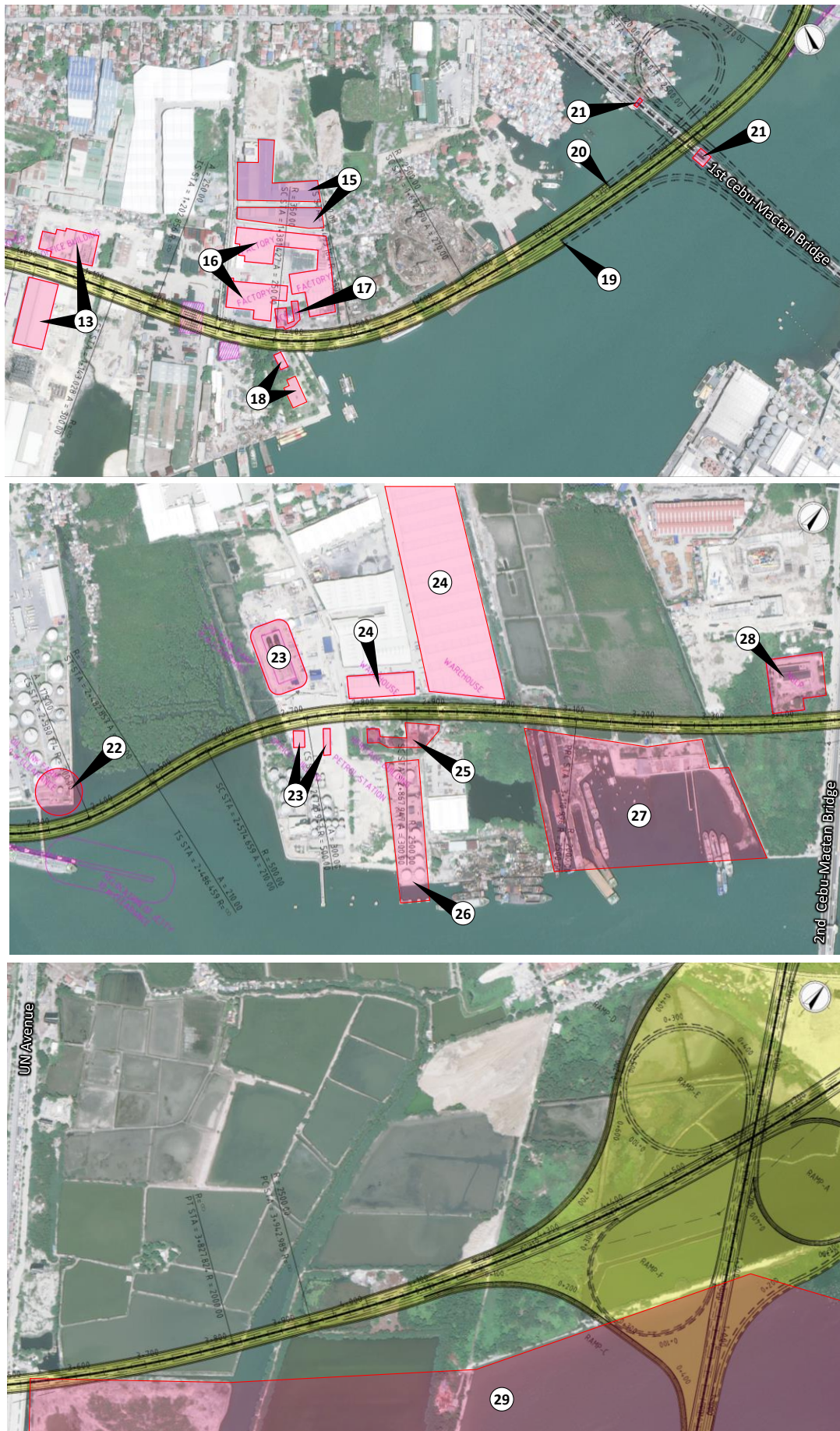
11	Factory	Avoid building
12	Mabuhay Vinyl Corporation	Avoid buildings
13	San Miguel Food	Avoid buildings
14	MCCTEST Center	Avoid building
15	Warehouse	Avoid buildings
16	DUPONT	Avoid building
17	Inchland Academy	Avoid building
18	E. C. Ouano	Avoid buildings
19	Diverging nose (to 1st Cebu-Mactan Bridge)	Secure space for future expansion
20	Merging nose (from 1st Cebu-Mactan Bridge)	Secure space for future expansion
21	Bridge piers of 1st Cebu-Mactan Bridge	Avoid
22	Petron Corporation Mandaue Terminal	Avoid oil tanks (30 m clearance)
23	Arctura Tank Terminal	Avoid buildings, LPG tank
24	Warehouse	Avoid buildings
25	Residential houses including a historical building	Avoid buildings
26	Tank farm	Avoid
27	V.M. Cabahug Shipyard	Avoid as much as possible
28	National Grid Corporation of the Philippines	Avoid
29	Reclamation Project (Mandaue Global City)	Avoid as much as possible

Source: JICA Survey Team



Source: JICA Survey Team

Figure 3.5.6 Control Points for Horizontal Alignment of Mandaue Coastal Road (1)



Source: JICA Survey Team

Figure 3.5.7 Control Points for Horizontal Alignment of Mandaue Coastal Road (2)

(3) Vertical Alignment

Table 3.5.5 summarizes the control points for vertical alignment of the Mandaue Coastal Road.

Table 3.5.5 Control Points for Vertical Alignment of Mandaue Coastal Road

No.	Control Point	Description
1	Mandaue Causeway	Beginning point (at-grade)
2	F.E. Zuellig Avenue	Grade separation with intersecting road (vertical clearance: 5.2 m)
3	Mandaue Causeway	Grade separation with intersecting road (vertical clearance: 5.2 m)
4	J.M. Ceniza	Grade separation with intersecting road (vertical clearance: 5.2 m)
5	C.M. Cabahug	Grade separation with intersecting road (vertical clearance: 5.2 m)
6	1st Cebu-Mactan Bridge	Grade separation with intersecting road (vertical clearance: 5.2 m)
7	Petron Corporation Mandaue Terminal	Provide 10 m clearance over the pipe line
8	V.M. Cabahug Shipyard	Provide 10 m clearance over the shipyard
9	2nd Cebu-Mactan Bridge	Grade separation with intersecting road (vertical clearance: 5.2 m)
10	4th Cebu-Mactan Bridge	Grade separation with intersecting road (vertical clearance: 5.2 m)
11	Mandaue Interchange	Gentle slope is preferable in interchange section

Source: JICA Survey Team

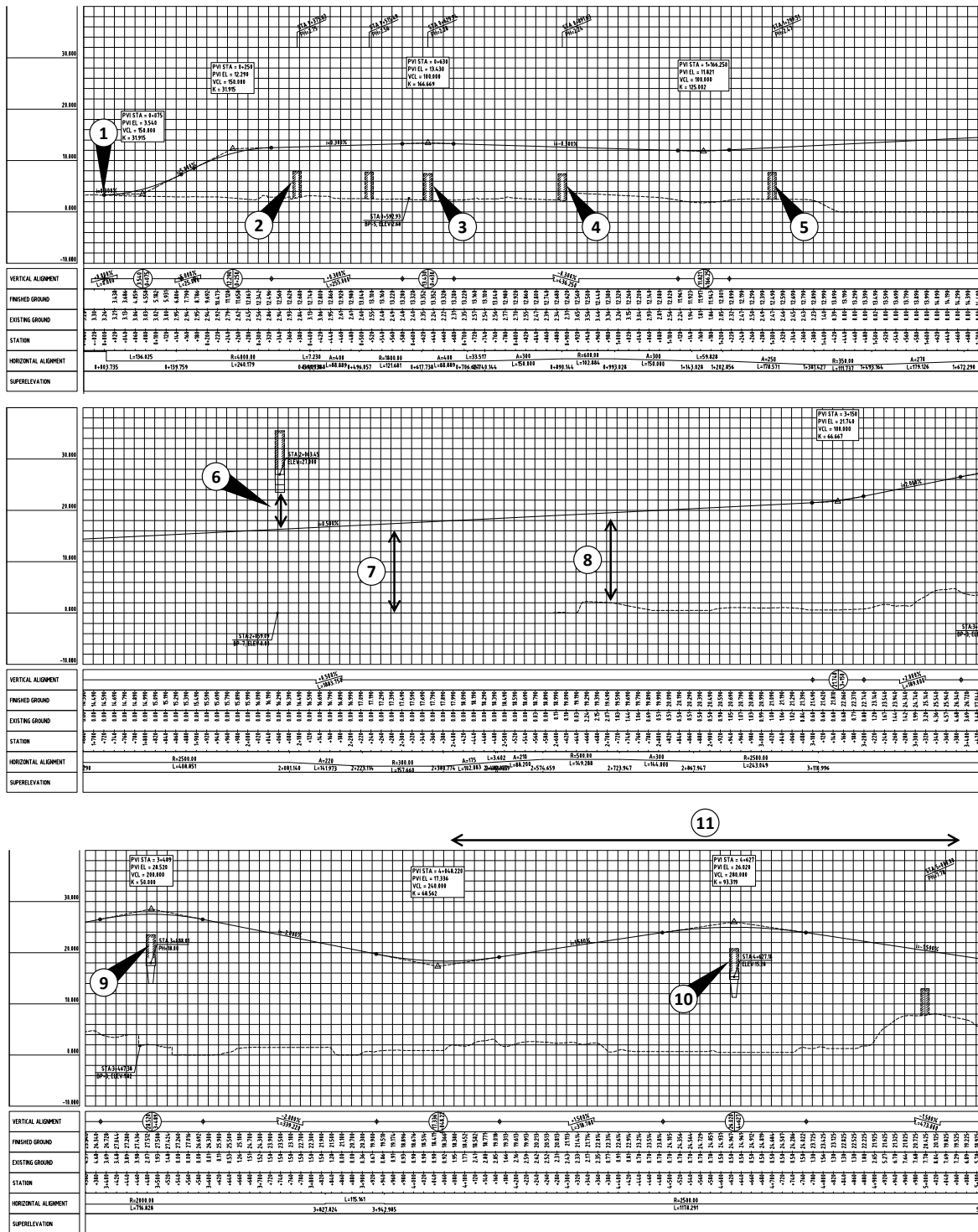


Figure 3.5.8 Control Points for Vertical Alignment of Mandaue Coastal Road

(4) Number of Through-Traffic Lanes

In reference to Highway Capacity Manual, the required number of through-traffic lanes was determined for each road segment. Figure 3.5.9 shows examples of the traffic flow condition at each level of service (LOS).



LOS A
Free-flow operations



LOS B
Reasonably free-flow operations



LOS C
Flow with speeds near the free-flow speed of highway



LOS D
The level at which speeds begin to decline with increasing flows, with density increasing more quickly.



LOS E
Operation at capacity



LOS F
Breakdown or unstable flow

Source: Highway Capacity Manual 2010 (Transportation Research Board)

Figure 3.5.9 Level of Service Examples

The maximum service flow rates for the design speeds of 60 km/h and 80 km/h were calculated using the approximation formula based on the maximum service flow rates at LOS D described in Highway Capacity Manual 2010 (see Table 3.5.6). The approximation formula for LOS D was determined as follows and the calculated maximum service flow rates for the design speeds of 60 km/h and 80 km/h are 1,550 pcu/hour/lane and 1,710 pcu/hour/lane respectively:

$$MSF_D = 12.407 \times FFS + 1001.6$$

Where

MSF_D : Maximum Service Flow Rates at LOS D (pcu/hour/lane)

FFS : Free-Flow Speed (km/h)

Table 3.5.6 Maximum Service Flow Rates (pcu/hour/lane)

FFS		Target LOS				
(mi/h)	(km/h)	A	B	C	D	E
60	96.6	660	1,080	1,550	1,980	2,200
55	88.5	600	990	1,430	1,850	2,100
50	80.5	550	900	1,300	1,710	2,000
45	72.4	290	810	1,170	1,550	1,900

Source: Highway Capacity Manual 2010 (Transportation Research Board)

Using the calculated maximum service flow rates, the required number of lanes for 4th Cebu-Mactan Bridge and Mandaue Coastal Road were determined as 2 lanes and 3 lanes per direction respectively.

Table 3.5.7 Required Number of Lanes per Direction

	Unit	4th Cebu-Mactan Bridge	Mandaue Coastal Road		Remarks
			Section 1	Section 2	
Traffic Volume per Direction	pcu/day	30,000	52,000	12,000	Half of design traffic volume
K-Factor		8%	8%	8%	Based on the traffic survey result in 2017
Hourly Traffic Volume (A)	pcu/hour	2,400	4,160	960	
Free-Flow Speed	km/h	60	80	80	Design speed
Basic Traffic Volume (B)	pcu/hour/lane	1,550	1,710	1,710	$MSFD = 12.407 \times FFS + 1001.6$
Required Number of Lanes	lanes	1.55	2.43	0.56	Calculated by A / B
		2	3	2	Rounded number, minimum 2 lanes

Source: JICA Survey Team

For determination of the required number of lanes for interchange ramps, traffic capacity of 1,200 pcu/hour/lane was considered in reference to the Japanese Standard (NEXCO, Design Manuals, Part 4: Geometric Design, 2010). Table 3.5.8 summarized the required number of lanes each interchange ramp.

Table 3.5.8 Required Number of Lanes for Interchange Ramps

Interchange	Ramp		Traffic Volume (PCU/hour)	Number of Lanes
1st Bridge Interchange	Coastal Road (Cebu)	→ 1st Bridge	2,813	2
	1st Bridge	→ Coastal Road (Cebu)	3,216	2
Mandaue Interchange	4th Bridge (Mandaue)	→ Coastal Road (Cebu)	19	1
	4th Bridge (Mandaue)	→ Coastal Road (Liloan)	29	1
	Coastal Road (Liloan)	→ 4th Bridge (Mandaue)	47	1
	Coastal Road (Liloan)	→ 4th Bridge (Lapu-Lapu)	1,182	2
	4th Bridge (Lapu-Lapu)	→ Coastal Road (Cebu)	514	1
	4th Bridge (Lapu-Lapu)	→ Coastal Road (Liloan)	1,172	2
	Coastal Road (Cebu)	→ 4th Bridge (Mandaue)	28	1
	Coastal Road (Cebu)	→ 4th Bridge (Lapu-Lapu)	471	1
Lapu-Lapu Interchange	4th Bridge (Mandaue)	→ Mactan Circumferential Road (East)	573	1
	4th Bridge (Mandaue)	→ Mactan Circumferential Road (West)	1,420	2
	4th Bridge (Mandaue)	→ Airport Access Road	437	1
	Mactan Circumferential Road (East)	→ 4th Bridge (Mandaue)	485	1
	Mactan Circumferential Road (West)	→ 4th Bridge (Mandaue)	1,315	2
	Airport Access Road	→ 4th Bridge (Mandaue)	518	1

Source: JICA Survey Team

3.5.3 Width of ROW referring to the Laws and Regulations Concerned

With regards to the ROW, it is stated under Executive Order 113 (1995) and Executive Order 621 (1980) that:

- National Roads shall have an Right-of-Way (ROW) width of at least 20 m in rural areas which may be reduced to 15 m in highly urbanized areas
- ROW shall be at least 60 m in unpatented public land
- ROW shall be at least 120 m through natural forested areas of aesthetic or scientific value

Table 3.5.9 and Table 3.5.10 below summarize the widths of the ROW for the 4th Cebu-Mactan Bridge and Mandaue Coastal Road, respectively.

Table 3.5.9 ROW Width of 4th Cebu-Mactan Bridge

Station	Length (m)	ROW Width (m)	Remarks
0+000 - 0+050	50	40.0	Embankment
0+050 - 0+400	350	25.5	4-lane viaduct
0+400 - 1+650	1,250	Varies (Interchange)	Mandaue Interchange
1+650 - 1+930	280	30.5	6-lane viaduct
1+930 - 2+125	195	30.5 – 35.5	2-lane + 2-lane + 2-lane viaduct
2+125 - 2+295	170	35.5	ditto
2+295 - 2+500	205	35.5 – 40.25	ditto + 1-lane viaduct
2+500 - 2+640	140	40.25	ditto + service road
2+640 - 2+730	90	Varies (Interchange)	Lapu-Lapu Interchange
2+730 - 2+960	230	20.0 – 30.0	2-lane viaduct + service road
2+960 - 3+100	140	30.0	ditto
3+100 - 3+230	130	22.0	4-lane road

Source: JICA Survey Team

Table 3.5.10 ROW Width of Mandaue Coastal Road

Station	Length (m)	ROW Width (m)	Remarks
0+000 - 0+300	300	47.0	6-lane viaduct + service road
0+300 - 0+360	60	37.5 – 47.0	ditto
0+360 - 0+620	260	37.5	ditto
0+620 - 1+660	1,040	30.5	6-lane viaduct
1+660 - 1+920	260	Varies (Interchange)	1st Cebu-Mactan Bridge Interchange
1+920 - 3+940	2,020	25.5	4-lane viaduct
3+940 - 4+890	950	Varies (Interchange)	Mandaue Interchange

Source: JICA Survey Team

3.6 Description of Project Phases

3.6.1 Pre-Construction Phase

These involved the following activities, namely:

- Detailed Engineering Design, including the review of the feasibility study result and implementation of supplemental studies
- Road-Right-of-Way acquisition
- Securing of permits and clearances from relevant national government agencies and the LGUs (City/Municipal and barangay governments of Mandaue City and Lapu-lapu City) as prerequisite for project construction and operation to commence. (See Table 1.4.5)
- Preparation of procurement for the construction
- Relocation of utilities (e.g. electric poles, water lines, communication lines, etc.) along right of ways
- Removal, relocation and replanting trees

- Others

3.6.2 Construction Phase

(1) Construction Plan

Based on the result of the Preliminary Design, the construction plan is prepared in consideration of seasonal characteristics whereas the Project site is located at sea and coastal area where is susceptible to typhoons.

(2) Special Construction Method for Election of Main Bridge (Japanese Technology)

Steel box girders will be assembled on the super barge near new bridge construction area. After assembling, girders will be conveyed to the bridge construction site. Set up for position and lift up of steel box girder is used special winch system for large-scale one-time casting of steel box girder bring from Japan. Size of super barge is assumed to be as follows:

- Length: 110 m
- Width: 32 m
- Loading Capacity: 14,500 ton

(3) Procurement of Material and Equipment

The major materials and equipment would be procured in the Philippines but steel members, steel pipe sheet piles, steel pipes etc., may need to be imported from Japan. Procurement for other material is procured in the Philippines or other country. s.

(4) Traffic Management and safety during Construction

Metro Cebu was established Mactan Cebu Bridge Management Board (MCBMB) and this board member is including 15 agency such as Cebu Government, Cebu City, Mandaue City, Lapu Lapu City, Municipality of Cordova, Police regional 7 office, DPWH Region VII office, Land Transportation office 7, Coast Guard, PNP Regional Maritime office 7, NEDA region 7, Naval Forces central, Department of Tourism 7, Philippine Information Agency 7 and Chairman is Cebu Provincial Governor.

Traffic Management during construction works of the project would need coordination with MCBMB for management of traffic control of the roads along the site during construction works. Each LGU has Traffic control section and this project needs support from them such as exemption of Track Ban.

The Contractor should arrange traffic enforcer at each entrance of construction site, camp yard and the intersections near the construction site.

(5) Safety and Health at Construction Site

Safety and health for construction worker at inside of construction site shall follow DO13 Guideline of Safety and Health for Labor at Construction Site issued by Department of Labor and Employment (DOLE). Contactor should appoint Chief of Safety and Health Control and this parson shall instruct workers before starting works every day. For every month this parson shall conduct safety patrol during construction and give feedback about improvement of work condition.

(6) Research of Potential Material Source

Potential material sources for the Project were given from DPWH Region VII Office and the location, accessibility, available quantity and quality of materials were reviewed. Quarry site, natural exposure site or Manufacturing supplier of material source is selected from the nearest location from project site. Material Source map is shown in Figure 3.6.1.

1) Fine and Crushed Aggregate Material Source

Material source sites for fine and crushed aggregate material were selected at six (6) river sites and one (1) supplier near project site. Each location, hauling distance and possible volume are shown in Table 3.6.1 Fine Aggregate and Crushed Aggregate Material Sources.

Quality of the above material sources would be good for construction materials and these materials can be utilized as crushed aggregate for base course, sub-base course of pavement and fine aggregate and crushed aggregate for concrete.

Table 3.6.1 Fine Aggregate and Crushed Aggregate Material Sources

Name of Quarry Site or Supplier	Location	Hauling Distance (km)	Estimated Quantity (m3)	Remarks
Yuson Construction and supply	6 km from Talamban Road Cebu City Sebu	15	20,000	Fine and Crushed Aggregates
Camanchiller River	Km 49+400 Carmen Toledo City Cebu	50	15,000	Fine and Crushed Aggregates
Combado River	Km.65+151 Cantu-od Balamban, Cebu	36	50,000	Fine and Crushed Aggregates Boulders, Cobbles
Bago River	Km. 87+377 Asturias, Cebu	90	50,000	Fine and Crushed Aggregates Boulders, Cobbles
Arpili River	Km.55+301 Balamban Cebu	70	10,000	Fine and Crushed Aggregates
Cambus OC Quarry	KO 83+060 Buenavista Bohol	65	90,000	Fine and Crushed Aggregates Boulders, Cobbles
Inabanga River	KO 87+252 Inabanga Bohol	70	191,500	Fine and Crushed Aggregates Boulders, Cobbles
Dulang Quarry	KO 105+700 TNR Tanghaligue Talibon Bohol	72	260,000	Fine and Crushed Aggregates Boulders, Cobbles
Sinandigan Quarry	KO 137+80 TER Sinandigan Ubay Bohol	75	260,000	Fine and Crushed Aggregates Boulders, Cobbles

Source: DPWH Region VII Office

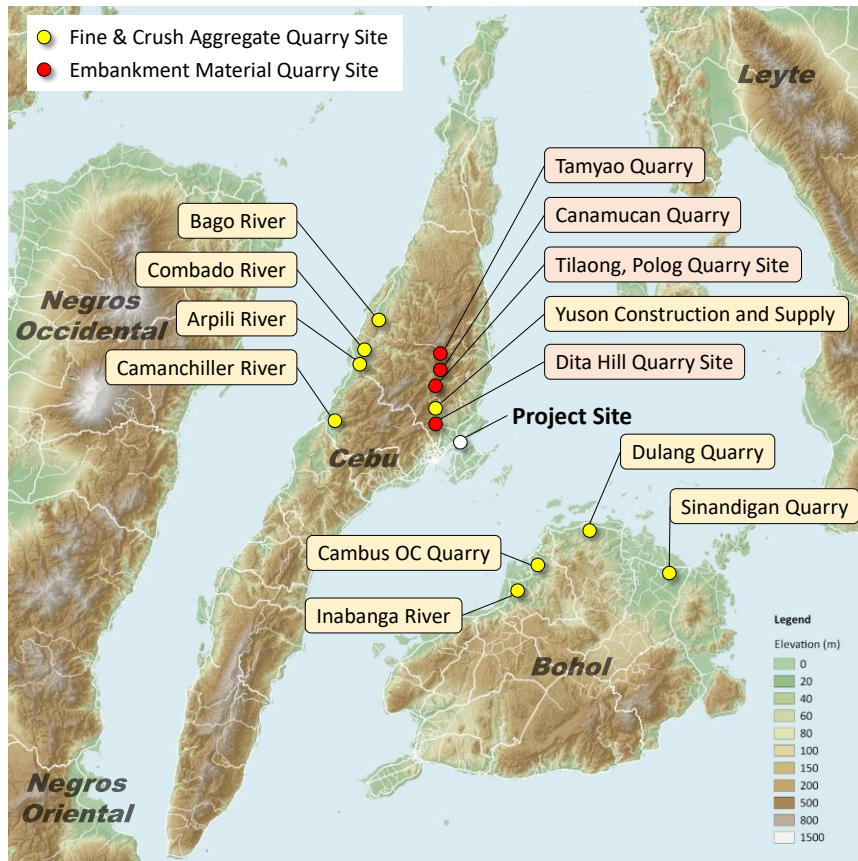
2) Embankment Material Source

There are four (4) possible borrow sources for embankment fill materials selected from the nearest project site. The Four (4) material sources site for embankment, its locations, hauling distance and possible volume are shown in Table 3.6.2

Table 3.6.2 Embankment Material Sources

Name of Material Sources	Location	Hauling Distance (km)	Estimated Quantity (m3)	Remarks
Dita Hill Quarry site	8.7 km from Talamban Road Cebu City	15	20,000	Embankment (Limestone)
Canamucan Quarry site	KM 25+990 Compostela	20	52,000	Embankment (Limestone)
Tilaong, Polog Quarry site	Tilaong, and Polog Consolacion,	15	60,000	Embankment (Limestone)
Tamyao Quarry	Tamyao, Cambayog, Compostela,	20	55,000	Embankment (Limestone)

Source: DPWH Region VII Office



Source: JICA Survey Team

Figure 3.6.1 Material Source Map

(7) Application of Advanced Japanese Technology

Depending on the necessity, Japanese advanced technology for bridge construction may need to be considered for applied STEP Loan.

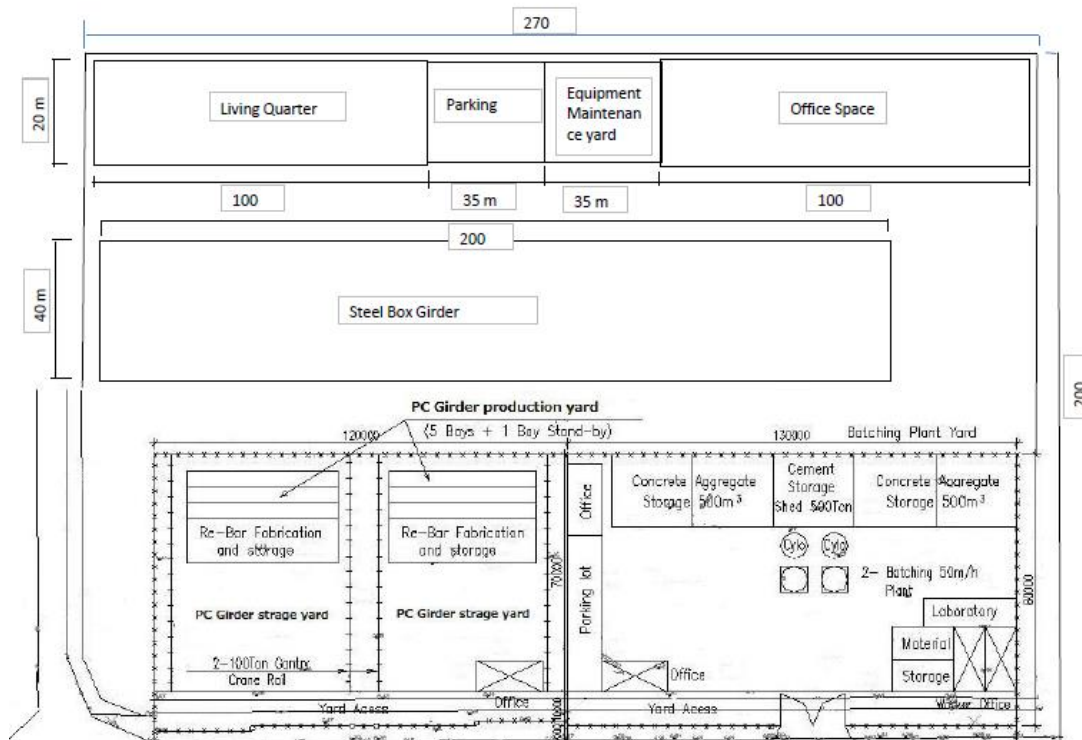
(8) Construction site and access Roads

The construction site of the Project is located at sea shore of Mactan Channel and construction area is almost at the sea. One of the accessible points to the construction site is from the sea using barge and temporary staging would be prepared from the land. Selecting access road is important. A temporarily available land or the existing road will be used as the main construction site. It is the place for stockpiling materials as steel, formworks and scaffoldings for construction of piers. If access from the sea would be necessary to pass under the existing Cansaga Bay Bridge, the center span of this bridge having 35 m width and 4 m depth of water level would be passable for large barge.

For access to the construction site at beginning point on land it is intended to use the existing roads near the proposed route and other roads in the area of local road. The transportation of vehicles would be affected by local traffic to some extent, so it is required to carry out proper traffic management in order to minimize adverse impacts to the public transportation.

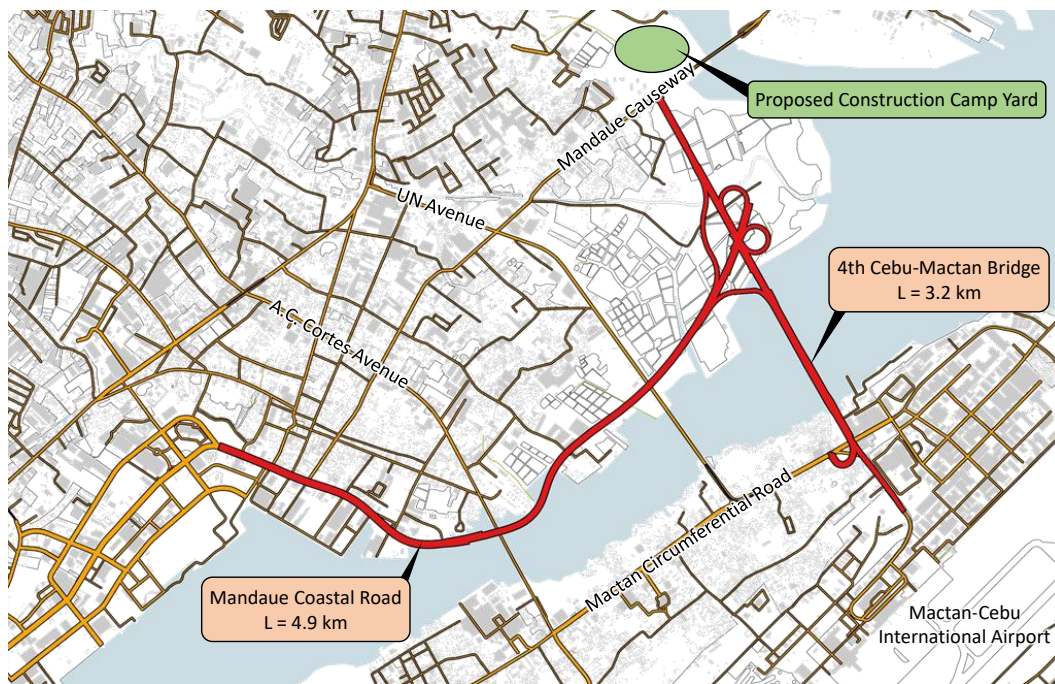
(9) Construction Camp yards

The major construction activities for the 4th Cebu-Mactan Bridge project are producing numbers of PC girders and Steel Box Girders for each package, these manufactured PC girders and assembled steel box girder will be transported from construction yard to the project construction site timely in accordance with the implementation schedule using mostly by barge. The candidate of the construction camp yard is proposed at the reclamation area beside the existing Cansaga Bay Bridge. Since the construction camp yard is temporary use but production activities are large volume to prepare concrete materials by the concrete batching plant and assembling of steel box girders. The contractor will select proper location for the construction site and its scale during tender procedure. Typical recommendable construction camp yard layout plan for this Project is shown in the Figure 3.6.2. The location of recommendable construction camp yard is shown in Figure 3.6.3.



Source: JICA Survey Team

Figure 3.6.2 Typical Recommendable Construction Camp Yard Layout Plan



Source: JICA Survey Team

Figure 3.6.3 Location of Recommendable Construction Camp Yard

(10) Construction Disposal Area

According to Republic Act (RA) 6969-Toxic and Hazardous Substances and Republic Act (RA) 9003-Ecological and Solid Waste Management Act, the project proponents shall require to submit detailed waste management program (WMP) for proper handling, collection and disposal of solid, hazardous and liquid waste to EMB Regional/ Central office and LGUs such as Department of Public service (DPS) prior to construction.

Construction debris or unsuitable material to be reused will be disposed within the interchange area, if the WMP will be accepted. The WMP will include the plan that this area will be redeveloped as a Wetland Park after the construction works (See 4.1.3.1 (3)).

Other option for excess waste materials, contractors will secure hauling permits and dispose excess earth materials to approved-suitable disposal sites (e.g. projects already issued with ECCs). The candidate sites are shown below and in Figure 3.6.4.

a. Binaliw Sanitary landfill (SLF) in Barangay Binaliw Cebu City

The open sanitary landfill site for now that has been accepting residuals from Cebu City and Mandaue since May 2019 is the Binaliw Sanitary landfill (SLF) in Barangay Binaliw Cebu City located approximately 10km from the project site, operated by a private company.

b. The SLF in Consolacion, Cebu operated by the Asian Energy System Corp.

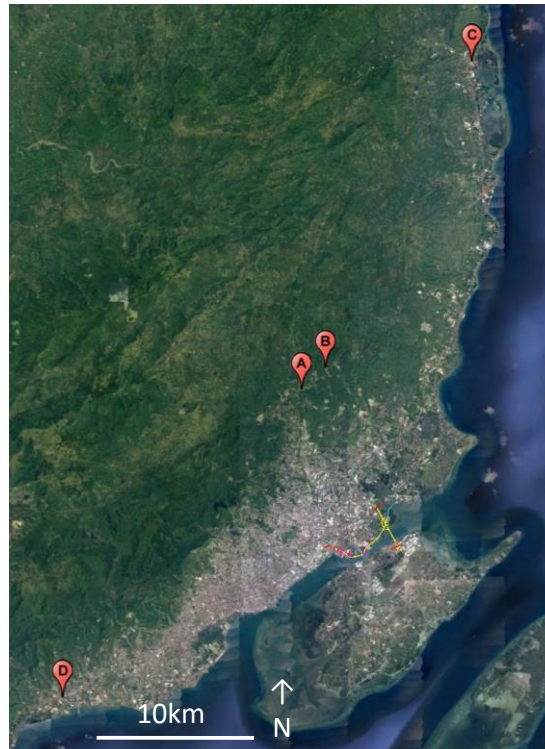
It is temporarily closed as it is undergoing rehabilitation to comply with the DENR-EMB Cease and Desist Order conditions issued in May 2019. It will be re-opened after the conditions are sufficiently met.

c. New Sanitary Landfill Facility

The Cebu Provincial Government has a Sanitary Landfill Facility project in the Municipality of Carmen to which an ECC is already issued, and will soon be constructed in the said locality. This will accept residuals from the LGUs within the province including Mandaue City.

d. New Sanitary Landfill Facility

A private company is currently constructing a SLF in the Municipality of Minglanilla. An ECC was already issued to this said SLF by the EMB.



Source: JICA Survey Team and Map is Google Map

Figure 3.6.4 Location of Candidate Disposal Sites

(11) Necessity Number of Equipment for Cebu Mactan 4th Bridge Construction Project

Number of necessity Construction Equipment is shown in below Table 3.6.3.

Table 3.6.3 Net working hours Rate for Cebu Mactan 4th Bridge Construction Project Equipment during Construction

Equipment	Capacity	Necessity Number of Equipment	Unit		Total Quantity
Equipment					
Dump Truck	11 ton	52	Total run Km./Unit	run km	3,127,832.85
Wheel Loder	1.53 m3	5	Total working hr/unit	hr	6,569.80
Motor Grader 14G	3m/200HP	1	Total working hr/unit	hr	274.19
Vibratory Roller	11 ton, 125 Hp	3	Total working hr/unit	hr	736.93
Tired Roller	12.6 ton	3	Total working hr/unit	hr	736.93
Crawler Tractor (w/ Bulldozer)	Caterpillar D7G PS		Total working hr/unit	hr	-
Hydraulic Excavator	1.0 m3	12	Total working hr/unit	hr	29,351.82
Backhoe	0.6 m3	6	Total working hr/unit	hr	14,115.86
Vibratory Plate Compactor	7 Hp	20	Total working hr/unit	hr	48,864.18
Track Crane	160 ton, 300Hp	2	Total working hr/unit	hr	630.00
Crawler Crane	60T/275Hp	11	Total working hr/unit	hr	109,895.00
Drill Rig for Pile	CWV Model TRM35/31	11	Total working hr/unit	hr	109,895.00
Concrete transit Mixer	5 m3	29	Total run Km./Unit	run km	514,736.60
Concrete Pump	60 yd3	7	Total working hr/unit	hr	17,157.89
Concrete Plant	40m3/hr	4	Total working hr/unit	hr	12,868.42
Track Mounted Crane	21-25t, 200Hp	5	Total run Km./Unit	run km	58,625.83
Concrete Vibrator	Gasoline type	57	Total working hr/unit	hr	411,789.28
Semi Trailer	20 ton	6	Total run Km./Unit	run km	1,260.00
Asphalt Paver	4.7 m, 112 Hp	3	Total working hr/unit	hr	783.97
Asphalt Distributor	5 ton	4	Total working hr/unit	hr	1,412.45
Asphalt Plant	60 t/hr	3	Total working hr/unit	hr	741.54
Lane Marker	8 ton Track	1	Total run Km./Unit	run km	8,106.00
Deck Barge Non Propelled	1000 t	5	Total working hr/unit	hr	720.00
Tugboat	30.96m	5	Total working hr/unit	hr	720.00
Super deck Barge	Shinyo 14,500t	4	Total working hr/unit	hr	2,160.00
Non Propelled Barge with Crane	650t with 60t Crane	5	Total working hr/unit	hr	720.00
Crane Hydraulic Tel Boom,	121-140 tons	8	Total working hr/unit	hr	-
High Bed Trailer	65 t	4	Total run Km./Unit	run km	-

Source: JICA Survey Team

(12) Possibility of Employment Number

Possibility of Employment number is shown in below Table 3.6.4.

Table 3.6.4 Number of Employment

	Contractor	Consultant	Total
Professional	40	58	98
Skilled Labor	9,226		9,226
Unskilled Labor	7,074		7,074
Technical and Support Staff	40	24	64
Total	16,380	82	16,462

Source: JICA Survey Team

(13) Demobilization

Demobilization is the final stage in the construction phase, which includes the following:

- Demolition of temporary facilities (e.g. scaffoldings, formworks, temporary power supply lines, etc.);
- Decommissioning/moving-out of construction equipment and machineries,
- Disposal of construction solid waste (e.g. debris, etc.),
- De-hiring, laying-off of local construction workers

The project proponents shall require to submit detailed waste management program (WMP) prior to construction. Proof of implementation shall be submitted together with Compliance Monitoring Report (CMR). The project proponents shall also require to detailed demobilization plan for the construction yards.

1) Demolition of temporary facilities, construction equipment and machineries

Through the activities on demolition of temporary facilities, construction equipment and machineries, further contamination of the waterways and dust re-suspension may occur due to abandoned wastes. In addition, possible spread of communicable diseases shall occur due to abandoned wastes.

The following actions will also be implemented by the contractors;

- All temporary sanitation facilities, especially the portable toilets are properly dismantled and no domestic wastes are abandoned; and
- Conduct a site inspection at the work sites to ensure that construction spoils/debris, solid, and domestic wastes are properly disposed to approved disposal sites and not abandoned in the construction areas

2) Disposal of construction solid waste

Pre-construction activities that will result in solid waste generation include the demolition of existing road structures. During construction phase, a total of around 18,500 m³ of construction debris will be for disposal. The excess soil from earthwork activities such as excavation, backfilling and embankment will be used for redevelopment of “Wetland Park “within the interchange area.

Table 3.6.5 Summary of Excavation work and Removal

Item	Unit	Quantity
Excavation	qu.m	352,249.09
Back fill	qu.m	277,088.16
Removal of Existing Concrete Pavement	qu.m	18,507.77

Source: JICA Survey Team

The following actions will also be implemented by the contractors;

- Reuse excavated excess soil to backfill depressed areas within or nearby the area
- Recycle construction debris through sorting and stockpiling
- Take appropriate measures, such as covering hauling trucks with tarpaulin or canvass, in

- transporting excess/excavated earth materials to disposal site
- Take proper and diligent management of solid waste, such as covering temporary stockpiles of excavated materials and hauling regularly to DENR-approved disposal sites

3) Demobilization of Social Service Utilities

Possible long-term interruption of basic social service utilities such as power and water supplies will occur. Contractors/Sub-Contractors must ensure that all affected service utilities are immediately and properly restored to their normal operation; and conduct a joint site inspection involving the ESHO of the Contractors, leaders of affected barangays, and representatives of concerned utility companies to ensure immediate restoration of affected service utilities.

3.6.3 Operation Phase

The operation phase basically includes the 4th Cebu-Mactan Bridge-Mandaue Coastal Road presence, infrastructure maintenance, vegetation maintenance, and traffic management.

(1) Infrastructure Maintenance

General highway maintenance activities retain roadways at a reasonable level of service, comfort, and safety. The rate of degradation of the pavement surface will be determined by the volume of traffic, proportion of heavy trucks, certain vehicle characteristics (*e.g.*, radial tires), and the structure and quality of pavement. The repair of the asphalt surface may involve excavation or removal of the existing pavement and subgrade, patching and leveling, grading and gravelling, surface treatment, and asphalt concrete overlays. Disruption to the public from these repairs would be temporary and infrequent in nature.

Periodic maintenance of roadway drainage systems may be required. This may involve the replacement or repair of culverts and re-establishment of the drainage ditches. Other highway maintenance activities include shoulder grading, localized pavement repair, and line repainting. Disruption to the public from these repairs will be temporary and infrequent in nature.

(2) Vegetation Management

Growth of vegetation within the 4th Cebu-Mactan Bridge-Mandaue Coastal Road may interfere with the lines of sight required for safe use of the highway. Clearing/mowing along the 4th Cebu-Mactan Bridge-Mandaue Coastal Road is part regular maintenance to maintain sight lines and may involve both manual and mechanized cutting.

Vegetation Management will also include maintenance of planted trees (along sidewalks), pocket parks, mangrove plantations and tree plantations outside of the project area (per ECC condition compliance).

(3) Accidents, Malfunctions, and Unplanned Events

All necessary precautions will be taken to prevent the occurrence of Accidents, Malfunctions, and Unplanned Events that may occur throughout all phases of the Project and to minimize any environmental effects should they occur. Accidental events with the greatest potential for environmental effects include:

- Hazardous material spills

- Failure of erosion and sediment control measures
- Fire
- Vehicular collisions
- Disturbance of archaeological or heritage resources

3.6.4 Decommissioning/Abandonment Phase

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road is being plan and intended for long-term operations. Should there be a plan to alter or demolished the structures and new developments will be introduced thereon, an abandonment plan shall be prepared and submitted to the EMB.

3.7 Project Cost

The total cost is estimated: 233,776 (million JPY)

3.8 Project Schedule

The project schedule is shown in Table 3.8.1 エラー! 参照元が見つかりません。 .

Table 3.8.1 Expected Implementation Schedule of the Project

	Start	End	Months	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Procurement of Consultant	2020/01/01	2020/12/31	12										
Consulting Services	2021/01/01	2029/09/30	105										
Detailed Design	2021/01/01	2022/03/31	15										
Procurement of Contractor	2022/01/01	2023/04/30	16										
Civil Works (Package 1)	2023/05/01	2026/10/31	42										
Civil Works (Package 2)	2025/01/01	2027/12/31	36										
Civil Works (Package 3)	2025/01/01	2028/06/30	42										
Civil Works (Package 4)	2025/01/01	2027/12/31	36										
Defects Notification Period (Package 1)	2026/11/01	2027/10/31	12										
Defects Notification Period (Package 2)	2028/01/01	2028/12/31	12										
Defects Notification Period (Package 3)	2028/07/01	2029/06/30	12										
Defects Notification Period (Package 4)	2028/01/01	2028/12/31	12										

Source: JICA Survey Team

4. BASELINE ENVIRONMENTAL CONDITIONS, IMPACT ASSESSMENT & MITIGATION

4.1 Land

4.1.1 Baseline Environmental Conditions

4.1.1.1 Land Use and Classification

(1) Land Use Pattern/Zoning

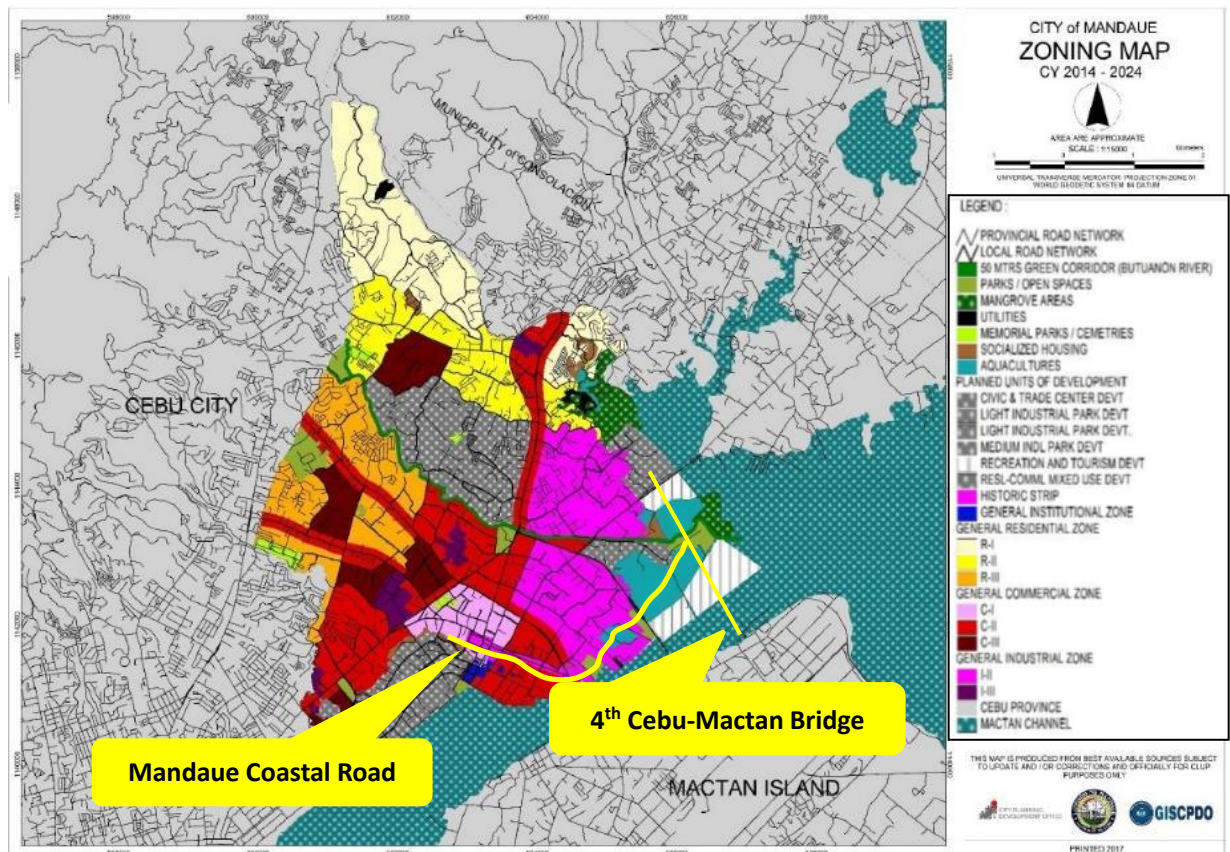
1) Zoning Classification

The existing/actual land use pattern of the areas and vicinities that the 4th Cebu-Mactan Bridge-Mandaue Coastal Road traverses is mixed of residential, commercial, and industrial. The dense settlements in Mandaue are mostly informal settlers along the coastal areas.

Mandaue City

According to the Comprehensive Land Use Plan (CLUP: 2014-2024) of Mandaue City, a large part of the project site falls under a commercial zone. In addition, aquacultures can be seen in the eastern side of the city with areas designated for recreation and tourism. There is an area for industrial park development in the more inland area and a relatively small area of parks/open spaces. A green corridor is also located within the project site.

The road planned to be constructed on Cebu Island (i.e. Mandaue Coastal Road) runs along its southern coast. The western side of the road is an industrial park with facilities such as factories and oil tanks. There is also a high school located approximately 1 km east of the starting point of the planned route. Figure 4.1.1 shows the zoning map of Mandaue City and Figure 4.1.2 shows the location of facilities located along the subject road.



Source: Mandaue City (2014)

Figure 4.1.1 Zoning Map of Mandaue City (2014-2024)



Source: JICA Survey Team

Figure 4.1.2 Major Facilities near the Project Site

The northeast side of the project site is largely an open space. Nevertheless, there is a waste collection site (i.e. open dumping site) and aquacultures in Umapad Barangay.

The western side of the coastal road passes through an industrial area, where industrial facilities such as petrochemical factories and oil tanks are located.

According to a sea guard, only one aquaculture farm/fish pond (i.e. Batiller Fish Pond) is operating within the coastal area. Some fish ponds are converted to warehouses, reclaimed for other development and some are sold to private entities. According the City Agriculture Office (CAO), the area is no longer suitable for aquaculture operation due to contaminations/seepage from the closed dumpsite and from other sources (e.g. industries).

An area that includes aquaculture ponds located near the 2nd Cebu-Mactan Bridge belongs to the key biodiversity area (KBA) around Mactan Channel as it is claimed to be an important roosting sites for shorebirds. A survey carried out by the Department of Environment and Natural Resources (DENR) in the Philippines have also recorded ecologically-important birds in the area.

The area designated as ‘recreation and tourism development’ and parks/open spaces are relative to the Mandaue Reclamation Project and Mandaue City Dumpsite Eco park as detailed in 4.1.1.1(4). At the bottom of the 2nd Cebu-Mactan Bridge lies a park where people have been residing illegally in the mangrove forest. These people are said to be making a living by picking wastes at the open dumping site above mentioned, making and selling brooms and carrying out fishing activities at a small scale. The park located at the bottom of the 2nd Cebu-Mactan Bridge, the open dumping site and houses situated in the mangrove forest are shown in Figure 4.1.3.

An illegal reclamation undertaking is ongoing in the mangrove and fish pond area located on the norther side of the Butuanon River. As shown in Figure 4.1.4, the reclaimed area has been expanding rapidly from the west to east cutting mangrove trees.



Park located at the Bottom of the 2nd Cebu-Mactan Bridge in Umapad



Opened Dumping Site



Illegal Houses within the Mangrove Forest

Source: DENR 2018; Sun Star Publishing Inc.
(available at: <https://www.sunstar.com.ph/article/116106/>)

Figure 4.1.3 Park located at the Bottom of the 2nd Cebu-Mactan Bridge in Umapad, Open Dumping Site and Illegal Houses in Mangrove Forest



Satellite image as of April 12, 2019, extracted from Google Earth



Satellite image as of April 23, 2019, extracted from Google Earth



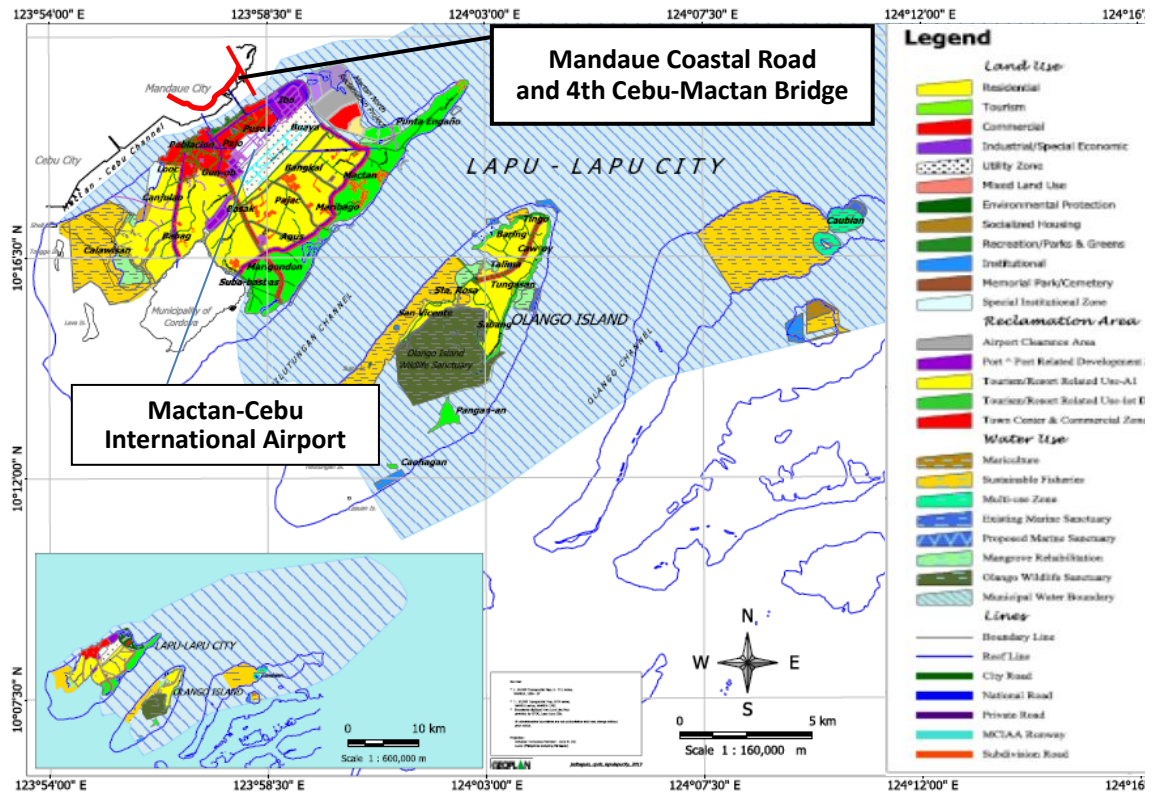
Satellite image as of May 4, 2019, extracted from Google Earth

Source: JICA Survey Team

Figure 4.1.4 Illegal Reclamation in Barangay Paknaan, Mandaue City

Lapu-Lapu City

According to the City Planning and Development Office (2011) of Lapu-Lapu City, a bulk of the project area that falls within Lapu-Lapu City is considered under the land use plan as ‘commercial area’ and ‘tourism area’. Other land includes ‘industrial/special economic’ and ‘environmental protection’. Mactan-Cebu International Airport is located within Lapu-Lapu City. The zoning map of Lapu-Lapu City is shown in Figure 4.1.5.

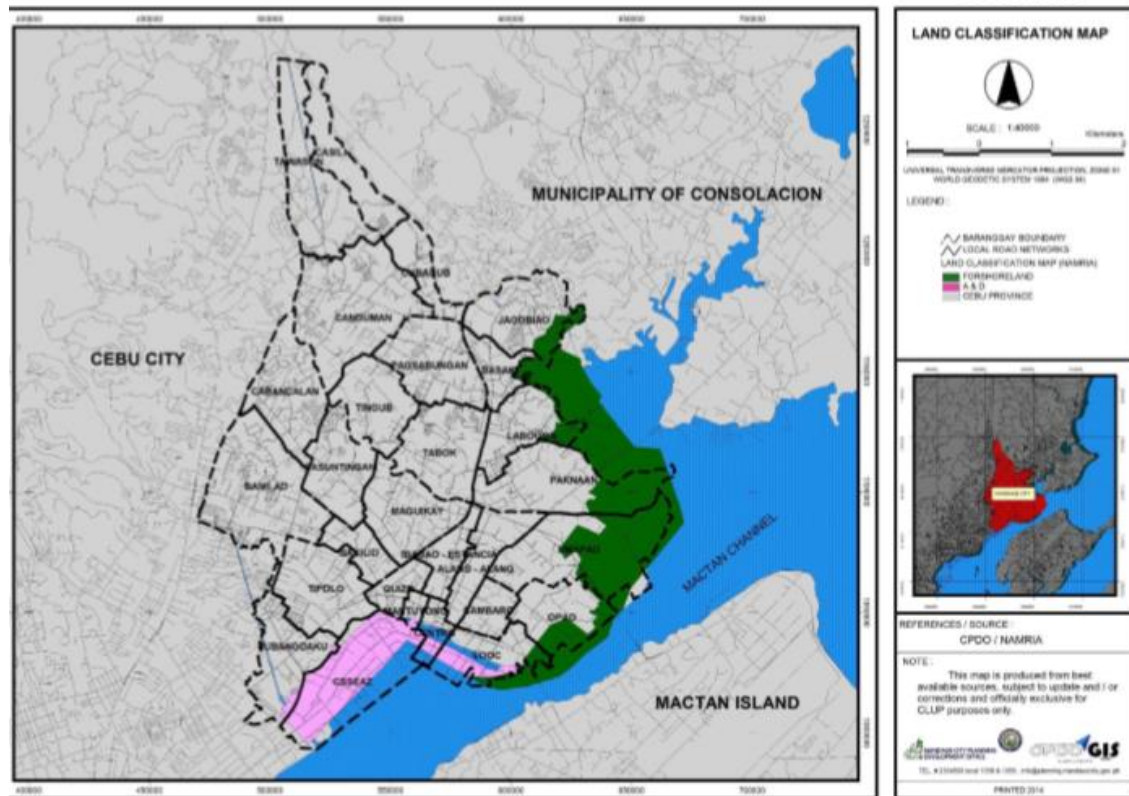


Source: Lapu-Lapu City

Figure 4.1.5 Zoning Map of Lapu-Lapu City

2) Land Use Classification

The Mandaue City government in its land classification map in the CLUP has identified areas traversed by the ROW alignment of the 4th Mactan Bridge/Mandaue Coastal Road as Alienable and Disposable (A&D) for portions of NRA, Centro and Looc, and the remaining areas as Foreshoreland (Figure 4.1.6).



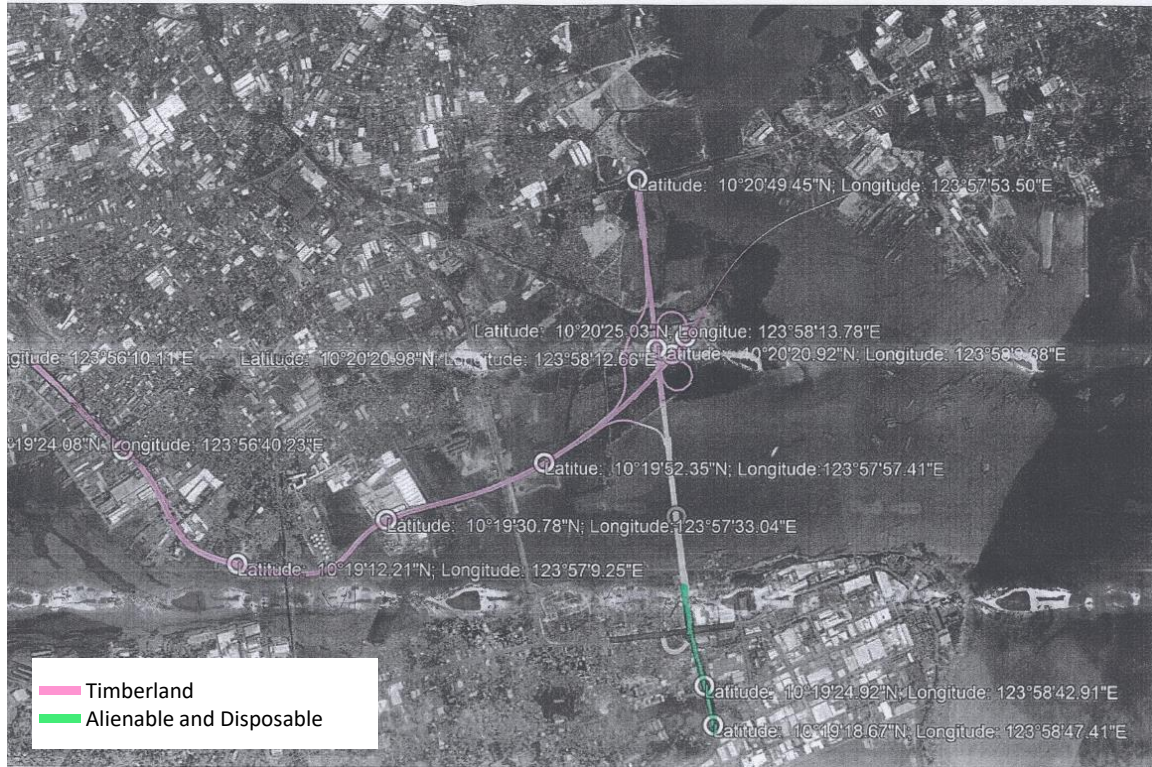
Source: Mandaue City

Figure 4.1.6 Land Classification Map of Mandaue City

The DENR-CENRO Land Use Certification, obtained for the Project on July 15, 2019, indicated that the entire alignment in Mandaue City is within “Timberland”, while the portion in Lapu-lapu City as Alienable and Disposable (Figure 4.1.7).

For foreshore lands, the Mandaue City government requires project proponents to enter into a “Foreshore Lease Agreement” with reference to its City Charter/RA 5519, while for “Timberland Areas” the DENR-CENRO requires a Special Land Use Permit/Forest Land Agreement (SLUP/FLAG).

DPWH, as a government entity and the project proponent, will apply/secure the necessary and appropriate tenurial instrument at the later stages of project implementation, or post ECC, when the parcellary survey is completed.



Source: Mandaue City, JICA Survey Team

Figure 4.1.7 Lands Verification Projection Map (CENRO Certification dated July 15, 2019)

(2) Protected Areas

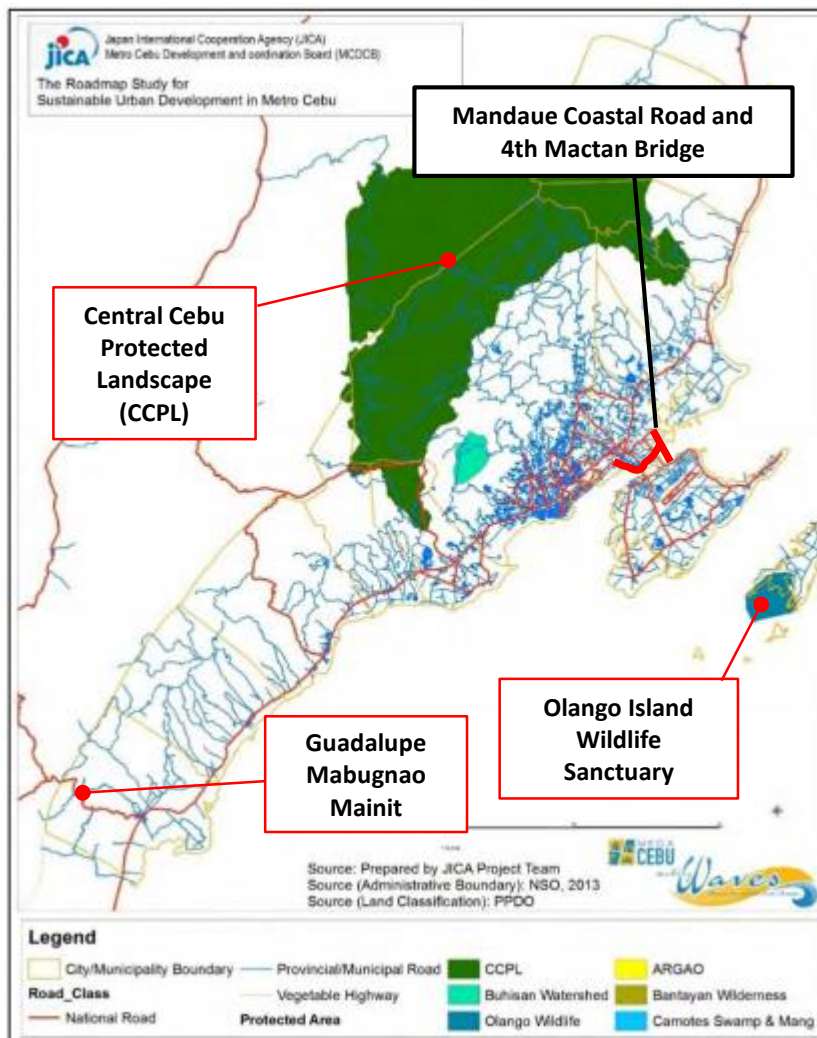
Among the protected areas designated under the Republic Act No. 7586 (National Integrated Protected Areas System/NIPAS Act of 1992), Olango Island Wildlife Sanctuary located in Olango Island Wildlife Sanctuary, Central Cebu Protected Landscape (CCPL) located in the center of Cebu City, and Guadalupe Mabugnao Mainit situated in Carcar City of Cebu Island are the closest from but not within the project site. Since these protected areas are located distant from the project site (i.e. approximately 10km, 20km and 40km, respectively), any adverse impact of the project is expected. Description of the protected areas and their locations are shown in Table 4.1.1.

Table 4.1.1 Protected Areas located near but not within the Project Site

Name of Protected Areas	Olango Island Wildlife Sanctuary	Central Cebu Protected Landscape (CCPL)	Guadalupe Mabugnao Mainit
Reason/Purpose of Designation	important habitat for water birds including endangered Chinese Egret (Egretta eulophotes)	watershed and its complementary biological diversities as well as the aesthetic, historical, cultural and economic significance to the continued existence, survival, sustenance, growth and development of present and future inhabitants of the Island of Cebu	existence of important watershed forest reserve in the central Mantalongon
Land Size	920 ha	29,062 ha	57.5 ha
Major Protected Species	Chinese Egret (Egretta eulophotes) and Asian Dowitcher (Limnodromus semipalmatus)	NA	NA
Management Organization	DENR	DENR	DENR

Name of Protected Areas	Olango Island Wildlife Sanctuary	Central Cebu Protected Landscape (CCPL)	Guadalupe Mabugnao Mainit
Time of Designation	1992	2007	1986
Distance from Project Site (as crow flies)	approx. 10km	approx. 20km	approx. 40km
Remarks	Registered tidal flat under the Ramsar Convention (Nov 1994)		

Source: JICA Survey Team



Source: The Roadmap Study for Sustainable Urban Development in Metro Cebu Final Report

Figure 4.1.8 Protected Areas located near the Project Site

(3) Wildlife Sanctuary -Tidal flat in Cansaga Bay

Tidal flat is located at the outer edge of the mangrove forest that grows along Cansaga Bay with its area being approximately 50 hectare (see Figure 4.1.9). These tidal flats have been found to be providing a habitat for herons, snipes and terns and to be offering to more than 300 birds a feeding ground as explained above. Hence, the possibility cannot be denied that endangered species also use these areas and these tidal flats should be considered important for birds. However, the state of tidal flats' environment has been found to be degrading due to development and the associated garbage and driftwood.



Source: JICA Survey Team

Figure 4.1.9 Tidal Flat in Cansaga Bay

(4) Development Projects near the proposed Project area

Mandaue Reclamation Project

Global City Mandaue Corporation and City Government of Mandaue (Joint Venture) will plan to conduct Mandaue Reclamation Project. The alignment of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road will pass through the site of Mandaue Reclamation Project. Therefore, the project proponent shall coordinate with Mandaue City closely. The outline of the Mandaue Reclamation Project is shown in Table 4.1.2.

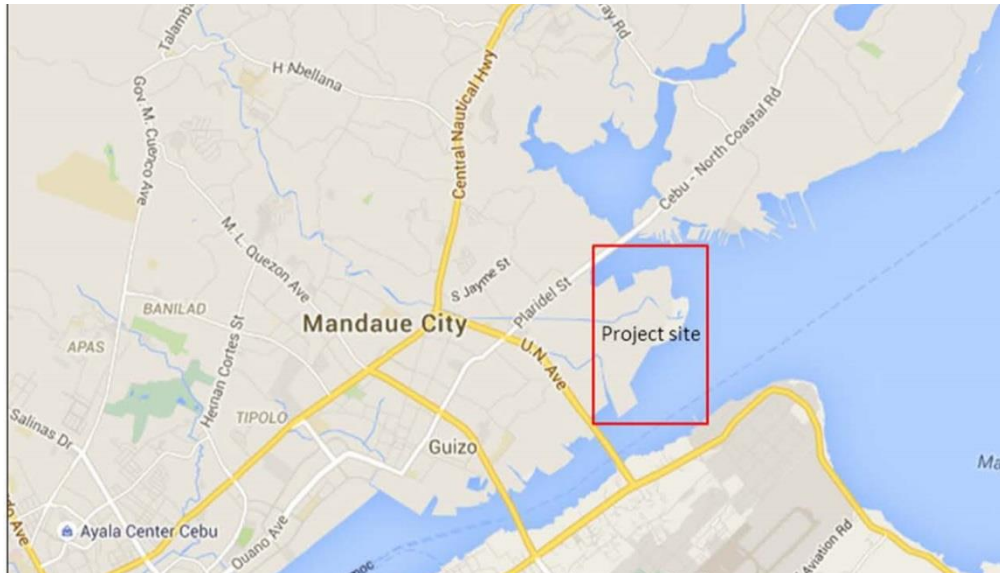
Table 4.1.2 Project Fact Sheet of Mandaue Reclamation Project

Name of Project:	Mandaue Reclamation Project
Location of Project:	Barangays Paknaan and Umapad in Mandaue City
Project Type:	Reclamation and other land restoration projects (3.3 Category A EMB MC 005 July 2014)
Proponent:	GlobalCity Mandaue Corporation and City Government of Mandaue (Joint Venture)
Year Established:	Proposed
Project rationale:	The City Government of Mandaue has signed a memorandum of agreement (MOA) with the Philippine Reclamation Authority last December 2, 2008 (“2008 PRA MOA”). In this MOA, the city identified a part of its territory for reclamation purposes as part of its

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	patrimonial interest as a local government unit.
Project Duration:	Six (6) years
Project Area:	Approximately 131 hectares (1,310,261.88 m ²)
Total project cost:	Nine Hundred Fifty Million Pesos (PhP 950,000,000.00)
Total manpower:	Max of 70 workers (reclamation phase) 10 (maintenance phase)

Source: GlobalCity Mandaue Corporation and City Government of Mandaue, Executive Summary for the Public of Mandaue Reclamation Project



Source: GlobalCity Mandaue Corporation and City Government of Mandaue, Executive Summary for the Public of Mandaue Reclamation Project

Figure 4.1.10 The location of Mandaue Reclamation Project

Mandaue City Dumpsite Ecopark

The alignment of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road will pass the open dumping site in barangay Umapad in Mandaue City. This dumping site was permanently closed in December 2017 and has been undergoing rehabilitation, in accordance with the Executive Order No. 37 “An Order Declaring the Permanent Closure of Umapad Controlled Dumpsite and Institutionalizing the Synchronized Waste Collection and Disposal System (SWCDS)”. To execute properly the closure and rehabilitation, the Mandaue Dumpsite Closure Plan was elaborated (Hydronet, 2018). This plan notes that the Umapad dumpsite, having an approximate 5 hectares area, has a great potential for several redevelopments and land uses after closure. It recommended to be developed as the “Mandaue City Dumpsite Ecopark”, with the three components: Transitional facilities, Public Ecopark and Open Space Facilities, and Educational Facilities. Therefore, the project proponents shall coordinate with the Mandaue City closely.



Source: Mandaue Dumpsite Closure Plan (Hydronet, 2018)

Figure 4.1.11 Conceptual Plan of Umapad Landfill Post-Closure Land Use

4.1.1.2 Topography, Geology, Geohazard

(1) Topography

Metro Cebu is located at the center of Cebu Island. High land and mountains rise behind the more urbanized area that is largely limited to the coastal areas. The altitude in Cebu Island is approximately 0 m above sea level in the coastal areas in the east while it reaches over 500 m above sea level in the highlands in the west. Metro Cebu is largely composed of sedimentary rocks as is in other areas in Cebu Island.

“The general topography of 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment and surrounding areas are generally flat to nearly level being in the lowlands coastal regions.

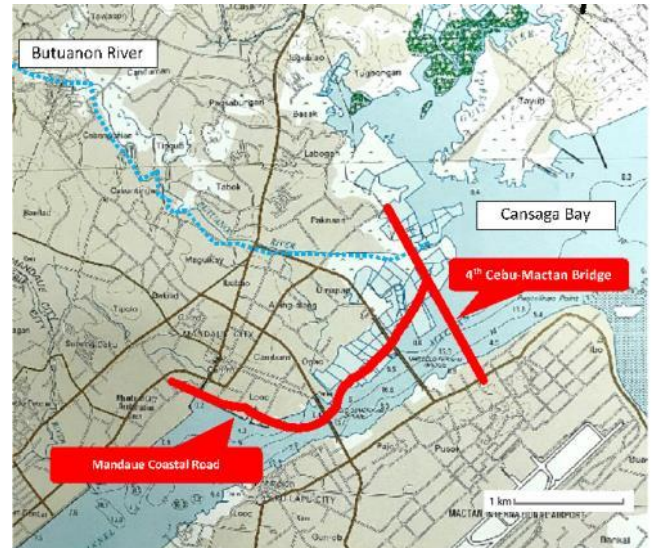


Figure 4.1.12 Topographic Map of Project Site

Source: NAMRIA

(2) Geology

1) Geological Characteristics

Based on the Mines and Geosciences Bureau (MGB), the regional geology of Cebu is described as follows:

- The oldest rock unit in Central Cebu is the Tunlob Schist which is probably of Jurassic age. This consists of chloritic orthoschists and micaceous paraschists belonging to the albite-epidote-amphibolite facies of moderate grade metamorphism.
- The Mananga Group of Cretaceous to Paleocene age, overlies the Tunlob Schist. This consists of limestone, clastic sedimentary rocks, andesitic to basaltic pyroclastics and lava, calcareous mudstone, conglomerate and sandstone. The group includes the Pandan Formation (Corby et al.), Cansi Volcanics and Tuburan Limestone (Santos Yñigo, 1951).
- Unconformably overlying the Mananga Group are the late Eocene to early Miocene sedimentary formations consisting of the Lutak Hill Formation, Cebu Formation and Malubog Formation. The Lutak Hill formation is mainly limestone with basal sandstone containing *Lepidocyclina* and *Nummulites*. An upper Orbitoidal limestone, a lower clastic unit with coal measures and a basal conglomerate (Guindaruhan) comprise the Cebu Formation. The Malubog Formation is composed of mudstone, shale and occasional beds of conglomerate, limestone and coal.
- Middle Miocene rock formations unconformably overlie the older rocks. First in the sequence is the Luka Formation consisting of interbedded sandstone and mudstone with conglomerate and limestone lenses. The Uling Limestone comes next and is a generally hard, massive limestone but partly porous and coralline. A pinkish to reddish colored facies occurs at places. At the top of the sequence is the Toledo Formation consisting of thin to thick bedded sandstone and shale with occasional lenses of conglomeratic limestone and calcarenite.
- The Late Miocene Maingit Formation unconformably overlies the older rocks. The formation is composed of granule to cobble conglomerate with interbedded shale, sandstone, limestone and conglomeratic limestone in the lower part.
- Unconformably overlying the older formations is the Barili Formation of Late Miocene to Early Pliocene age. This consists of a Lower Limestone member which is generally light brown in color, hard, coralline and porous and an Upper Marl member which is poorly bedded and slightly sandy.
- The Plio-Pleistocene Carcar Formation occupies the flanks of the island. It is a dominantly coralline limestone, poorly bedded to massive and partly dolomitic.

- The Quaternary Alluvium occupies the low lying areas and the river banks. This consists of detrital materials made-up of silt, sand and gravel.
- The Lutopan Diorite intrudes the Mananga Group at places which have been postulated to have brought the mineralization of economic quantity and quality in the Central Cebu area.
- The Bulacao Andesite of Late Miocene age also occur at places. This consists of porphyritic andesite and partly intrusive breccia.
- Serpentinized ultramafic and mafic rocks occurs as diapiric intrusions along the major faults.

The proposed 4th Cebu-Mactan Bridge Project in the island of Cebu geologically falls within the Central Physiographic Province of the Philippines, which is composed of cordilleras, lowlands, troughs and offshore basins. The island lies towards the central portion of the Visayan Basin and moderately interrupted by the uplift of the Cebu geanticline in Late Miocene to Pliocene. The basement is mainly Cretaceous to lower Tertiary metavolcanics and metasediments. These are intruded by diorite stocks and batholiths (BMG, 1982).

2) Tectonic Setting

The complex geological development of Cebu Island is produced by periodic magmatism and forearc basin deposition. Arc magmatism is believed active until Pliocene time. The development of the Visayan Sea Basin during Eocene-Pleistocene time provided a suitable environment and ample space for periodic deposition of the clastics and non-clastic units/formations. The latest episodic event of submarine deposition before the final stage of uplift is the building up of algal-reefal limestone of the Carcar Formation, which is presently fringing the entire Cebu Island.

3) Geologic Structures

The prominent structural features in Cebu Island are the major northeast-southwest trending structural grain lineation, which are distinctly defined by nearly vertical fault system.

Santos Ynigo (1958) has further subdivided Cebu Island into three structurally distinct units namely: the Northern Highland Area, Central Highland Area and the Southern Highland Area. The principal fault systems bounding these areas are believed to have vertical movements early during the Cretaceous to Tertiary period but later exhibited left lateral strike slip movements. Block faulting specifically in Central Cebu Highlands has also been reported and plays a very important role in the emplacement of acid plutonic intrusives with associated metallization in portions.

4) Geomorphology

Cebu Island has a NNE-SSW trending mountainous axis, about 160 km long and is flanked by intermediate highlands heavily dissected by deep narrow valleys with steep slopes. Narrow coastal plains skirt the hilly terrain and are principally coral reefs mantled by alluvial sediments.

Four (4) geomorphologic features are found in the regional vicinities of study area, namely:

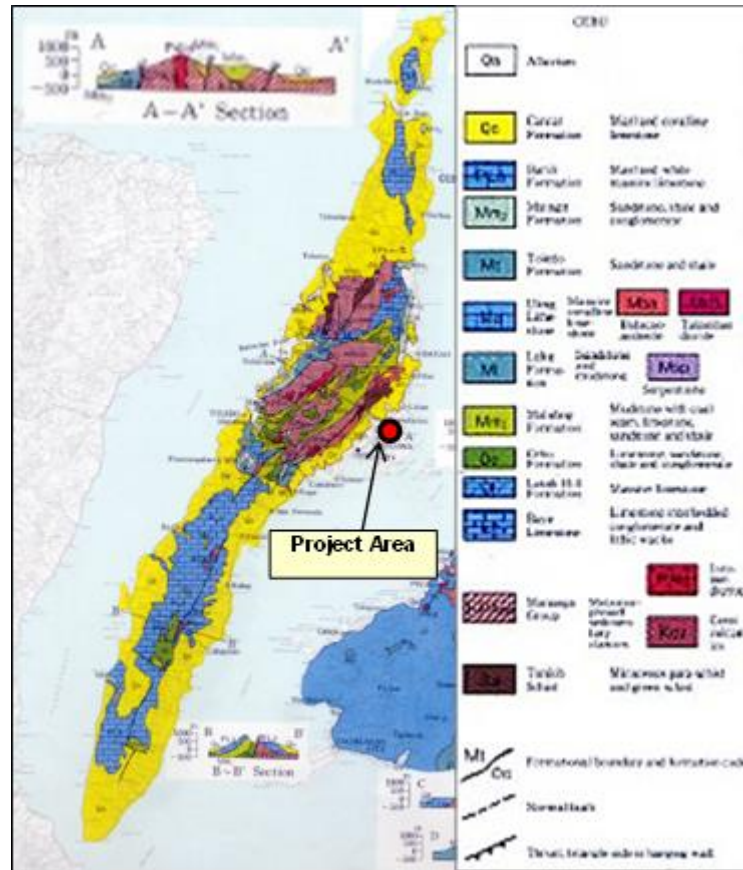
1. The first geomorphologic feature is that of the flat low-lying Quaternary Alluvium which consists of detrital deposits sand, silt, gravel and clay in beaches, alluvial plains and river beds. The entire project area is part of this feature and are often flood prone.
2. The second and third features are represented by the limestone of the Carcar Formation. The limestone exhibits two distinct geomorphological regions. The second feature is where ground elevation rises gently from just above sea level inland near the coast to about 50 meters above sea level to form low lying limestone foothills.
3. The third geomorphologic feature is where ground reaches elevations of over 200 meters above sea level, forming the rugged deeply dissected limestone hills of the Carcar Formation.
4. The fourth is the sharp crested narrow parallel ridges of the older Mananga Formation. These rocks are variably weathered with extensive severe erosion. It is located in the mountains further to the west of study area in Central Cebu.

5) General Stratigraphy

The project area is located on the east central portion of Cebu Island. The stratigraphy of this region reveals a complex sequence of lithologic units deposited from Cretaceous to Quaternary periods. The rock formations in the vicinities of the project site include the Quaternary Alluvium and the underlying Carcar Limestone Formation. Following is the stratigraphic sequence arranged from oldest to youngest within the regional vicinities of project site (*Bu. of Mines, 1983*):

Mananga Group

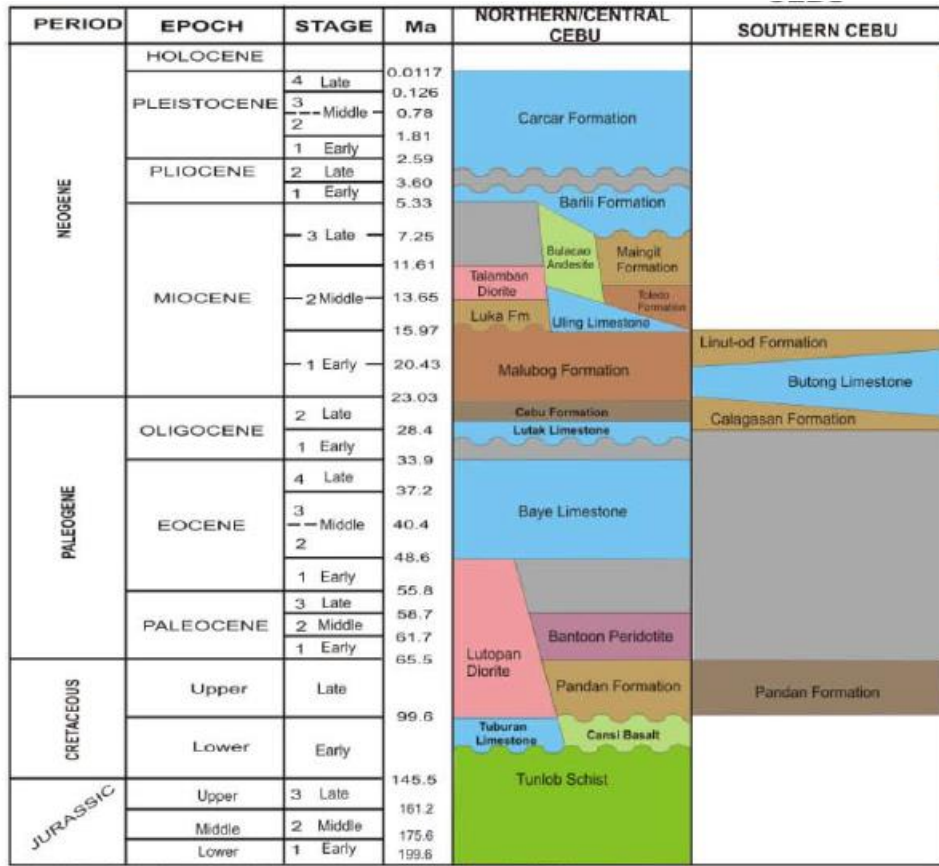
It is consisting of a sequence of andesitic to basaltic pyroclastics and lava, limestone and clastic sedimentary rocks, which is Cretaceous to Paleocene in age. It is found further NW of project area.



Source: JICA-MMAJ, 1990

Figure 4.1.13 Regional Geologic Map of Cebu Island Showing the Study Area

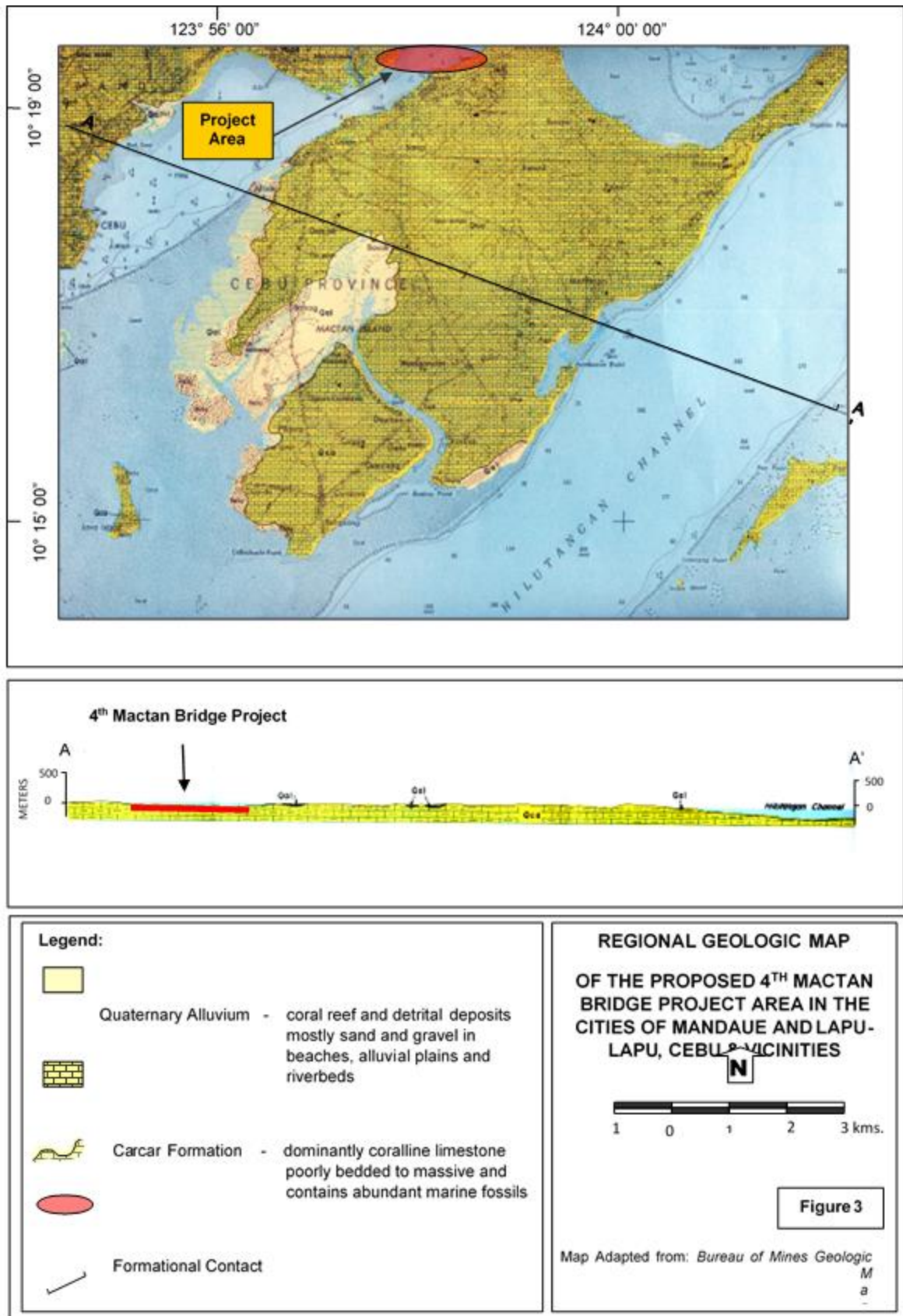
Unconformably overlying the Mananga Group is the late Eocene to early Miocene sedimentary formations consisting of the Lutak Hill Formation, Cebu Formation and Malubog Formation. The Lutak Hill formation is mainly limestone with basal sandstone containing *Lepidocyclina* and *Nummulites*. The Cebu Formation consists of an upper Orbitoidal limestone, a lower clastic unit with coal measures and a basal conglomerate. The Malubog Formation is composed of mudstone, shale and occasional beds of conglomerate, limestone and coal.



Geologic Time Scale adopted from International Commission on Stratigraphy (2009)

Source: MGB

Figure 4.1.14 Stratigraphic Column of Northern/Central Cebu and Southern Cebu (MGB, 2010)



Source: MGB

Figure 4.1.15 Regional Geologic Map

Middle Miocene rock formations unconformably overlie the older rocks. First in the sequence is the Luka Formation consisting of interbedded sandstone and mudstone with conglomerate and limestone lenses. The Uling Limestone comes next and is a generally hard, massive limestone but partly porous and coralline. At the top of the sequence is the Toledo Formation consisting of thin to thick bedded sandstone and shale with occasional lenses of conglomeratic limestone and calcarenite.

The Late Miocene Maingit Formation unconformably overlies the older rocks. The formation is composed of granule to cobble conglomerate with interbedded shale, sandstone, limestone and conglomeratic limestone in the lower part.

Unconformably overlying older formations is the Barili Formation of Late Miocene to Early Pliocene age. This consists of a Lower Limestone member which is generally brown in color, hard, coralline, and porous and an Upper Marl member which is poorly bedded and slightly sandy.

Carcar Formation

It is dominantly massive to bedded coralline limestone, which is most widespread along the coastal areas of the island. It has a Plio-Pleistocene age. This type of formation is exposed further NW of the project.

Quaternary Alluvium

Composed mostly of detrital deposits mostly sand and gravel in beaches, alluvial and riverbeds. This type of formation underlies the whole project site including the

6) Seismicity

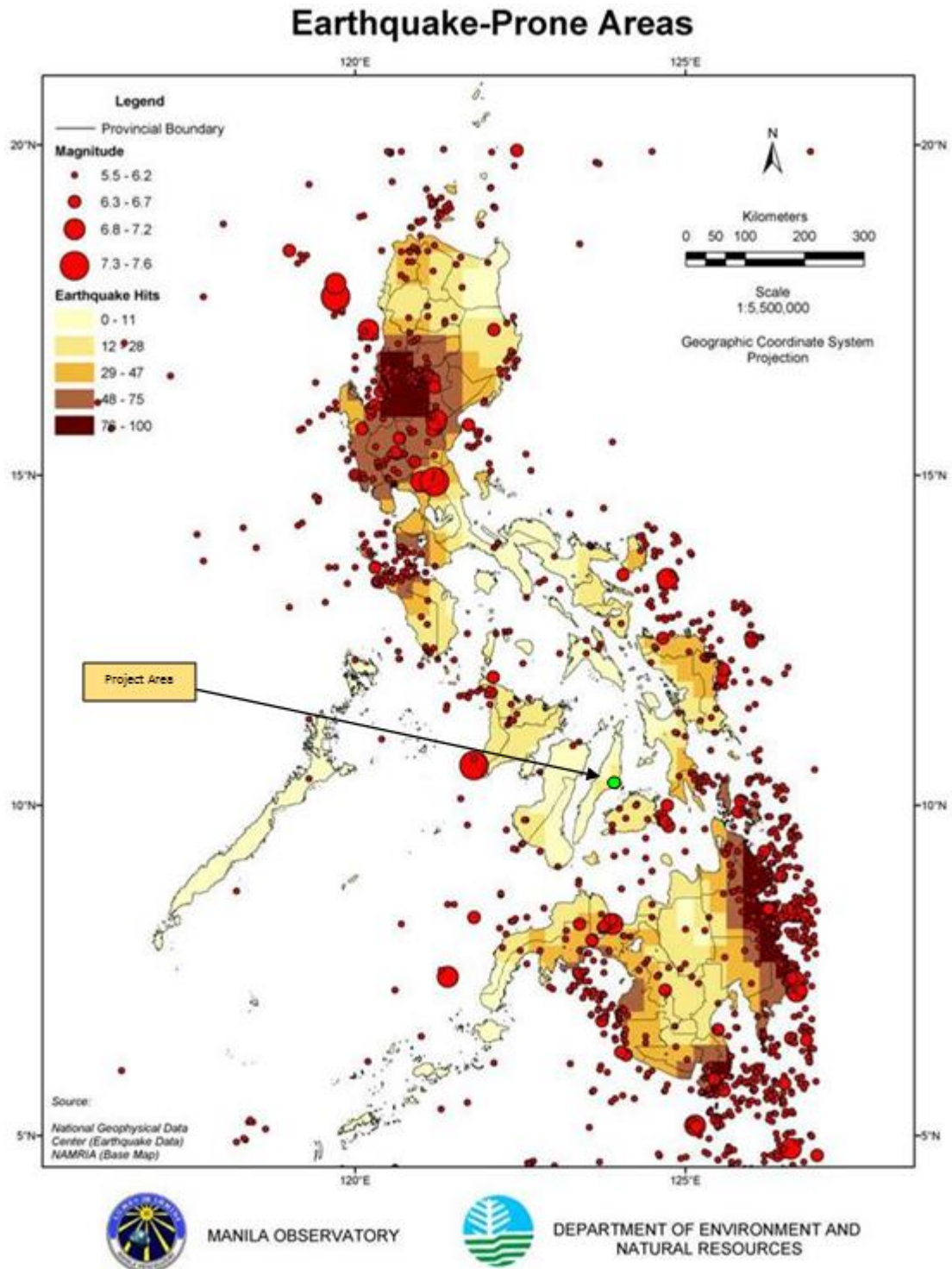
Active seismic generators of the Philippine Archipelago are associated with mobile belt boundaries specifically along convergent zones as exemplified by the East- Luzon-Philippine trench to the east and the Manila-Negros-Sulu-Cotabato trenches to the west where the Philippine Sea Figure and the Eurasian Figure are being consumed respectively (Figure 4.1.13). Furthermore, several active fault systems within the Philippine Arc itself more importantly the sinistral Philippine Fault systems are also active and even worst contributors to damaging earthquakes. The distribution and concentration of the destructive earthquakes in the Philippines as per past records showed that these are directly associated with active subduction zones and/or mobile fault zones.

Cebu Island being geographically located distal from the primary earthquake generators as explained above has the least chances of experiencing major and destructive earthquakes, as exemplified by the earthquake frequency distribution in the Philippines done by Philippine Institute of Volcanology and Seismology (PHIVOLCS) (Figure 4.1.17). Thus, the low number of recorded earthquakes in the island of Cebu also suggests low seismicity or seismic activity level in the project area.



Source: PHIVOLCS, 2000

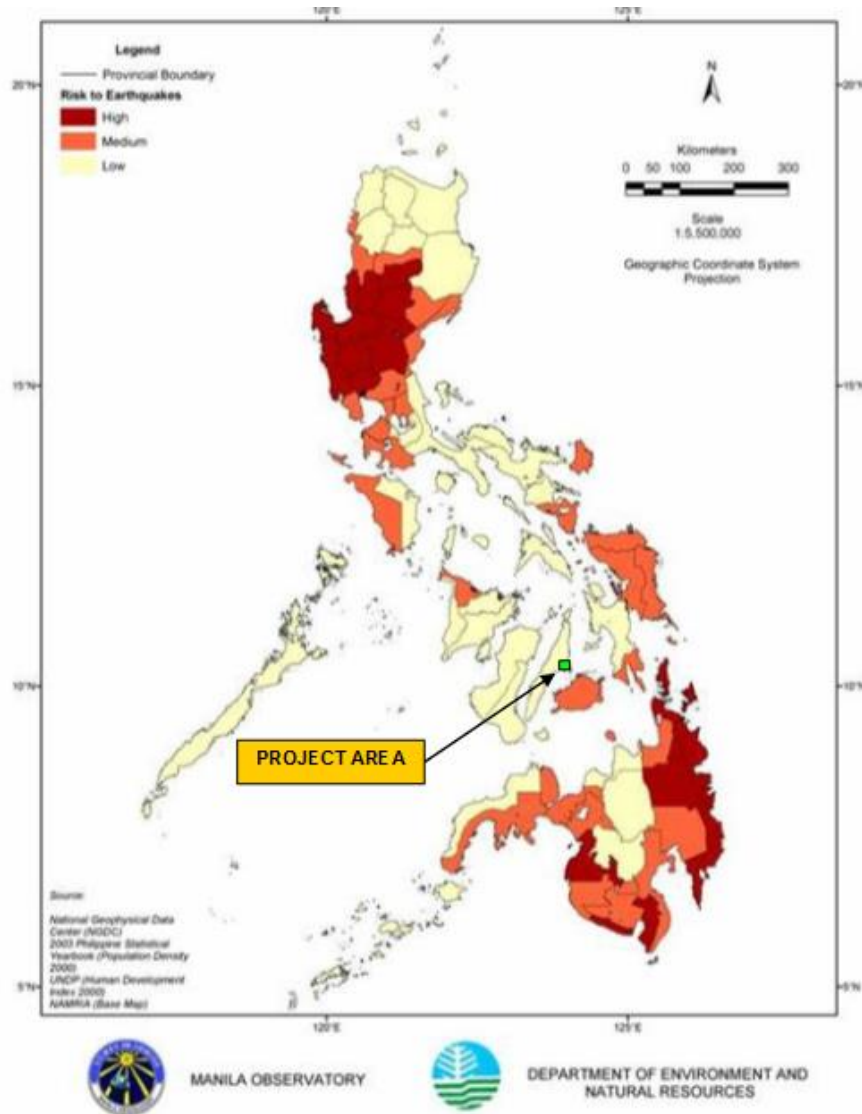
Figure 4.1.16 Tectonic Map of the Philippines showing the Project Area



Source: PHIVOLCS, 2000, DENR-Manila Observatory

Figure 4.1.17 Earthquake-prone Area Map of the Philippines showing the Project Area

In a provincial scale of risk assessment, the Province of Cebu including the proposed project in the Cities of Mandaue and Lapulapu, have a general low risk to earthquake (Figure 4.1.18).



Source: DENR-Manila Observatory

Figure 4.1.18 Earthquake Risk Map of the Philippines

7) Subsurface Geology

Soil exploration and subsurface geotechnical investigation study was conducted in the project area last March 11, 2019 to May 9, 2019 by Advanced Geotechnical Engineering Services (AGES). The purpose of the investigation was to assess the general subsurface condition of the project site, and to provide recommendations relevant to the foundation design of the project.

It includes subsurface investigation in which the geotechnical consultants conducted drilling of seven (7) test bore holes (labeled as BH-1 to BH-7) within the project site (Figure 4.1.19). Bore holes BH-3, BH-4 and BH-5 are located onshore in the Mandaue City side, bore hole BH-1 located in the Lapulapu City side while boreholes BH-2, BH-6 and BH-7 are located offshore within the Mactan Channel. All boreholes were drilled ranging from 25.7 to 63.3 meters below ground. Water depth to seabed in bore holes BH-2 and BH-6 is at 9.055 meters and 2.775 meters respectively (see Figure 4.1.20 & Figure 4.1.21 for Soil Profile of each borehole).

Standard Penetration Test (SPT) were conducted on site in all the boreholes. Laboratory physical tests of selected soil and rock samples from the bore holes were made which include Grain Size Distribution, Sieve Analysis, Atterberg Limit Test, Unconfined Compressive Strength of Intact

Rock Core Specimens and Soil Classification for Engineering Purposes. All the test bore holes encountered the overlying Quaternary Alluvium and underlying Carcar Limestone Formation (see Table 4.1.3). Of particular attention is Borehole No. 4 where the ‘interchange will be located (along with BH-3), where the composition is compost soil, plastics and garbage (as this is the landfill site).

Table 4.1.3 Drilling Data of the Seven (7) Bore Holes Drilled by Advanced Geotechnical

Bore Hole No.	Location	Purpose of Bore Hole	Drill Depth (m.)	Date Drilled	Drill Collar Elev. (m.)	Geographic Coordinates		Geology
						Northings	Eastings	
BH-1	Onshore, PEZA road side, Bgy. Pusok, Lapulapu City	Approach Embankment of 4th Mactan Bridge, Lapu Lapu side	25.70	May 8-11, 2019	11.0	10° 19' 35.6"	123° 58' 34.8"	Limestone from 1.0 to 25.7m
BH-2	Offshore, Mactan Channel, Bgy. Pusok Lapulapu City	Main Pier of 4th Mactan Bridge Lapu Lapu side	42.15	April 8-12, 2019	(-) 9.06	10° 19' 46.3"	123° 58' 28.6"	Clay 0-33.45m, Limestone at 33.45-42.15m
BH-3	Onshore, near 2 nd Mactan Bridge, Bgy. Opao, Mandaue City	Interchange of Mandaue Coastal Road and 4th Mactan Bridge	50.45	March 22-27, 2019	1.82	10° 19' 44.8"	123° 57' 51.9"	Clay 0-50.0m, clay/gravels 50.0-50.45m
BH-4	Onshore, near mouth of Butuanon River and abandoned Umapad Dumpsite	Interchange of Mandaue Coastal Road and Access road to Plaridel St	37.70	May 2-5, 2019	7.72	10° 20' 24.4"	123° 58' 07.4"	Compost soil with plastics & garbage materials 0-7.5m, clay 7.5-28.5m, limestone 28.5-37.7m
BH-5	Mandaue City Hospital Compound, Bgy. Centro, Mandaue City	Approach Embankment of Mandaue Coastal Road Mandaue side	63.30	March 11-18, 2019	2.68	10° 19' 25.1"	123° 56' 35.3"	Clay and minor sand 0-58.5m, limestone 58.5-63.3m
BH-6	Offshore, Mactan Channel, Bgy. Paknaan, Mandaue City	Main Pier of 4th Mactan Bridge Mandaue side	40.70	March 31-April 4, 2019	(-) 2.77	10° 19' 57.3"	123° 58' 22.3"	Sandy clay 0-27.0m, limestone 27.0-34.5m, clayey sand 34.5-40.7m
BH-7	Offshore, near 1 st Mactan Bridge, Bgy. Looc, Mandaue City	Viaduct Bridge of Mandaue Coastal Road	46.70	April 23-27, 2019	0	10° 19' 15.8"	123° 57' 18.8"	Clay 0-42.0m, limestone 42.0-46.7m

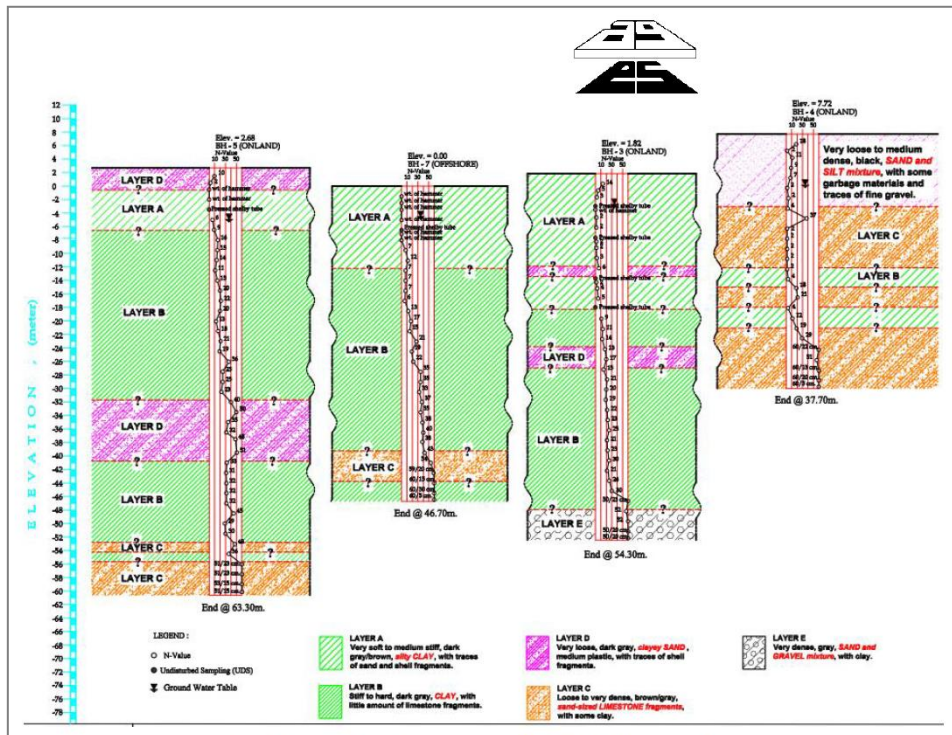
Source: AGES,2019



Source: JICA Survey Team, Google Earth, 2018

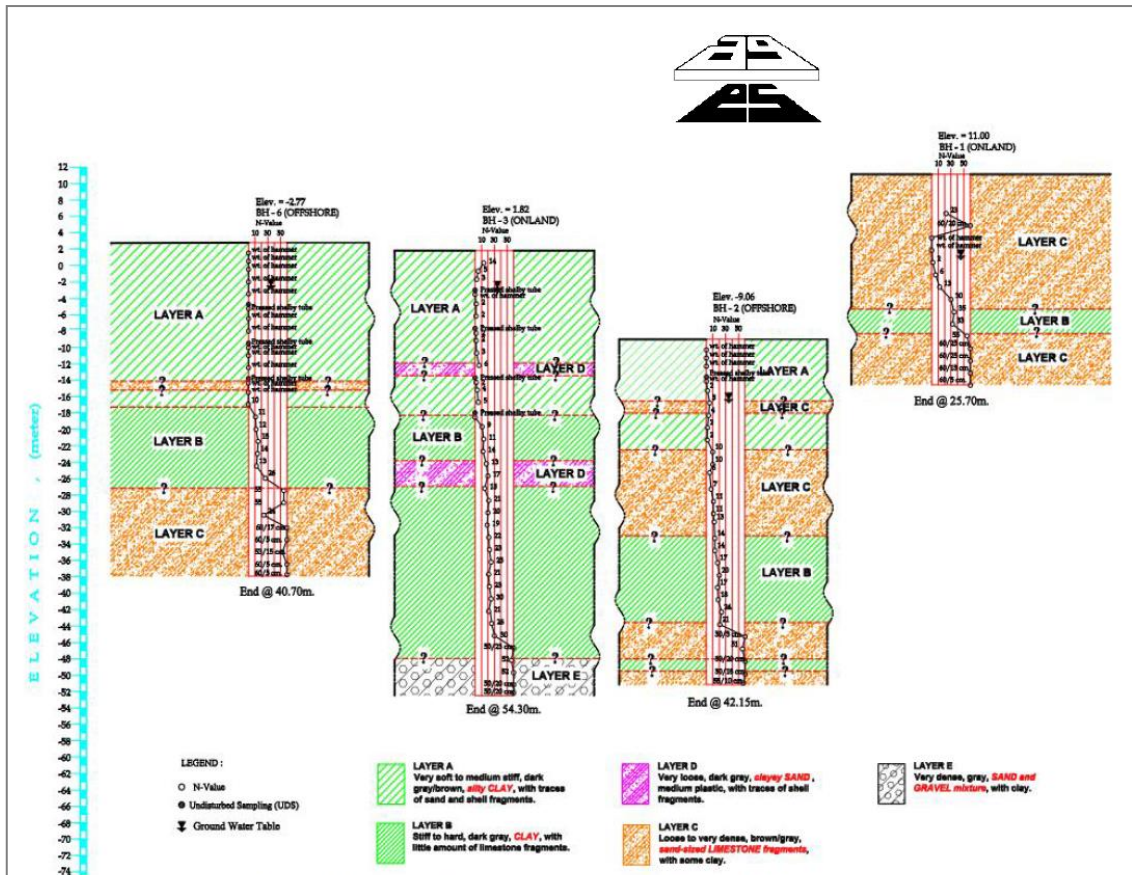
Figure 4.1.19 Google Map Showing the Location of the Seven (7) Bore Holes Drilled by Advanced Geotechnical Engineering Services (AGES) for the 4th Mactan Bridge Project

0m and the underlying limestone from 42.0-46.7 meters.



Source: AGES, 2019

Figure 4.1.20 Soil Profile Represented by Bore Holes BH-5, BH-7, BH-3 & BH-4



Source: AGES, 2019

Figure 4.1.21 Soil Profile Represented by Bore Holes BH-6, BH-3, BH-2 & BH-1 (AGES, 2019)

(3) Geological Hazard Assessment

1) Geologic Hazards

The geologic hazards that were identified to have potential impacts on the proposed project are seismic hazards, differential settlement and hydrogeologic/hydrologic hazards.

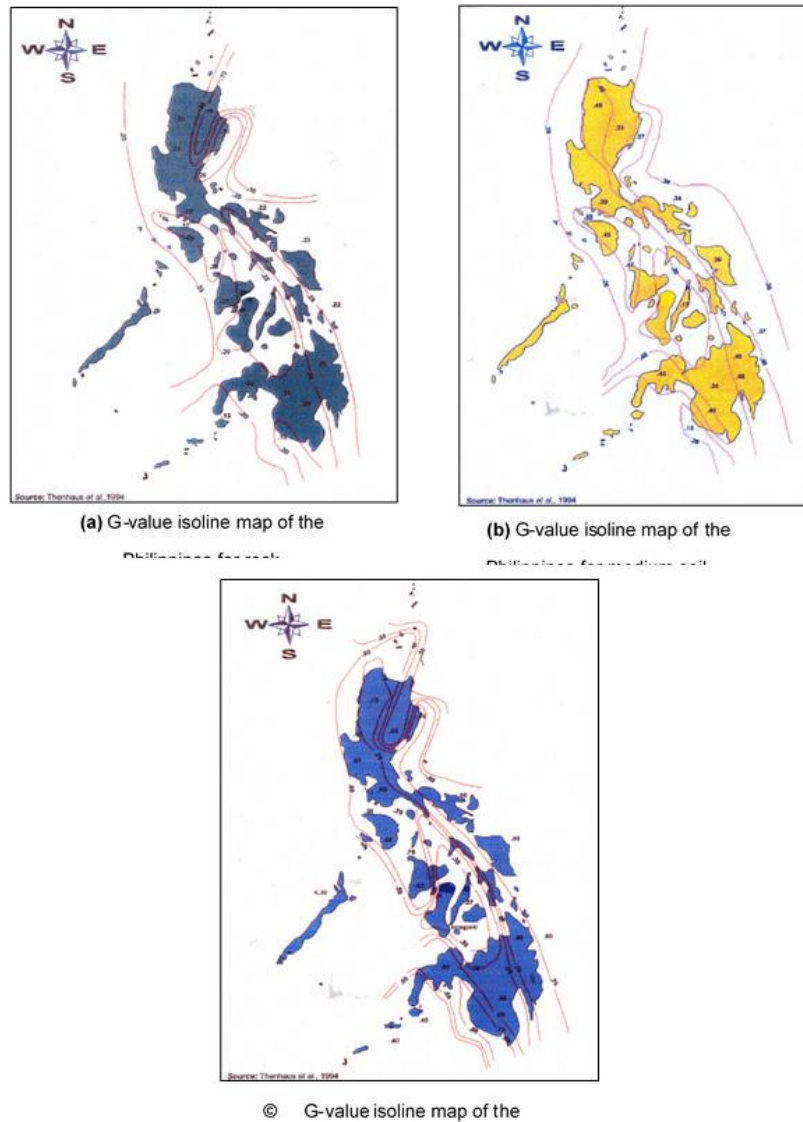
a.1 Seismic Hazards

Although historical seismic data from PHIVOLCS show that only small magnitude earthquakes occur in Cebu Island and the project area, the probability of occurrence of high magnitude earthquakes is not discounted. This is due to the presence of the tectonically active Negros Trench located southwest of Cebu and Negros Island. This trench may possibly produce high magnitude earthquakes and can trigger earthquake-induced geohazards such as ground shaking and liquefaction.

Ground shaking refers to the actual trembling or jerking motion produced by an earthquake. Seismic magnitude, epicenter distance to earthquake generators and the modifying effects of subsoil conditions mainly influence the intensity of ground vibration in an earthquake. Soil that is thicker, more unconsolidated and water saturated is more prone to ground shaking.

A joint study of PHILVOLCS and the United States Geological Survey (USGS) entitled “Estimates of Regional Ground Motion Hazard in the Philippines” showed estimates of PGA (peak ground acceleration) “g” values for rocks, medium soil and soft soil. The calculation of a “g” value was based mainly on historical records of seismic events. For Cebu and Bohol Islands, the g value for

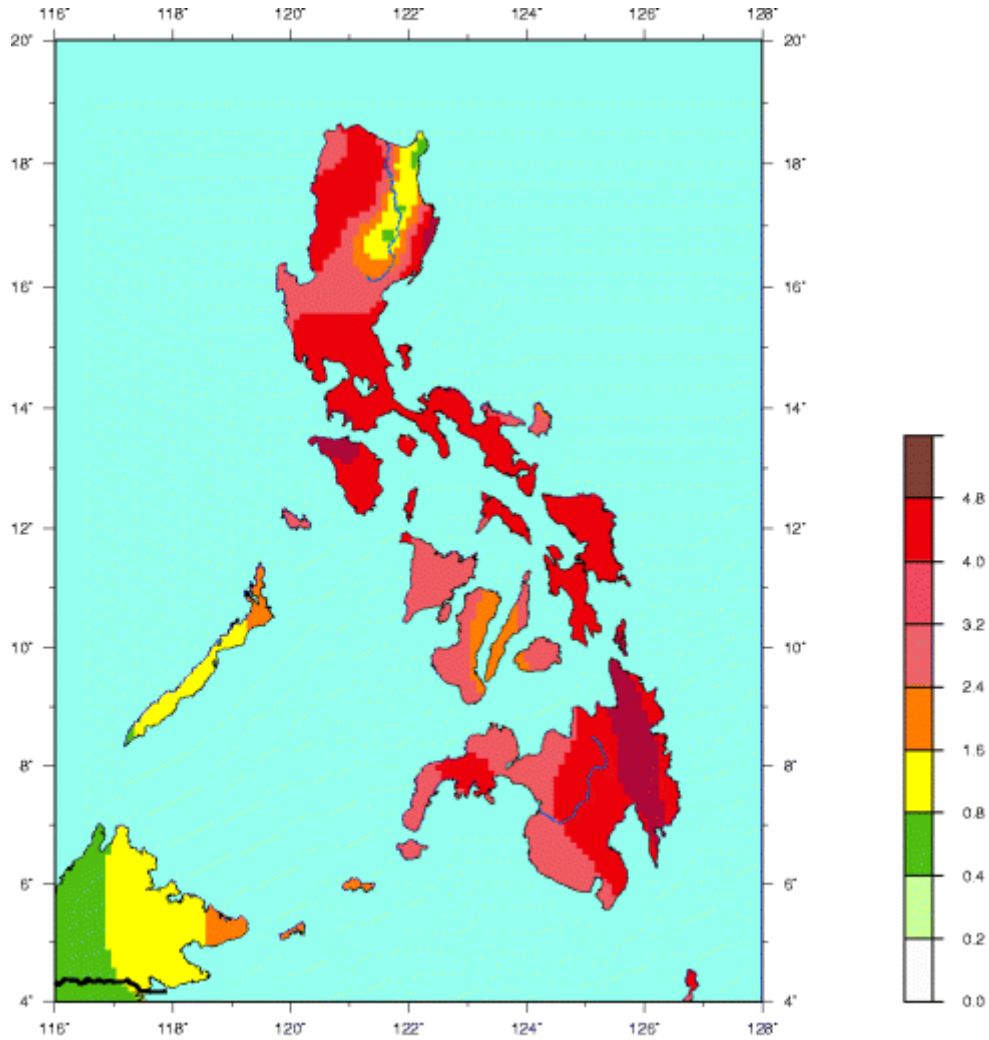
rocks is 0.11, medium soil is 0.17 and soft soil is 0.27. These values have a 10% probability of exceedance in 50 years (Figure 4.1.22).



Source: PHILVOLCS- USGS

Figure 4.1.22 G-Value Isoline map of the Philippines

The selection of “g” values to be used for engineering design depends on the type of analysis to be performed whether static or dynamic load analyses. The “g” values are taken into account by Structural Engineers in engineering design to determine the potential hazard of an earthquake occurring during the life of a structure.



Source: PHILVOLCS- USGS

Figure 4.1.23 Peak Ground Acceleration (m/s²) with 10% Probability of Exceedance in 50 Years

a.2 Differential Settling/Compaction of Filling Materials

Differential settling and or compaction may occur in backfilled areas. This depends upon the nature and the degree of compaction of the emplaced filling material. The less compacted filling material is prone to surface water infiltration thus, scouring effect may occur during heavy precipitation. Man-made structures on the surface are damaged when some portions of the heterogeneous soil mass underlying the foundation settle more than the other parts.

Another cause of differential settlement is when the contact between bedrock and soil or backfilling material in a project area is irregular. Problem happens when one footing of the foundation is erected on top of the bedrock and the other on an uncompacted soil or back-filled area. The weight of the constructed structure will tend to compact the soil to some extent and the structure will settle. However, since the bedrock supports one part of the foundation and the other by the soil, the result would be differential settling of the structure. This may produce cracks in the road surface thus weakening the structures.

a.3 Liquefaction and Subsidence Potential

Liquefaction is a process involving the conversion of loose, cohesion-less, and water-saturated layers of soil from a solid to liquid state. Differential settlement is one of the damaging effects of liquefaction. Housing and other man-made structures on the surface are damaged when some portions of the heterogeneous soil mass underlying the foundation settle more than the other parts. During strong earthquakes, the ground shakes when seismic waves move from the earth's subsurface to the ground surface. Liquefaction occurs when loosely packed and water-saturated sediments yield to strong vibration and assume a "quick sand" condition or a liquid state condition. During vibration, sand particles are rearranged into a more compact state (Figure 4.1.24).

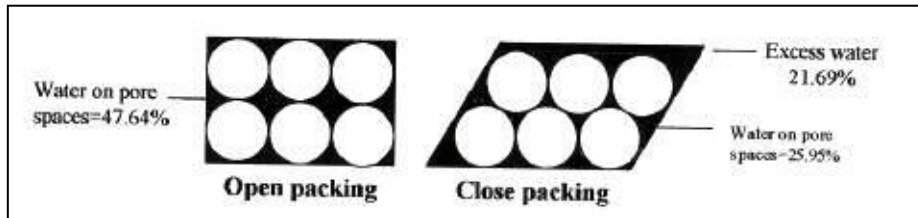


Figure 4.1.24 Compaction showing release of water from pore spaces during liquefaction

Based on the *Japanese Society of Civil Engineers (JSCE) 1971* specifications, the soil deposit is likely to liquefy if the following conditions are met:

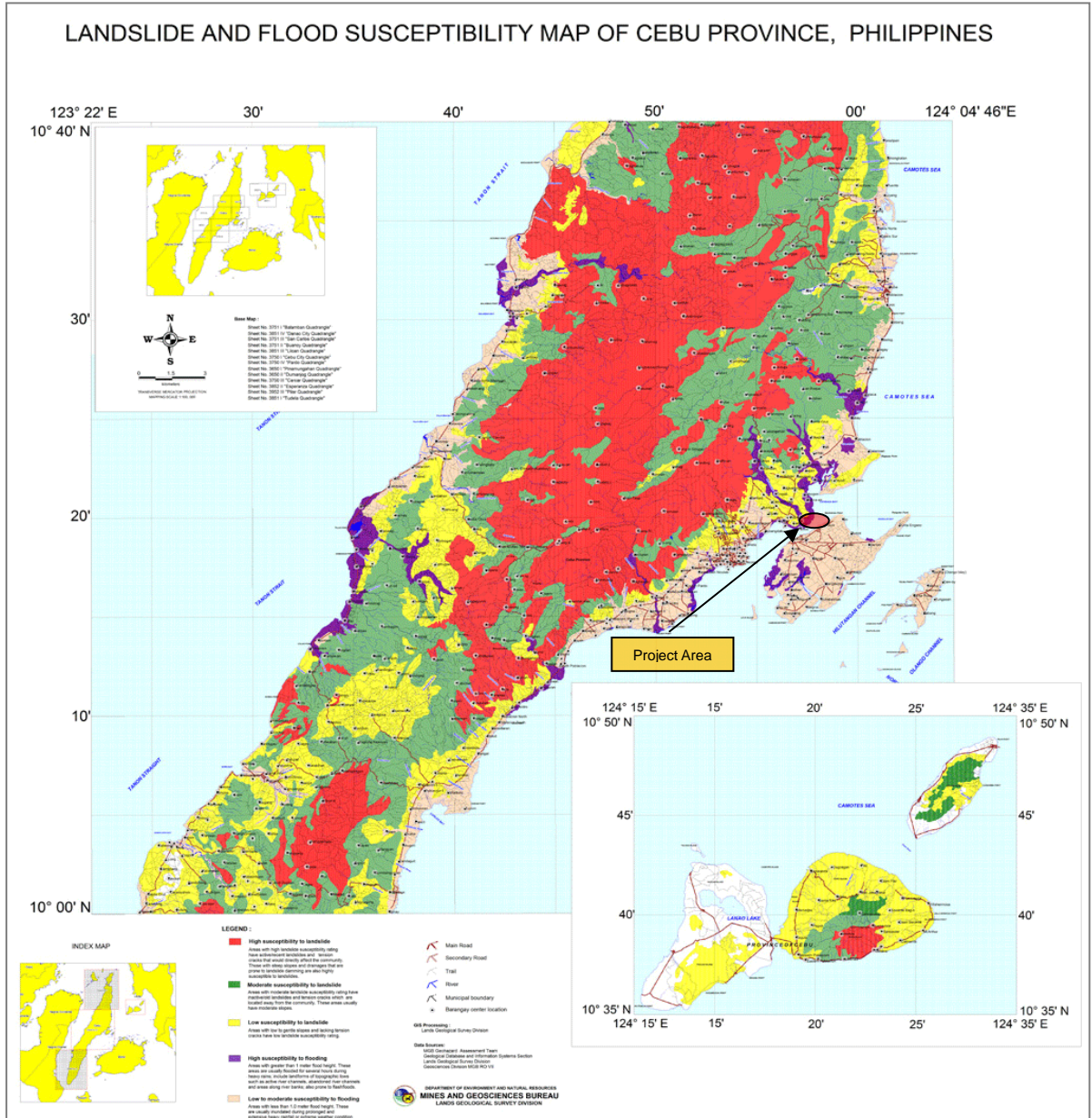
1. Depth at 10.0 meters from the actual ground surface
2. N-value is less than 10
3. Sandy layer within 20 meters from ground
4. Water table within 10.0 meters from the ground surface.

The degree of liquefaction in a particular area is controlled by the intensity and duration of ground shaking during an earthquake, geological formation and the load of civil structure development in the area. The tendency of a sedimentary body to liquefy is determined by lithologic parameters such as porosity, grain size, degree of water saturation, sediment cohesion and age of deposition.

The potential for liquefaction in the project area including the whole island of Cebu is low because it is not an earthquake-prone area.

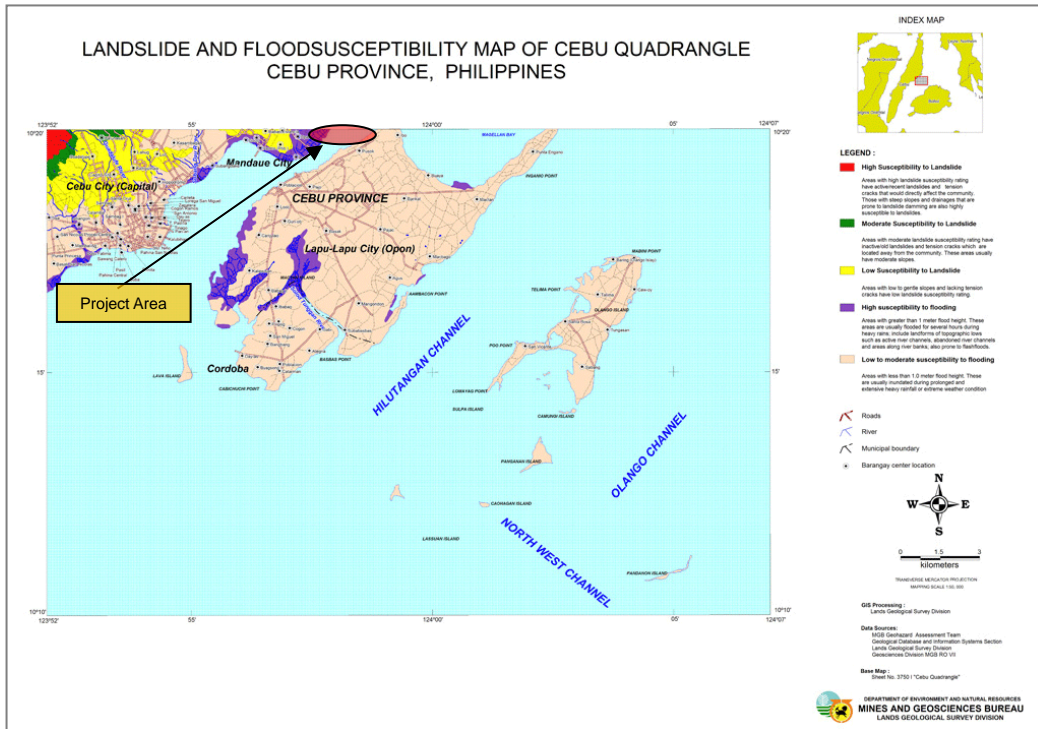
a.4 Landslide Susceptibility

Based on the 1:50,000 scale Landslide and Flood Susceptibility Map of Cebu Quadrangle as prepared by the Mines and Geosciences Bureau (MGB-7), the project area and its vicinities in the Cities of Mandaue and Lapulapu, Cebu have low susceptibility to earthquake induced and rainfall induced landslides because the area is generally flat (Figure 4.1.25 & Figure 4.1.26).



Source: MGB, 2008

Figure 4.1.25 Mines and Geosciences Bureau Landslide and Flood Susceptibility Map of Cebu Province showing the location of the proposed 4th Bridge Project Area in the Cities of Mandaue and Lapu-lapu, Cebu



Source: MGB, 2008

Figure 4.1.26 Mines and Geosciences Bureau Landslide and Flood Susceptibility Map of Cebu Quadrangle showing the location of the proposed 4th Bridge Project Area in the Cities of Mandaue and Lapu-lapu, Cebu

4.1.1.3 Pedology

(1) Soil Profile

The study area and its vicinities consist of one (1) soil type, which is the Mandaue Clay. This is based from the soil classification made by the Bureau of Soils and Water Management.

Mandaue Clay in the flat areas of study area is the result of weathering of the underlying Quaternary Alluvium. It has a surface soil color of light brown to dark, depending on the amount of organic matter and moisture content. It is friable when just moist, thick and sticky, soft when wet, and hard when dry. The substratum is made up of compact clay loam.

Based on the Soil Series Map of the Philippines (Figure 4.1.27), a soil map showing the distribution of the established Philippine Soil Series, the project area belongs to the Upland Soils, particularly the Faraon Soil Series. This map was compiled and produced by the Soil Survey Division of the Bureau of Soil and Water Management (BSWM) of the Department of Agriculture.

Another Soil Map of the Philippines was classified by the Food and Agriculture Organization (FAO-UNESCO) in the Soil Maps of the World and compiled by BSWM (Figure 4.1.28). The soil type in the project area is classified as Orthic Acrisols, a major type of tropical soils. Acid, low base status (<50% base saturation) and strongly leached. One of the most inherently infertile soils of the tropics, becoming degraded chemically and organically very quickly when utilized. All nutrients, except Al, decreased substantially. Acrisols have very low resilience to degradation and moderate sensitivity to yield decline (FAO, 1974).

Soil Erosion Rate Map of the Philippines as prepared by BSWM showed that the project area has a low potential soil loss of about 6.7 to 11.2 tons/hectare/year (Figure 4.1.29). The estimate as compiled by BSWM is based on average annual soil loss for the entire country using the Universal Soil Loss Equation (BSWM, 2013).

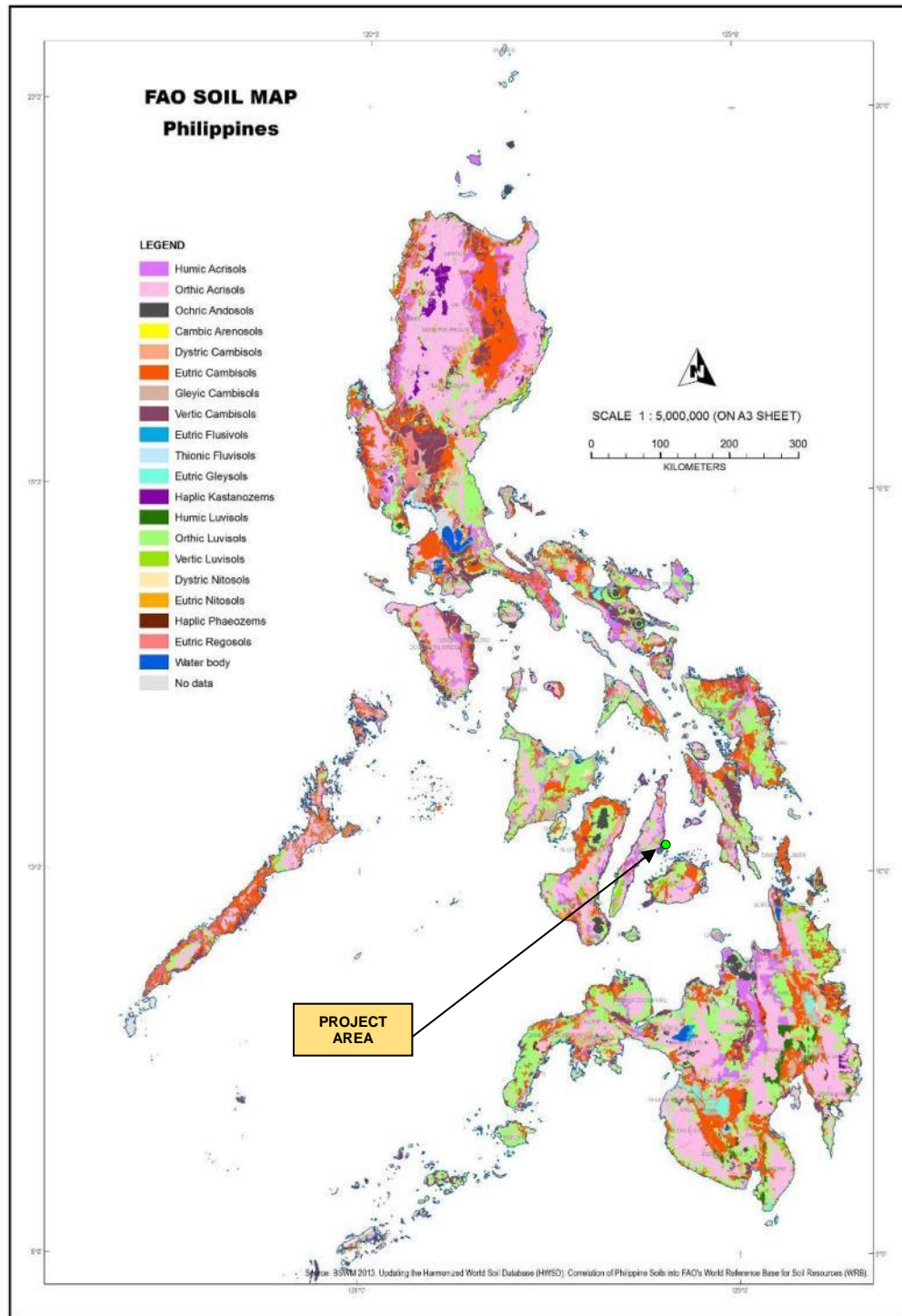
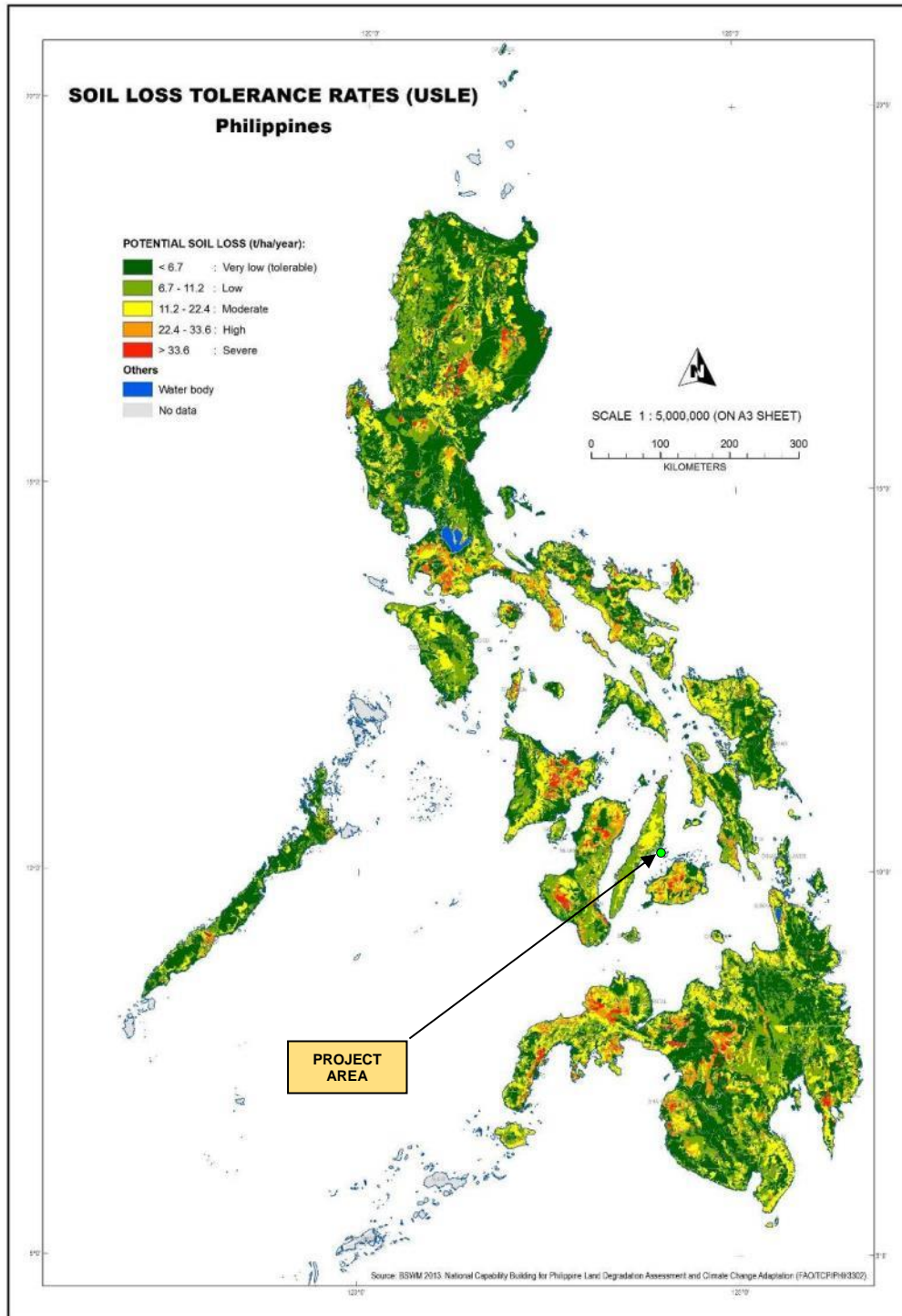


Figure 4.1.28 FAO Soil Map of the Philippines showing the Project Area

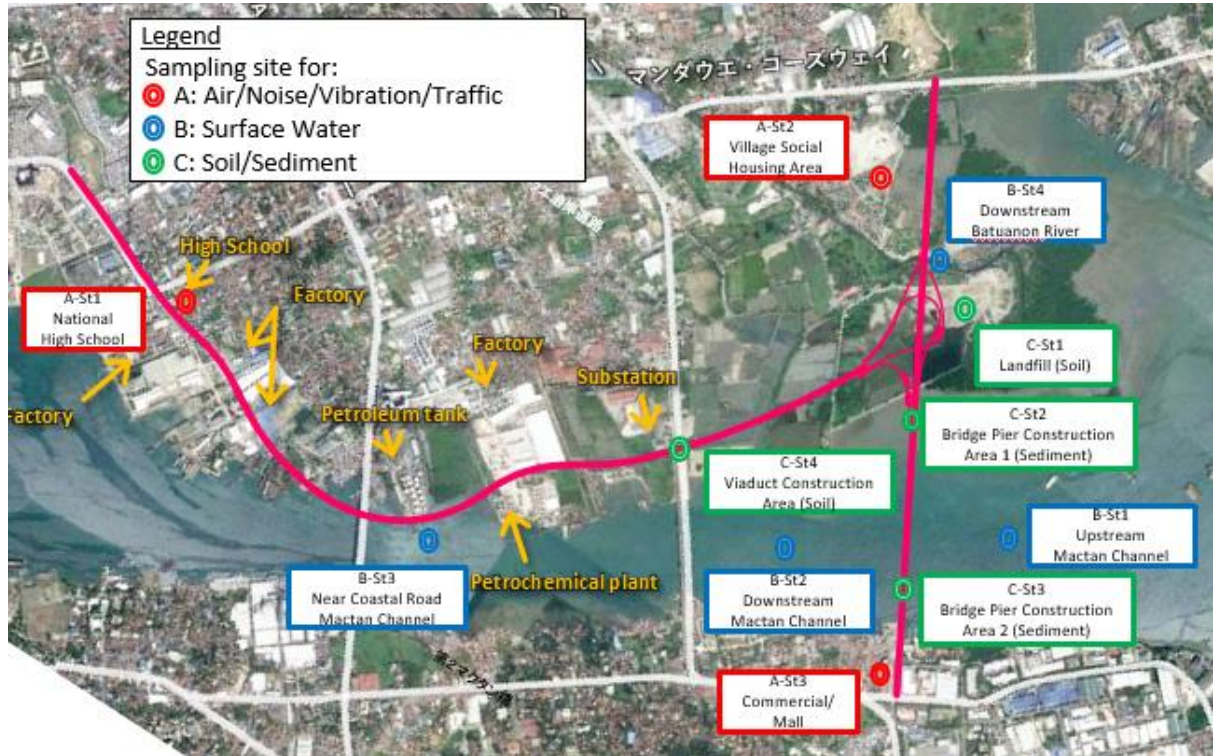


Source: BSWM, 2013

Figure 4.1.29 Soil Erosion Rate Map of the Philippines showing the Project Area

(2) Soil quality

Baseline survey for soil /Sediment quality was performed at four sampling sites along the proposed 4th Cebu-Mactan Bridge route. Figure 4 shows the location of each sampling site.



Source: JICA Survey Team

Figure 4.1.30 Sampling points for soil quality

The sampling result is shown in Table 4.1.4. There are no soil standards in the Philippines, but according to DENR-MC No 2017-003 “The Guidelines for Site Characterization”, US EPA Regional Screening Value (USEPA RSLs) and Dutch Intervention Value (DIV) are recommended to use for Environmental Assessment. Comparing with USEPA RSLs, DIV and Environmental Quality Standards for Soil Pollution in Japan, soil contamination was not confirmed, except the value of copper at C-St1 near Umapad Dumpsite.

Table 4.1.4 Sampling Results for Soil quality

	unit	C-St1 Landfill	C-St4 Viaduct Construction Area	US EPA Regional Screening Value ¹ (Resident/ Industry)	Dutch Standards reference values ²	Environmental Quality Standards for Soil Pollution in Japan ³
Cyanide (CN-)	mg/kg	0.05	0.10	23/150		50
Cadmium (Cd)	mg/kg	0.28	<0.03	71/980	12	150
Chromium (Cr)	mg/kg	66.53	30.62		380	250
Lead (Pb)	mg/kg	57.43	27.09	400/800	530	150
Copper (Cu)	mg/kg	952.11	94.02	3100/47000	190	125
Phosphorus (P)	%	0.054	0.065	-	-	-
Selenium (Se)	mg/kg	0.640	0.192	390/5800	100	150
Arsenic (As)	mg/kg	0.50	7.72	0.68/3	55	150
Mercury (Hg)	mg/kg	<0.004	<0.004	11/46	10	15

Source: JICA Survey Team

Note 1 : US EPA Regional Screening Value are presented with target hazard quotients (THQ) of 1.0

2 : Dutch Target and Intervention Values, 2000. Values for soil/sediment have been expressed as the concentration in a standard soil (10% organic matter and 25% clay).

3 : Soil Contamination Countermeasures Act, 2002, Hazardous Category: Class 2 Designated Hazardous Substances

Table 4.1.5 Sampling Results for Sediment

	unit	C-St2 Bridge Pier Construction Area 1	C-St3 Bridge Pier Construction Area 2	US EPA Regional Screening Value ¹ (Resident/ Industry)	Dutch Standards reference values ²	Environmental Quality Standards for Soil Pollution in Japan ³
Cyanide (CN-)	mg/kg	0.10	0.10	23/150		50
Cadmium (Cd)	mg/kg	<0.03	<0.03	71/980	12	150
Chromium (Cr)	mg/kg	38.53	13.97		380	250
Lead (Pb)	mg/kg	16.82	24.59	400/800	530	150
Copper (Cu)	mg/kg	73.52	56.74	3100/47000	190	125
Phosphorus (P)	%	0.041	0.062	-	-	-
Selenium (Se)	mg/kg	0.117	0.148	390/5800	100	150
Arsenic (As)	mg/kg	7.46	10.71	0.68/3	55	150
Mercury (Hg)	mg/kg	<0.004	<0.004	11/46		15

Source: JICA Survey Team

Note 1 : US EPA Regional Screening Value are presented with target hazard quotients (THQ) of 1.0

2 : Dutch Target and Intervention Values, 2000. Values for soil/sediment have been expressed as the concentration in a standard soil (10% organic matter and 25% clay).

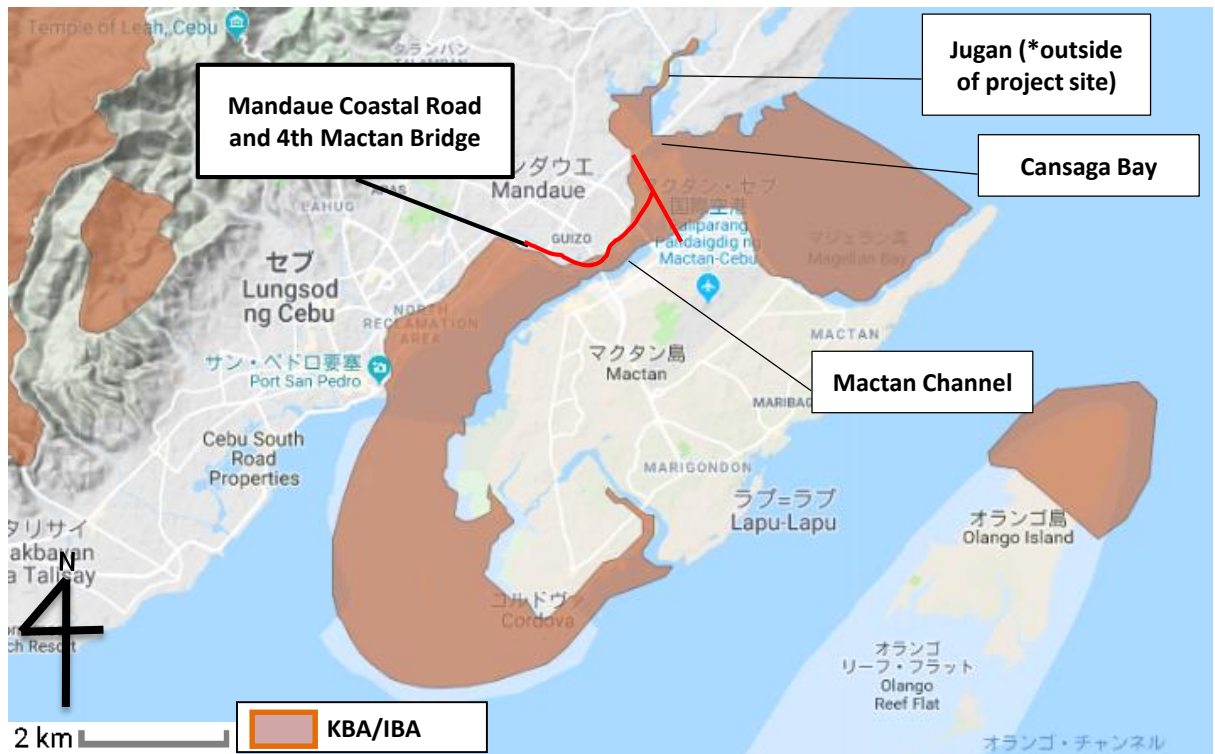
3 :Soil Contamination Countermeasures Act, 2002, Hazardous Category: Class 2 Designated Hazardous Substances

4.1.1.4 Terrestrial Flora and Fauna

(1) Important Bird Area and Key Biodiversity Area

Haribon Foundation and Birdlife International has designated in 2001 an area of 18,000 ha in Central Visayas, which covers Mactan Channel and Cansaga Bay and includes the project site, as an Important Bird Area (IBA) ‘Mactan, Kalawisan and Cansaga Bays’, as they consider it to be the most important stopping point in Visayan Island for migratory birds (refer to Figure 4.1.31 for an area showing the IBA). The criteria met are A1: Globally threatened species “The site is known or thought regularly to hold significant numbers of a globally threatened species” and A4i: Congregations “The site is known or thought to hold, on a regular basis, 1% or more of a biogeographic population of a congregatory water bird species”.

A maximum number of 3,700 birds in 1986 and approximately 1,600 birds in April 1987 have been found in the aquaculture ponds in Jugan, which is located in Cansaga Bay approximately 3 km northeast of the project site. This IBA includes the mangroves swamps, fishponds, sand flats and fringing coral reefs of southern and western Mactan Island. The surrounding areas are both rural and industrial, with a port complex, international airport, associated industrial complexes, oil terminals and open dumping site. This IBA is also designated as a Key Biodiversity Area (KBA) in 2011.



Source: Birdlife International 2019

(available at: <http://www.keybiodiversityareas.org/site/mapsearch>)

Figure 4.1.31 KBA/IBA located around the Project Site

(2) Salient Terrestrial Fauna: Bird

1) Secondary Data

According to Birdlife International, this IBA/KBA is an important habitat for a variety of herons and egrets, including Grey-Tailed Tattler (*Tringa brevipes*) classified as vulnerable (VU) under the IUCN Red List, and Chinese Egret (*Egretta eulophotes*) classified as near threatened (NT). According to the 'State of Cebu's Biodiversity (2015)' edited by the Philippines Biodiversity Conservation Foundation, there are observation records by the Cebu Ornithological Society of sighting of Great Knot (*Calidris tenuirostris*) whose IUCN Red List category was changed from VU to endangered (EN) in 2016, Grey-Tailed Tattler and Chinese Egret in the wetland near the 2nd Mactan Bridge. In addition, in Olango Island located approximately 12 km from the project site, 25 individuals of Great Knot, 10 individuals of Chinese Egrets and 15 individuals of Grey-tailed Tattler have been recorded in March, 2019 (eBird: <https://ebird.org/hotspot/L942437>). Table 4.1.6 shows the secondary data on the sightings of ecologically important bird species identified by relevant organizations.

Table 4.1.6 Ecologically-important Bird Species recorded near the Project Site

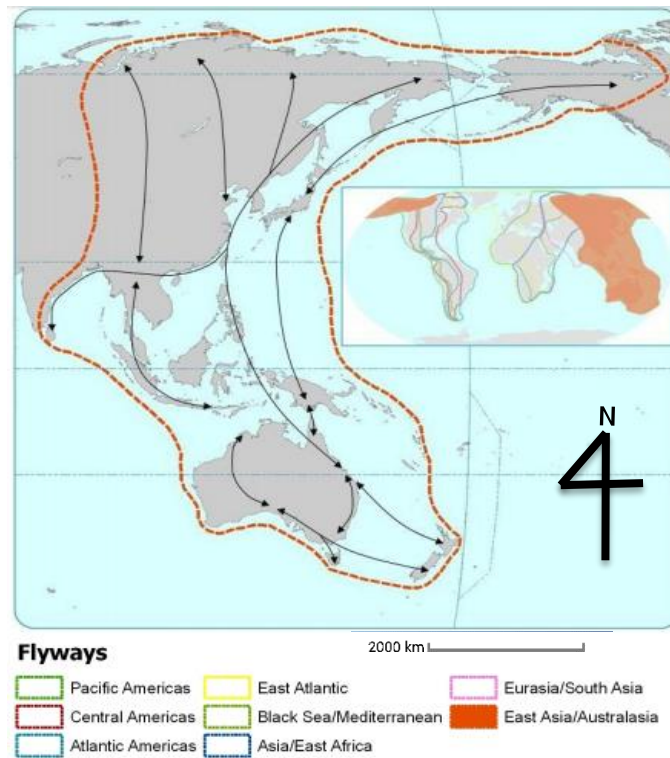
Species	IUCN		Organization responsible for observation		
	IUCN Red List Category	Estimated number of individuals in the World	Birdlife International	Cebu Ornithological Society	eBird (Bird watchers)
Chinese Egret (<i>Egretta eulophotes</i>)	VU	3,800-15,000	<ul style="list-style-type: none"> • Season: non-breeding period • Number (estimate): present • Year of Observation: 1987 	<ul style="list-style-type: none"> • Number: Unknown • Site of Observation: Tidal flat near the 2nd Cebu-Mactan Bridge (Marcelo Fernan Bridge) • Year of Observation: Unknown 	<ul style="list-style-type: none"> • 10 individuals • Site of Observation: Olango Island • Year of Observation: March 2019
Pacific Golden Plover (<i>Pluvialis fulva</i>)	LC	190,000-250,000	<ul style="list-style-type: none"> • Season: winter • Number (estimate): common • Year of Observation: 1986-1987 	N/A	N/A
Lesser Sandplover (<i>Charadrius mongolus</i>)	LC	310,000-390,000	<ul style="list-style-type: none"> • Season: winter • Number (estimate): common • Year of Observation: 1986-1987 	N/A	<ul style="list-style-type: none"> • 10 individuals • Site of Observation: Olango Island • Year of Observation: March 2019
Grey-tailed Tattler (<i>Tringa brevipes</i>)	NT	44,000	<ul style="list-style-type: none"> • Season: migration time • Number (estimate): 710 • Year of Observation: 1986-1987 	<ul style="list-style-type: none"> • Number: Unknown • Site of Observation: Tidal flat near the 2nd Cebu-Mactan Bridge (Marcelo Fernan Bridge) • Year of Observation: Unknown 	<ul style="list-style-type: none"> • 15 individuals • Site of Observation: Olango Island • Year of Observation: March 2019
Common Greenshank (<i>Tringa nebularia</i>)	LC	440,000-1,500,000	<ul style="list-style-type: none"> • Season: winter • Number (estimate): common • Year of Observation: 1986-1987 	N/A	<ul style="list-style-type: none"> • 10 individuals • Site of Observation: Olango Island • Year of Observation: March 2019
Common Redshank (<i>Tringa tetanus</i>)	LC	1,300,000-3,100,000	<ul style="list-style-type: none"> • Season: winter • Number (estimate): common • Year of Observation: 1986-1987 	N/A	<ul style="list-style-type: none"> • 20 individuals • Site of Observation: Olango Island • Year of Observation: March 2019
Great Knot (<i>Calidris tenuirostris</i>)	EN	292,000-295,000	N/A	<ul style="list-style-type: none"> • Number: Unknown • Site of Observation: Tidal flat near the 2nd Cebu-Mactan Bridge (Marcelo Fernan Bridge) • Year of Observation: Unknown 	<ul style="list-style-type: none"> • 25 individuals • Site of Observation: Olango Island • Year of Observation: March 2019

Species	IUCN		Organization responsible for observation		
	IUCN Red List Category	Estimated number of individuals in the World	Birdlife International	Cebu Ornithological Society	eBird (Bird watchers)
Purple Heron (<i>Ardea purpurea</i>)	LC	270,000-570,000	N/A	<ul style="list-style-type: none"> • Number: Unknown • Site of Observation: aquaculture pond in Jugan • Year of Observation: Unknown 	N/A
Chestnut-winged Cuckoo (<i>Clamator cormandus</i>)	LC	N/A	N/A	<ul style="list-style-type: none"> • Number: Unknown • Site of Observation: aquaculture pond in Jugan • Year of Observation: January 2015 	N/A

Source: Birdlife International 2019 (available at: <http://datazone.birdlife.org/site/factsheet/mactan-kalawisan-and-cansaga-bays-iba-philippines/details>), Philippines Biodiversity Conservation Foundation, eBird (available at <https://ebird.org/hotspot/L942437>)

Visayas region, which includes Cebu Island and Mactan Island, is part of the East Asia/Australasia Flyway that extends from the north (i.e. Arctic Russia and North America) to the south (i.e. Australia and New Zealand). The flyway serves as one of the main routes for migratory birds (refer to Figure 4.1.32). Great Knot, Chinese Egret and Grey-tailed Tattler mentioned above also take this route to migrate between north and south.

Olango Island Wildlife Sanctuary (OIWS), located approximately 12 km from the project site, is one of six sites designated as Wetlands of International Importance under the Ramsar Convention in the Philippines, and serves as one of the most important areas in the country for significant numbers of migratory waterbirds, with its mangrove forest and tidal flat providing habitat for staging, wintering, roosting and feeding birds. The annual migration happens towards the winter months starting September when the birds would leave their breeding areas in the northern hemisphere (e.g. Siberia and Polustrov Kamchatka) for their wintering areas in the southern hemisphere (e.g. Australia and New Zealand). These birds stop by an area near Olango Island mostly between December and February, and the migration towards the northern hemisphere happens towards the months of March to May. Around this time of the year, the shorebirds may be seen transitioning to their colorful breeding plumage as they prepare for their long migration to the breeding areas in the north. It is hence possible that the migratory route used by such birds exists within the project area.



Source: Birdlife International 2019 (available at:
https://www.birdlife.org/sites/default/files/attachments/8_East_Asia_Australasia_Factsheet.pdf)

Figure 4.1.32 East Asia/Australasia Flyway

2) Primary Data

a. Preliminary Bird Survey in December 2018

a.1 Survey Method and Locations

Based on the information above, a preliminary bird survey was undertaken from December 10 to 14, 2018. The Survey Team visually recognized number and species of birds using field glasses, and took photographic records. Observation was done from the sidewalk of Cansaga bay bridge, and from the sea side on boat. The survey areas are shown in Figure 4.1.33 .



Source: JICA Survey Team

Figure 4.1.33 Location of Bird Survey

Table 4.1.7 Location (geographical coordinates) of Bird Survey

Location on Map	Name of Survey Area	Longitude	Latitude
①	Cansaga Bay Bridge	10°20'58"	123°58'7"
②	Olango Island	10°24'13"	124°02'7"
③	Cansaga Bay	10°20'33"	123°58'7"
④	Umapad Barangay Waterway	10°16'23"	123°52'14"
⑤	Cansaga Bay Waste Collection Site	10°20'14"	123°58'6"
⑥	Cansaga Inland Bay	10°21'29"	123°57'55"

Source: JICA Survey Team

a.2 Survey Results

The survey found 360 individuals that fall under 11 species in the survey area. If we include those that have been identified in the surrounding areas, the number grows to 540 birds (i.e. 19 species including some unidentifiable ones). Based on the survey, it has been confirmed that the tidal flat facing the mangrove forest located adjacent to the development area in Cansaga Bay is likely to be offering a habitat for herons, snipes and terns (refer to Table 4.1.8 and Table 4.1.9). Threatened species namely Great Knot, Chinese Egrets and Grey-tailed Tattler, on the other hand, were not observed. In consideration of identified importance of the tidal flat in the Cansaga Bay, the road option passing across that area was not prioritized in the alternative analysis (refer to 3.3.2 Analysis on Alternatives).

Table 4.1.8 Birds identified during Bird Survey

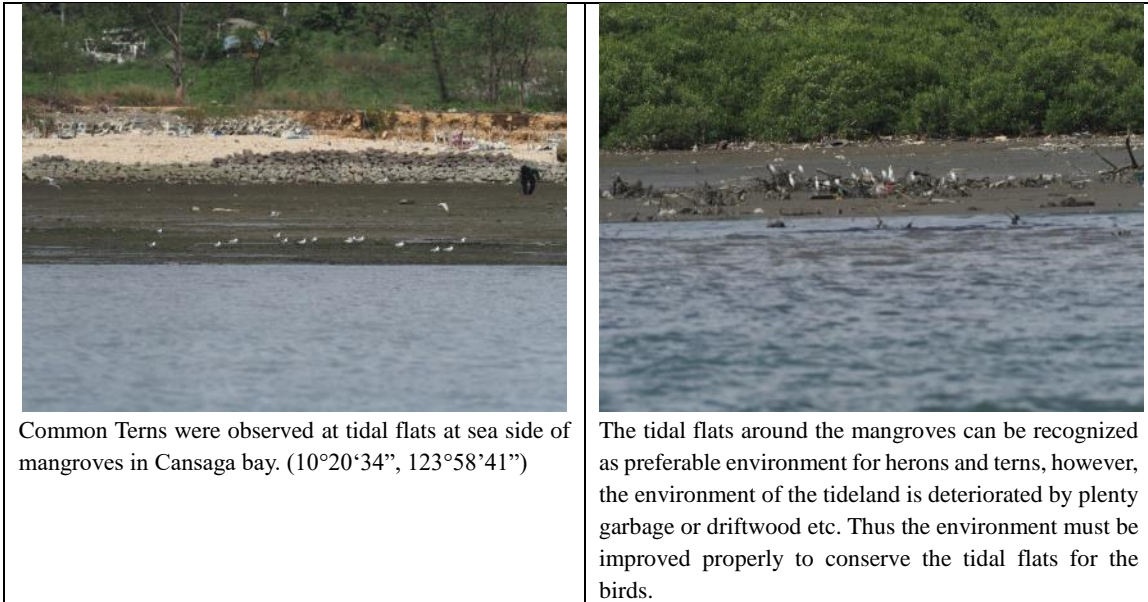
Date	Time	Place	Longitude	Latitude	Common Name	Species	Number
Dec 12	12:00-12:30	Cansaga Bay Bridge	10°20'58"	123°58'7"	Mangrove Kingfisher	<i>Todiramphus chloris</i>	2
					Swift sp.		≧ 10
					Little Egret	<i>Egretta garzetta</i>	≧ 50
					Great Egret	<i>Ardea alba</i>	1
					Javan Pond Heron	<i>Ardeola speciosa</i>	2
					Common Curlew	<i>Numenius arquata</i>	1
					Zebra Dove?	<i>Geopelia striata</i>	1
Dec 13	8:55-9:45	Olango Island	10°24'13"	124°02'7"	Little Egret	<i>Egretta garzetta</i>	≧ 20
					Bar-tailed Godwit	<i>Limosa lapponica</i>	2
					Whimbrel	<i>Numenius phaeopus</i>	1
					Wood sandpiper?	<i>Tringa glareola</i>	3
					Common Tern	<i>Sterna hirundo</i>	≧ 50
					Mangrove Kingfisher	<i>Todiramphus chloris</i>	2
	11:35-12:30	Cansaga Bay	10°20'33"	123°58'7"	Little Egret	<i>Egretta garzetta</i>	58
					Intermediate egret	<i>Egretta intermedia</i>	5
					Great Egret	<i>Ardea alba</i>	4
	16:00-16:20	Waterway	10°16'23"	123°52'14"	Common Tern	<i>Sterna hirundo</i>	≧ 50
					Brahminy Kite	<i>Haliastur indus</i>	1
					Little Grebe	<i>Tachybaptus ruficollis</i>	2
					Phillipine Duck?	<i>Anas luzonica</i>	2
					Moorhen	<i>Gallinula chloropus</i>	2
					Black-headed Munia	<i>Lonchura malacca</i>	≧ 20
					Tree Sparrow	<i>Passer montanus</i>	≧ 50
Dec 14	12:08-12:16	Cansaga Bay Waste	10°20'14"	123°58'6"	Intermediate egret	<i>Egretta intermedia</i>	27

Date	Time	Place	Longitude	Latitude	Common Name	Species	Number	
		Collection Site			Little Egret	<i>Egretta garzetta</i>	1	
					Great Egret	<i>Ardea alba</i>	1	
					Pied Stilt	<i>Himantopus leucocephalus</i>	15	
					Whimbrel	<i>Numenius phaeopus</i>	2	
	14:09-15:07	Cansaga Bay	10°20'34"	123°58'41"	Great Egret	<i>Ardea alba</i>	6	
					Intermediate egret	<i>Egretta intermedia</i>	10	
					Little Egret	<i>Egretta garzetta</i>	15	
	15:30-15:55	Cansaga Inland Bay	10°21'29"	123°57'55"	Common Tern	<i>Sterna hirundo</i>	≥ 100	
					Intermediate egret	<i>Egretta intermedia</i>	18	
					Great Egret	<i>Ardea alba</i>	2	
					Wood sandpiper?	<i>Tringa glareola</i>	2	
Total in Project Site							361	
Total outside of Project Site							177	
					Total	Number of Genus	Number of Species	Number of Individuals
						≥ 16	≥ 19	≥ 538

Source: JICA Survey Team

Table 4.1.9 Photos of Birds identified during Bird Survey

	
<p>Many species of swallow were observed at garbage collection plant adjacent to mangroves along Cansaga bay. The mangroves in the project area may have function to purify the polluted water from garbage plant and squatter residential area.</p>	<p>Herons and terns were observed at wetland near mangroves which is located behind garbage collection area (10°20'14", 123°58'6").</p>
	
<p>Herons and terns were observed at tidal flats at sea side of mangroves in Cansaga bay (10°20'34", 123°58'41").</p>	<p>Colony of Little Egret, Intermediate Egret and Great Egret were observed at tidal flats at sea side of mangroves in Cansaga bay.</p>



b. Bird Survey in March 2019

b.1 Methodology

Assessment of all terrestrial fauna in mangrove and terrestrial vegetation was conducted following the pre-identified road line alignment in the area (refer to 4.1.1.2 (4) 1) d. Charting and Mapping).

Transect lines were established from segment 1 to 3 inside mangrove forest with at least 100 meters apart. The observer used a handy binocular with field identification guide for Philippine birds and Digital Single Lens Reflex (DSLR) camera for photo documentation. Observations were conducted during 6:00 A.M. to 9:00AM and 4:00PM to 6:00PM on March 30 and 31, 2019. All birds, seen or heard calling, were identified and recorded. Stations 4 to 7 were skipped because the area was claimed by the private individual. The activity was continued in segment 8 to 14. At this time, the point count method was used in the area; the observer waited for at least 3 minutes after arriving and then recorded all birds within a 20-meter radius for five minutes. Each station was placed 200 meters apart.

b.2 Results

Species Composition:

A total of twenty-one (21) species belonging to nineteen (19) families have been identified in the remaining mangrove forest and a terrestrial area along the proposed road alignment in Barangay Paknaan and Umapad of Mandaue City and Barangay Ibo of Lapu-Lapu City. Of the birds listed, Egret spp. is a migratory bird. White-collared Kingfisher is resident, and some are endemic species. The similar characteristics of egrets demonstrates the difficulty of taxonomic identification. With the assistance of local and international bird experts, it is concluded that the Egret spp. observed in this assessment are, most probably, either Great Egret, Intermediate Egret or Little Egret. Nevertheless, it should be noted that no sighting of threatened species such as Chinese Egret in a single-shot survey does not prove that they do not exist.

Species Population





A total number of 175 individuals of bird species were identified in the surveyed area. Of the twenty-one (21) species, Egret spp. (most probably, either Great Egret, Intermediate Egret or Little Egret) recorded the highest number of individuals with a total of 38 followed by Eurasian Tree

Sparrow (*Passer montanus*) (35 number of individuals), Terns spp. (25 number of individuals) and Glossy swiftlet (*Collocalia esculenta*) with 21 number of individuals, respectively. The rest of the species identified had registered below 15 numbers of individuals (Table 4.1.10). All the species identified in the area belong to Least Concern (LC) under the IUCN Red List.

Table 4.1.10 List of birds found within the Right of Way

Species		No. of Individuals	Status	Current IUCN Red List Category
Family/Scientific Name	Common Name			
A) Alcediniidae 1. <i>Todiramphus chloris</i>	White-collared Kingfisher	2	Resident	Least concern
B) Apodidae 2. <i>Collocalia esculenta</i>	Glossy swiftlet	21		Least concern
C) Ardeidae 3. <i>Egretta spp.</i>	(Great Egret/Intermediate Egret/Little Egret)	38	Migratory	Least concern
D) Ardeidae 4. <i>Nycticorax nycticorax</i>	Black-crowned night heron	2		Least concern
E) Campephagidae 5. <i>Lalage nigra</i>	Pied triller	1		Least concern
F) Charadriidae 6. <i>Charadrius mongolus</i> 7. <i>Pluvialis fulva</i>	Lesser Sand plover Pacific Golden plover	2 3		Least concern Least concern
G) Columbidae 8. <i>Geopelia striata</i>	Zebra Dove	4		Least concern
H) Decacidae 9. <i>Dicaeum australe</i>	Red-keeled flowerpecker	1		Least concern
I) Estrildidae 10. <i>Lonchura atricapilla</i>	Chestnut munia	12		Least concern
G) Laniidae 11. <i>Lanius cristatus</i> 12. <i>Lanius schach</i>	Brown shrike Long-tailed shrike	1 2		Least concern Least concern
K) Laridae 13. <i>Terns Spp.</i>	Terns <i>Spp.</i>	25		Least concern
L) Muscicapidae 14. <i>Cyornis rufigastra</i>	Mangrove blue-flycatcher	6		Least concern
M) Nectarinidae 15. <i>Cinnyris jugalaris</i>	Olive-backed sunbird	2		Least concern
N) Passeridae 16. <i>Passer montanus</i>	Eurasian tree sparrow	35		Least concern
O) Picnonotidae 17. <i>Pycnonotus goiavier</i>	Yellow-vented bulbul	3		Least concern
P) Rallidae 18. <i>Hypotaenidia torquate</i>	Barred rail	1		Least concern
Q) Rhipiduridae 19. <i>Rhipidura nigritorquis</i>	Pied Fantail	7		Least concern
R) Scolopacidae 20. <i>Tringa nebularia</i>	Common greenshank	2		Least concern
S) Sturnidae 21. <i>Aplonis panayensis</i>	Asian glossy Starling	5		Least concern
TOTAL		175		

Table 4.1.11 Photos of Fauna Assessment

	
<p>Avifauna survey using a handy binocular to observe a flock of birds within Segment 1 of Road 2 alignment at Barangay Paknaan, Mandaue City, Cebu.</p>	<p>A tern species of bird that belonged to Laridae family is perching on a water hose which crosses bank of Butuanon River from Barangay Paknaan to Barangay Umapad in Mandaue City, Cebu (Station 8-9 of Road 2 alignment).</p>
	
<p>An Egret spp., which shows characteristics of Intermediate Egret, was observed feeding in the open area near Station 1-2 of Road 2 alignment of Barangay Paknaan, Mandaue City.</p>	<p>An Egret spp., which shows characteristics of Little Egret, was spotted in near a fishpond development (segment/station 4 of Road 1 alignment).</p>

3) Interview to Local Experts on Birds and their Habitats

In general, long-term monitoring data of bird population over two seasons is of great importance to grasp accurately the baseline condition of birds, in particular migratory birds including threatened species, in the project area. This is because the result of one-shot surveys is insufficient to describe the target birdlife accurately due to its temporal and seasonal variations. However, as a result of consultations with relevant organizations/institutions, it is found that there is no such data for the project area unlike Olango Island where DENR has been conducting regular monitoring survey on bird species and population. Hence, to fill the gap and complement the one-shot survey findings, the Survey Team carried out interviews to local experts on birds.

a. Methodology

The Survey team presented the project brief, with an emphasis on the fact that the entire project area is located in an IBA/KBA because of the sighting records of threatened bird species such as Chinese Egret in 1980s, and asked questions on adverse impacts of the project on birds and their habitats and possible mitigation measures in the semi-structured interviews. A semi-structured interview is a meeting in which the interviewer does not strictly follow a formalized list of questions. They ask more open-ended questions, allowing for a discussion with the interviewee rather than a straightforward question and answer format.

b. Interviewee

Interviews were carried out to the following local experts. In consideration of the experiences in bird surveys near the Cansaga Bay area as well as the role of designation of this area as an IBA, technical insights from the Philippines Biodiversity Conservation Foundation, Inc., DENR-

CENRO, the Former president of Cebu Biodiversity Conservation Foundation, Inc. and Haribon Foundation are referred to.

Table 4.1.12 Interviews with the local experts

Organization/Institution	Experience in bird survey in Cansaga Bay Area
Philippines Biodiversity Conservation Foundation, Inc.	Yes - More than 20 years of bird census in Cebu Region - Chief editor of “State of Cebu’s Biodiversity”
DENR-CENRO	Yes - Experience in bird census in Olango Island
Former president of Cebu Biodiversity Conservation Foundation, Inc.(Cebu Chamber of Commerce and Industry)	Yes - Formerly led bird census team in Cebu
Haribon Foundation	Unknown - The organization that designated the IBA in collaboration with Birdlife International
University of Philippines Cebu	No
Freelance Consultant	No
Wild Bird Club of the Philippines	No

c. Summary of the Interview Results

Table 4.1.13 shows the summary of technical insights provided by the interviewed experts. All of them highlighted the higher importance of Olango Island and Jugan area as birds’ roosting and feeding grounds relative to the Cansaga Bay area, as the Cansaga Bay area is highly degraded as birds’ habitat due to development carried out over years since 1980s. They also mentioned that they did not have any observation record of migratory endangered species or their nests such as Chinese Egret near the Cansaga Bay area, and that Little Egret, Intermediate Egret and/or Great Egret are often misidentified with Chinese Egret due to their similar characteristics. Nevertheless, they also indicated that some individuals of endangered species including Chinese Egret, recorded to roost and feed in Olango Island, may fly to the Cansaga Bay area to look for alternative feeding ground, when Olango Island is not utilizable due to, for example, high tide time. This is likely not only in the peaks of migration seasons (i.e. December-February towards north and September-October towards south), but also in period other than those seasons, as some individuals are recorded to overstay in the Central Visayas area, including Olango Island, Cansaga Bay area and Jugan area, not flying over to their general destinations in the northern hemisphere (i.e. Siberia and Polustrov Kamchatka) and Southern hemisphere (i.e. Australia and New Zealand). This demonstrates how important it would be to conduct regular bird monitoring.

Table 4.1.13 Summary of insights by local experts

Interviewee	Summary
Philippines Biodiversity Conservation Foundation, Inc. (Executive Manager and Operations Manager)	<ul style="list-style-type: none"> • In 1980s, the continuous area “Jugan- Cansaga bay-Olango Island” used to be an important feeding/roosting area for migratory birds. However, the area surrounding the mouth of Cansaga bay is no more functional as a feeding/roosting area due to heavy siltation of tidal flat and development activities such as reclamation and fishpond operation causing degradation of mangrove forest. Hence, since 2000s, Olango Island and Jugan areas are the only functional and important feeding/roosting grounds for migratory birds. • The peak of migration towards northern hemisphere is December-February, and that of migration towards south (i.e. Australia and New Zealand) is September-October. There are some individuals that do not fly to Australia and New Zealand and overstay in Central Visayas area. It is thus important to carry out regular monitoring not only over two migration seasons but also the period between them. • Endangered migratory bird species such as Chinese Egret have not been observed near the project site, whereas they have been observed in Olango Island and Jugan. Egret species that are often misidentified as Chinese Egret due to similar characteristics are mostly Little Egret, Intermediate Egret or Great Egret (*Indeed, pictures of birds that the Survey Team took during the flora and fauna survey was checked by the Philippines Biodiversity Conservation Foundation, Inc. and no Chinese Egret was identified in the pictures).
DENR (Olango Island-	<ul style="list-style-type: none"> • DENR just started quarterly water birds census near the Cansaga Bay since January 2019. The 2nd census is to be done in June 2019. Joint monitoring with the new Mactan Bridge project

Interviewee	Summary
based Protected Area Coordinator)	<p>would be appreciated.</p> <ul style="list-style-type: none"> • In the 1st census in January 2019, any endangered species such as Chinese Egret was not observed near the Cansaga Bay, whereas many of them were recorded feeding and roosting in Olango Island. The egret species found feeding near the Cansaga Bay area included Little Egret and Intermediate Egret. • When Olango Island is in high tide, birds tend to look for other feeding ground, possibly Jugan and Cansaga Bay area. • It is recommended to avoid construction work during low tide when birds come to feed on tidal flats and other wetlands. • Two season survey is needed only for fauna in tidal flats because living conditions are different over seasons (i.e. under and above water). In addition, these invertebrates are important because they serve as resources for migratory birds. • DENR-CENRO agrees on the suggested plan to make the interchange area to be maintained as wetland area for birds to be able to continue to use the area as feeding ground.
Former president of Cebu Biodiversity Conservation Foundation, Inc	<ul style="list-style-type: none"> • Main feeding and roosting ground of the birds observed near the project site is Olango Island. They are also observed in Talibon, Bohol Island. • Since the mangrove forest facing the Cansaga Bay has already been severely disturbed, it is doubtful whether birds can still roost in that forest. Also, Olango Island is the most important bird habitat in the Central Visayas area. Considering that the quality of the mangrove forest facing the Cansaga Bay in terms of birds' roosting area and that Olango Island can host many birds as feeding and roosting grounds, it is unlikely that the project site (i.e. Cansaga Bay area) is presently an irreplaceable important habitat for bird species, in particular, endangered species. • Even if endangered bird species feed on the tidal flat near the Cansaga Bay and if the tidal flat near the Cansaga Bay is degraded as feeding ground due to road and bridge constructions, I think that endangered species would be hardly affected because they can move to other habitable sites such as Olango Island looking for feeding/roosting grounds. • Given the project site is designated as IBA/KBA, it is recommendable to conduct an orientation on how to deal with sightings of endangered species during construction phase for implementers such as DPWH and contractors. • It would be advisable to integrate in the designing the element that can possibly contribute to the project site becoming a touristic spot making use of the environmental value of IBA/KBA, such as viewpoint of mangrove and tidal flats on the interchange section.
Haribon Foundation	<ul style="list-style-type: none"> • The project site (ROW) and the surrounding environment is the most ideal habitat for birds because the tidal flats provide feeding ground, while mangrove provides areas for roosting. • Dwindling habitats for birds forces these birds to seek refuge in any place they can find for feeding and resting. • It is recommended to conduct the second stage of the bird survey in the period between September-March where the migratory birds visit the area. The survey should be detailed so as to identify the egret species. Suggest to conduct an RBI (Rapid Biodiversity Inventory). Haribon foundation could do such study. • The construction activities will be the most critical as the area will be highly disturbed and could prevent the birds from accessing their foraging and roosting places. • As for the operation stage, it is still unclear whether the noise could affect the birds—that is, if the environment/habitat will be preserved/maintained or restored back after construction • Construction activities should not significantly pose disturbances to birds during the migration season (September-March). • After construction, the natural habitat shall be restored and the area be declared as a 'critical habitat' to allow local or national protection of the area • There are example that bridges have become 'viewing decks' for bird watching, when the surrounding environments have been restored back to more or less to its original state. • If the disturbance to birds caused by the construction activities will be mitigated, then the project will be implemented • Restoration of the habitat shall be undertaken after the construction stage and measures to protect the area (e.g. declaring it as a critical habitat) shall be implemented all throughout the operational stage of the project. However, declaration of 'critical habitat' shall be made when it is found out appropriate after undertaking an RBI. • The presence of fishponds and swamps provides alternative choices for birds to forage and roost. This area will probably be one of the few remaining areas, including Jugan, which the birds could visit outside of the Olango Island.

(3) Terrestrial Flora

To identify the existing terrestrial flora in the project site, an ocular study was undertaken in March 2019, focusing on mangrove and terrestrial tree in accordance with the scoping checklist agreed at the technical scoping with the EIA Review Committee. The study is comprised of an inventory and assessment of the stand structure and species composition of the mangrove and terrestrial trees within the Right of Way (RoW) of the New Mactan Bridge and the Mandaue Coastal Road.

Based on discussions with aforementioned local experts and secondary data analysis, it is concluded that flora and fauna surveys over two seasons (i.e. dry and rainy seasons) are unnecessary except for fauna living on wetland for the following reasons:

- The parameters used for grasping the baseline condition of mangrove and terrestrial trees such as species composition, density and abundances do not vary notably with the season because these parameters change over a longer period of time. Indeed, the FAO's National Forestry Inventory Field Manual Template (2004) recommends to conduct assessments with an interval of over 1 year. The Forestry Agency of Japan also carries out a forest resource assessment once in about five years.
- Aquatic fauna living on wetlands, on the other hand, are susceptible to the seasonal variations of environmental conditions, particularly the amount of water, because their habitats are affected directly, resulting in the change in distribution, species composition and abundance. In addition, understanding the baseline condition of the organisms living on wetland is important because organisms living on wetland, especially macro vertebrates, serve as the food for birds that are among the most salient characteristics of the natural environment in the project area.

1) Mangrove

a. Methodology and Survey Locations

Transect lines were run following the center line in the pre-identified stations. Five sampling segments only (Segment 1-2, 2-3, 3-4, 7-8, 11-12, and 12-13) were inventoried for mangrove assessment since other portions of mangrove areas are privately owned with an on-going reclamation activity and the Survey Team was not allowed to pass in these areas.

To facilitate inventory and data collection, transect lines were segmented at every 100 m distance resulting to 40 m x 100 m sampling stations. All mangrove species encountered along the transect line were identified, measured and recorded as to: species; diameter at breast height (DBH); total height; and the regeneration which includes 5cm below in DBH. From the data collected, the following parameters were computed: Frequency (F); Relative Frequency (RF); Relative Density (RDen); Relative Dominance (RDom); a number of trees per hectare; basal area per hectare; and importance value (IV) of mangrove species. The following formulas were used in the computation.

Frequency (F)

$$F = \frac{\text{Total No. of Segments in which Species A occur}}{\text{Total No. of Segments Sampled}} \times 100$$

Relative Frequency (RF)

$$RF = \frac{\text{F Value of Species A}}{\text{Total F Value of All Species}} \times 100$$

Relative Density (RDen)

$$\text{No. of Individuals of Species A}$$

$$RD_{En} = \frac{\text{Total No. of Individuals of All Species}}{\text{Total No. of Individuals of All Species}} \times 100$$

Relative Dominance (RDom)

$$RDom = \frac{\text{Total Basal Area of Species A}}{\text{Total Basal Area of All Species}} \times 100$$

Importance Value (IV)

$$IV = RF + RDen + RDom$$

Basal Area

$$\text{Average BA per ha} = \frac{\text{Total Basal Area (m}^2\text{)}}{\text{Total Area Sampled}} \times 100$$

Regeneration

$$\text{Regeneration (per sq.m)} = \frac{\text{Total Regeneration Count per Species A}}{\text{Total No. of Regeneration Plots}}$$

The relative location of these study sites is shown in Figure 4.1.34.

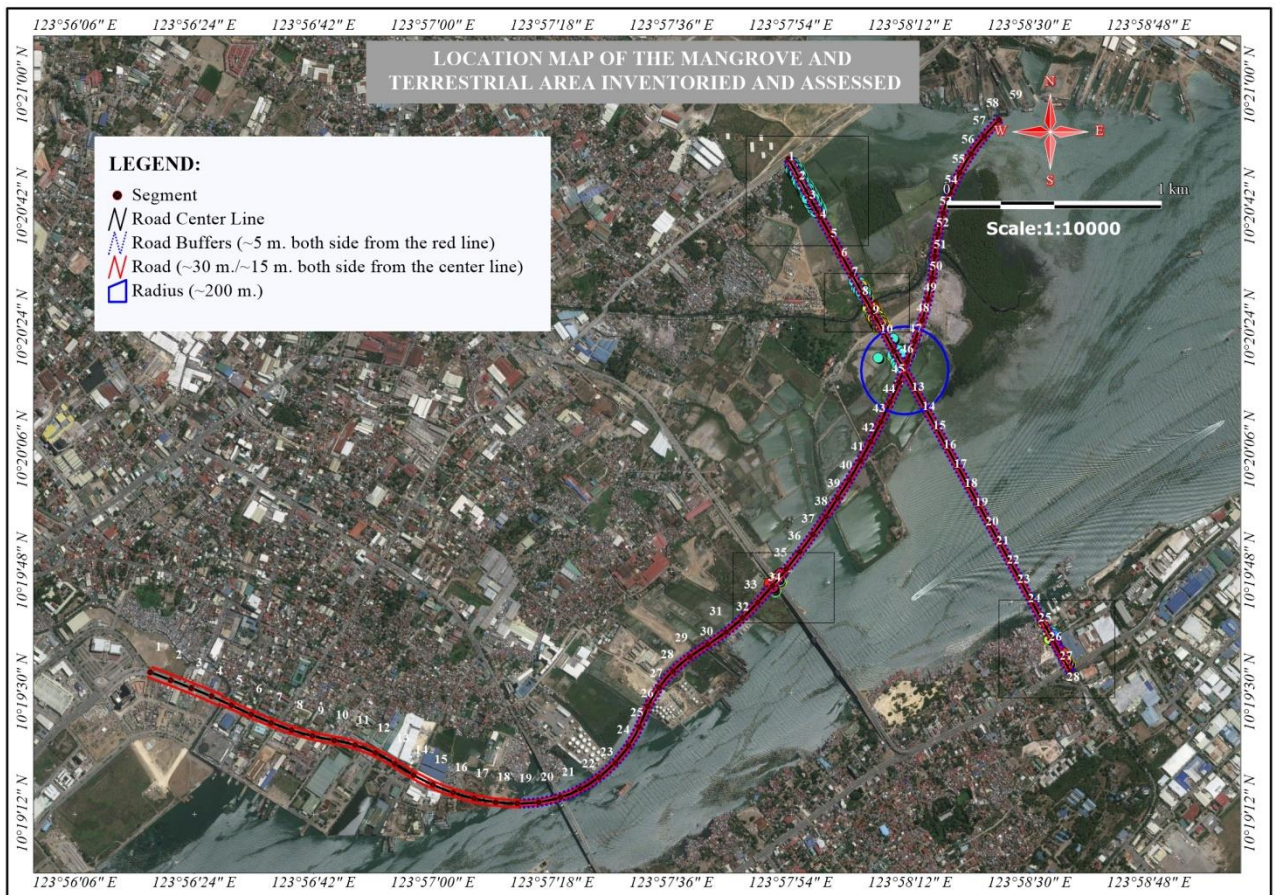


Figure 4.1.34 Location map of mangrove forest and terrestrial areas assessed

b. Survey Results

The mangrove forest is mainly distributed in Barangay Paknaan and Umapad of Mandaue City in the project site. A total of four species (4) mangrove species belonging to three (3) families were identified in the area, namely: 1) *Rhizophora apiculata* (Bakauan-lalaki); *R. stylosa* (Bakauan-bangkau); *Avicennia marina* (Bungalon); and *Sonneratia alba* (Pagatpat) as reflected in Table 4.1.14. All species are classified under Least Concern (LC) in the IUCN Red List.

Table 4.1.14 Species composition and diversity of the mangrove forest assessed

Family Name	Scientific Name	Common Name	IUCN Red List
1. Rhizophoraceae	1. <i>Rhizophora apiculata</i>	Bakuan lalaki	Least Concern (LC)
	2. <i>Rhizophora stylosa</i>	Bakuan bangkau	Least Concern (LC)
2. Avicenniaceae	3. <i>Avicennia marina</i>	Bungalon	Least Concern (LC)
3. Sonneratiaceae	3. <i>Sonneratia alba</i>	Pagatpat	Least Concern (LC)

Table 4.1.15 shows the stand structure and characteristics in the mangrove areas assessed. *Avicennia marina* recorded the highest Importance Value¹ (IV) with a total of 233.24. Ranked second is *Rhizophora stylosa* with an IV of 26.40 followed by *Sonneratia alba* (IV of 23.99) and the lowest was *Rhizophora apiculata* with a total of 16.37 IV only. The rest are of lesser importance in terms of their frequency of occurrence/distribution within the stand, their number of individuals, and the basal area occupied by the main stem.

The assessed mangrove areas registered the abundance of a total of 270 trees/ha only, mostly attributed by *Avicennia marina* having a relative dominance of 98.38%. The mangrove stand is largely made up of small size trees having an average basal area per ha of 7.080m² for the 270 trees/ha (Table 1b) or averaging about 10.92 cm stem diameter and 6.78 m in height per tree. There is inadequate natural regeneration having recorded an average of 935 regenerants per hectare.

Table 4.1.15 Stand structure and species composition of the remaining mangrove forest

Species	No. of Segment	Total No. of Trees	Total BA (m ²)	Frequency	Relative Frequency (%)	Relative Density (%)	Relative Dominance (%)	Important Value	Abundance (Trees/ha)	Basal Area (m ² /ha)	Regeneration (per ha)
<i>Rhizophora stylosa</i>	3	31	0.300	60.00	23.08	2.43	0.89	26.40	7	0.063	6
<i>Rhizophora apiculata</i>	2	6	0.173	40.00	15.38	0.47	0.52	16.37	1	0.036	3
<i>Avicennia marina</i>	5	1232	33.024	100.00	38.46	96.40	98.38	233.24	260	6.965	925
<i>Sonneratia alba</i>	3	9	0.0714	60.00	23.08	0.70	0.21	23.99	2	0.015	7
TOTAL	-	1278	33.568	260.00	100.0	100.0	100.00	300.00	270	7.080	935

Note)

No. of Segment Sampled: 5

The dimension of Segment: 4 segments with a dimension of 40m x 100m and 1 segment with a dimension of 200m radius located in the pre-identified station 11-12 and station 12-13

¹ Importance Value = Relative Frequency + Relative Density + Relative Dominance

Table 4.1.16 Photos of mangrove assessment

<p>A transect line is laid out to determine the center line of the road alignment that traverses Paknaan mangrove area to the 4th New Mactan Bridge (Road 2).</p>	<p>A first tree corner of the inventoried mangrove area is measured by a survey team member.</p>
<p>Measuring a stem/bole (diameter at breast height) of mangrove tree in Barangay Paknaan, Mandaue City, Cebu.</p>	<p>An on-going reclamation activity in mangrove area with significant tree covers at Paknaan road alignment covering Segments/Stations 4 to 7 (i.e., highlighted in red color).</p>
<p>Informal settlers in mangrove area that would be affected by the proposed road project (i.e., located at segment 7-8 in Road 2).</p>	<p>Segment 8 of Road 2 shows the inventoried mangrove vegetation and informal settlers.</p>



A panoramic view of the assessed mangrove area at Segments 11 to 13 of Road 2 and Segments 45 to 47 of Road 1 near the landfill, which is marked in red color.

2) Terrestrial Vegetation

a. Methodology and Survey Locations

Transect lines were run following the center line in the pre-identified stations. Six sampling segments only (Segment 8-9, 9-10, 24-25, 25-26, 33-34, and 34-35) were inventoried since other portions of the proposed roads is mangrove area, abandoned fishpond and landfill areas.

To facilitate inventory and data collection, transect lines were segmented at every 100 m distance resulting in 40 m x 100 m sampling stations. All terrestrial tree species encountered along the transect line were identified, measured and recorded as to species; diameter; merchantable height; total height; and the regeneration. The volume of every tree recorded is based on the “Regional Volume Equation for Standing Trees”². For volume data computation and analysis, the following formula was used.

$$\text{Volume} = 0.4874 \times (D^2) \times \text{MH}$$

b. Survey Results

b.1 Species Composition and Diversity

A total of twenty-six (26) terrestrial tree species belonging to fourteen (14) families were found in the surveyed area. Of the fourteen families, Fabaceae family recorded the highest number of species with a total of seven (7) species followed by Miliaceaceae family having a total of three species followed by Myrtaceae and verbenaceae with a total of 2 species each. The rest of the families were recorded one species each only. Of the twenty-six (26) species identified, a total of two (2) species are belonging to premium species, namely: 1) Molave (*Vitex parviflora*) and 2) Narra (*Pterocarpus indicus*). There were three (3) exotic species identified in survey areas such as Mahogany (*Swietenia macrophylla*), *Eucalyptus camaldulenses*, and Gmelina (*Gmelina arborea*). The rest of the species are indigenous, rurit trees and a lesser known species. Molave (*Vitex parvoflora*) is included in the list of threatened plants in the Philippines and their category stipulated in DAO No. 1-2007, being classified as category B belonging to endangered species, while all other species are not included in the list.

b.2 Stand Structures and Characteristics

The stand largely comprised of small, medium to large size trees. The large tree was *Alstonia scholaris* and *Ficus baletae* having a stem diameter of 85.94 cm, 10.0 m in merchantable height, and

² DENR Forest Management Bureau Technical Bulletin No. 2

20.0 m in average total height, respectively. While the medium size tree was *Acacia auriculiformis* averaging 22.7 cm stem diameter and 8.43 m in height per tree. Other species are considered small trees having an average diameter ranging from 5.00 cm to 24 cm in diameter per tree. The stand has an average diameter breast height, average merchantable height, and average height of a total of 19.13 cm, 4.27 m, and 8.25 m, respectively (Table 4.1.17).

Table 4.1.17 Species composition, diversity and Stand characteristics of terrestrial trees

Common Name	Scientific Name	List of threatened plants in Philippines (DAO No.1-2007)	Average Diameter Breast Height (cm)	Average Merchantable Height (m)	Average Height (m)
1. Anabiong	<i>Trema Orientalis</i>	Not included	17.74	2.82	8.43
2. Aroma	<i>Aroma farnesiana</i>	ditto	11.13	2.3	8.8
3. Atipo	Unknown	ditto	18.83	6	8.3
4. A. Auriculiformis	<i>Acasia auriculiformis</i>	ditto	22.7	2.82	8.43
5. Bagalunga	<i>Melia dubia</i>	ditto	12.8	3.7	7
6. Balete	<i>Ficus balete</i>	ditto	38.78	5.6	16.8
7. Bani	<i>Millettia pinnata</i>	ditto	13.4	1	5
8. Binunga	<i>Azadirachta indica</i>	ditto	11.33	2.85	7.6
9. Colis	Unknown	ditto	2.3	3	7
10. Caimito	<i>Chrysophyllum cainito</i>	ditto	22.36	2.6	7.2
11. Dita	<i>Alstonia scholaris</i>	ditto	85.94	10	22
12. E. camaldulensis	<i>Eucalyptus camaldulenses</i>	ditto	18.49	4.2	11.75
13. E. deglupta	<i>Eucalyptus deglupta</i>	ditto	20.67	4.22	13.44
14. Balite	<i>Ficus balite</i>	ditto	13.85	1.35	7.92
15. Fire Tree	<i>Delonix regia</i>	ditto	16.87	3.13	6.89
16. Gmelina	<i>Gmelina arborea</i>	ditto	27.93	4.93	11.19
17. Guava	<i>Psidium guajava</i>	ditto	8	2	4
18. Guyabano	<i>Annona muricata</i>	ditto	8	2	3
19. Indian Mast Tree	<i>Polyalthia lungifolia</i>	ditto	15.47	4.06	8.42
20. Ipil-ipil	<i>Leucaena leucocephala</i>	ditto	18.6	3.01	0.41
21. Kapok	<i>Ceiba pentandra</i>	ditto	34	4	10
22. Talisay gubat	<i>Terminalia foedisitimma</i>	ditto	7.5	3	5
23.. Mahogany	<i>Swietenia macrophylla</i>	ditto	14.44	3.27	7.61
24. Mangium	<i>Acacia mangium</i>	ditto	34.3	3.6	10.2
25. Mansanitas	<i>Ziziphus jujube</i>	ditto	12.06	1.71	4.26
26. Misc. spp.	N/A	ditto	12.53	33.3	7.46
27. Molave	<i>Vitex parviflora</i>	Endangered species	12.23	3.15	7.32
28. Narra	<i>Pterocarpus indicus</i>	Not included	16.92	2.6	7.73
29. Neem	<i>Azadirachta indica</i>	ditto	18.71	3.67	8.83
30. Noni	<i>Morinda citrifolia</i>	ditto	7	1.5	5
31. Rain Tree	<i>Samanea saman</i>	ditto	22.8	3.5	10.3
32. Talisay	<i>Terminalia catappa</i>	ditto	14.26	4.58	9.15
32. Taluto	<i>Pterocymbium tictorium</i>	ditto	21	4	7
34. Tambis	<i>Syzygium aqeuum</i>	ditto	17.5	1.75	7
		AVERAGE	19.13	4.27	8.25

b.3 Volume

The surveyed area has a total number of terrestrial trees of about 1,368 trees with a total volume of about 71.71 m³. Mahogany recorded the highest number of trees having a total of 662 trees. Ranked second and third were narra and molave having a total of 152 trees with 4.32 m³ and 118 trees with a total of 3.14 m³, respectively. It was followed by Ipil-ipil with a total of 74 trees. The rest of the terrestrial species were recorded below 60 trees as presented in Table 4.1.18.

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SPECIES	DIAMETER CLASS IN DIAMETERS														TOTAL	
	10		20		30		40		50		60		90		No. of Indv'l	Vol
	No. of Indv'l	Vol	No. of Indv'l	Vol	No. of Indv'l	Vol	No. of Indv'l	Vol	No. of Indv'l	Vol	No. of Indv'l	Vol	No. of Indv'l	Vol		
A. Premium species																
1. Molave	85	1.28	27	1.37	6	0.49									118	3.14
2. Narra	88	1.62	64	2.70											152	4.32
SUB-TOTAL	173	2.90	91	4.07	6	0.49									270	7.47
B- Lesser used species																
1. Acacia auriculiformis	3	0.04	4	0.15	7	0.77	1	0.27							15	1.23
2. Acacia mangium			1	0.27	5	0.72	3	0.82			1	0.35			10	2.16
3. Anabiong	1	0.01	2	0.02	1	0.18									4	0.20
4. Aroma	3	0.04													3	0.04
5. Bagalunga	4	0.07	2	0.09											6	0.16
6. Balite	11	0.30	2	0.06	4	0.98	1	0.50							18	1.84
7. Bani	1	0.01													1	0.01
8. Binunga	8	0.11	4	0.22											12	0.34
9. Colis			1	0.16											1	0.16
10. Dita													1	3.60	1	3.60
11. Eucalyptus camadulensis	8	0.21	24	1.83											32	2.03
12. Eucalyptus deglupta			1	0.08	9	1.43									10	1.51
13. Fire Tree	6	0.12	13	0.84											19	0.96
14. Gmelina	5	0.17	8	0.77	13	1.61	5	1.95	4	2.26					35	6.76
15. Guava	1	0.01													1	0.01
16. Guyabano	1	0.01													1	0.01
17. Indian Mast Tree	29	0.43	18	1.83	6	1.55									53	3.81
18. Ipil-ipil	47	0.53	25	1.41	2	0.21									74	2.15
19. Kaimito	1	0.04	3	0.13			1	0.12							5	0.28
20. Kapok					2	0.45									2	0.45
21. Mahogany	410	7.56	193	9.56	49	6.93	8	1.78	1	0.53	1	0.53			662	26.89
22. Mansanitas	14	0.07	2	0.11											16	0.18
23. Misc. spp.	9	0.14	3	0.13	1	0.09									13	0.36
24. Neem			38	2.51	23	2.46	12	2.45	1	0.15					74	7.58
25. Talisay	11	0.24	15	1.13											26	1.37
26. Talisay gubat	1	0.01													1	0.01
27. Taluto			1	0.09											1	0.09
28. Tambis			2	0.06											2	0.06
SUB-TOTAL	574	10.12	362	21.44	122	17.38	31	7.89	6	2.94	2	0.88	1	3.60	1,098	64.25
TOTAL	747	13.02	453	25.51	128	17.87	31	7.89	6	2.94	2	0.88	1	3.60	1,368	71.71

Table 4.1.18 List of the computed volume of terrestrial tree species

b.4 Charting and Mapping

Charting and mapping were prepared using the gathered coordinates in each mangrove and terrestrial trees identified in the proposed road construction and bridge in Mandaue and Lapu-Lapu City as presented in Table 4.1.19 and Figure 4.1.37 to Figure 4.1.41.

Table 4.1.19 Summary of the number of mangroves and terrestrial trees per station

Station No.	No. of Trees		Remarks
	Mangrove	Terrestrial	
<i>Road 1</i>			
1-2 to 16-17			Settlement build up areas connecting to the existing road
17-18			Old reclaimed area
18-19 to 24-25			Mactan channel
25-26 to 31-32			Old reclaimed areas with the private business claimant (e.g. International Pharmaceutical, Inc.etc.)
32-33			Privately claimed area, but previously reclaimed
33-34		23	Below Marcelo Fernan bridge and utilized for the public plaza of Barangay Umapad
34-35		23	Previously reclaimed area near Marcelo Fernan bridge
35-36 to 45-46			Fishpond aquaculture development
46-47 to 49-50			Mandaue sanitary landfill area
50-51 to 58-59			No survey made in these portions/ For future road expansion connecting to Liloan
<i>Road 2</i>			
1-2	323		Mangrove areas
2-3	388		-do-
3-4	298		-do-
4-7			Reclaimed areas
7-8	64		Mangrove areas
8-9		14	Dryland areas/Mandaue Ecopark
9-10		76	-do-
10-11			Dryland/Mandaue sanitary landfill areas
11-12	66		Abandoned fishpond with natural mangrove stand
12-13			Abandoned fishpond
13-14			-do-
14-15 to 15-24			Mactan Channel/sea
24-25		20	Dryland areas (Commercial, manufacturing industries)
25-26		11	-do-
26-34		900	-do-
TOTAL	1,142	1,140	

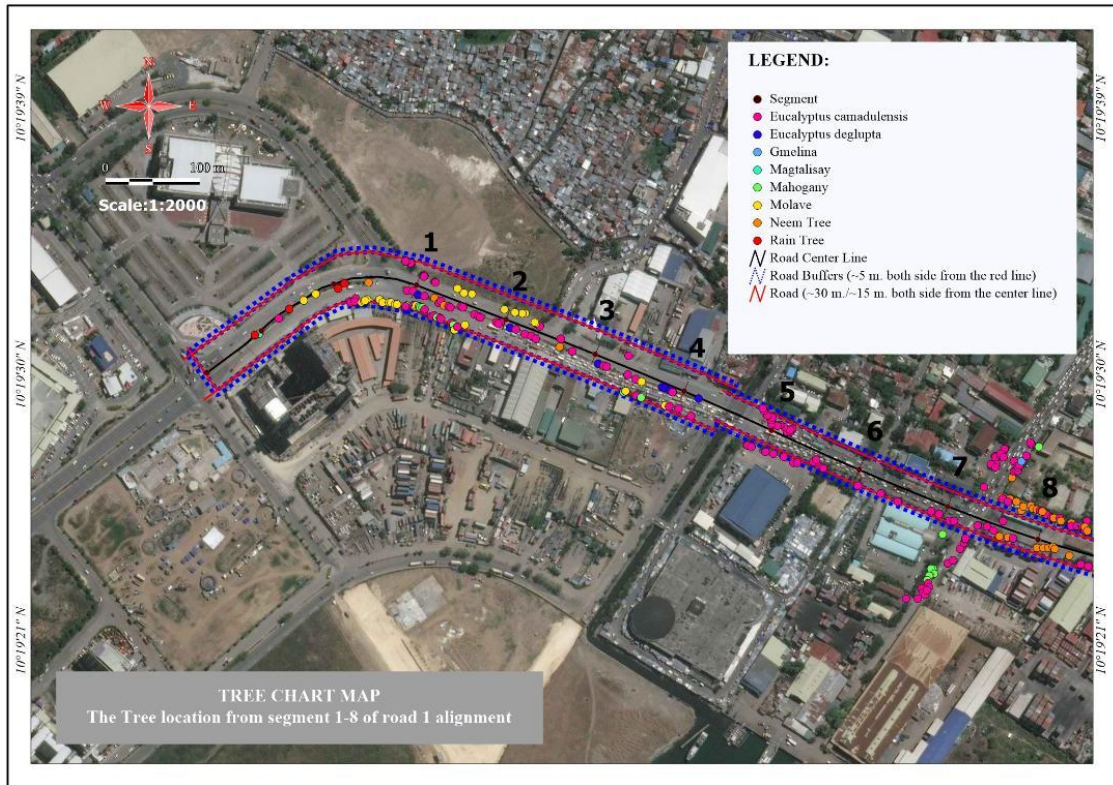


Figure 4.1.35 Chart map of terrestrial trees inventoried and assessed in segment 0- 8 of Road 1

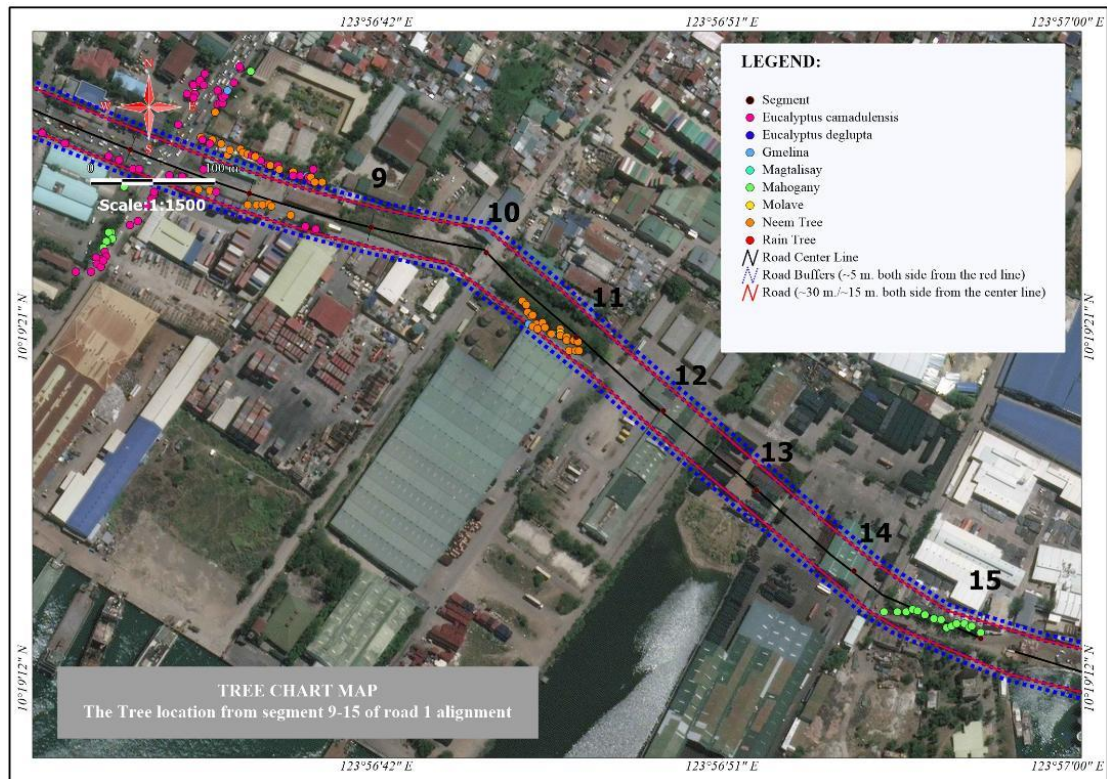


Figure 4.1.36 Chart map of terrestrial trees inventoried and assessed in segment 9-15 of Road 1

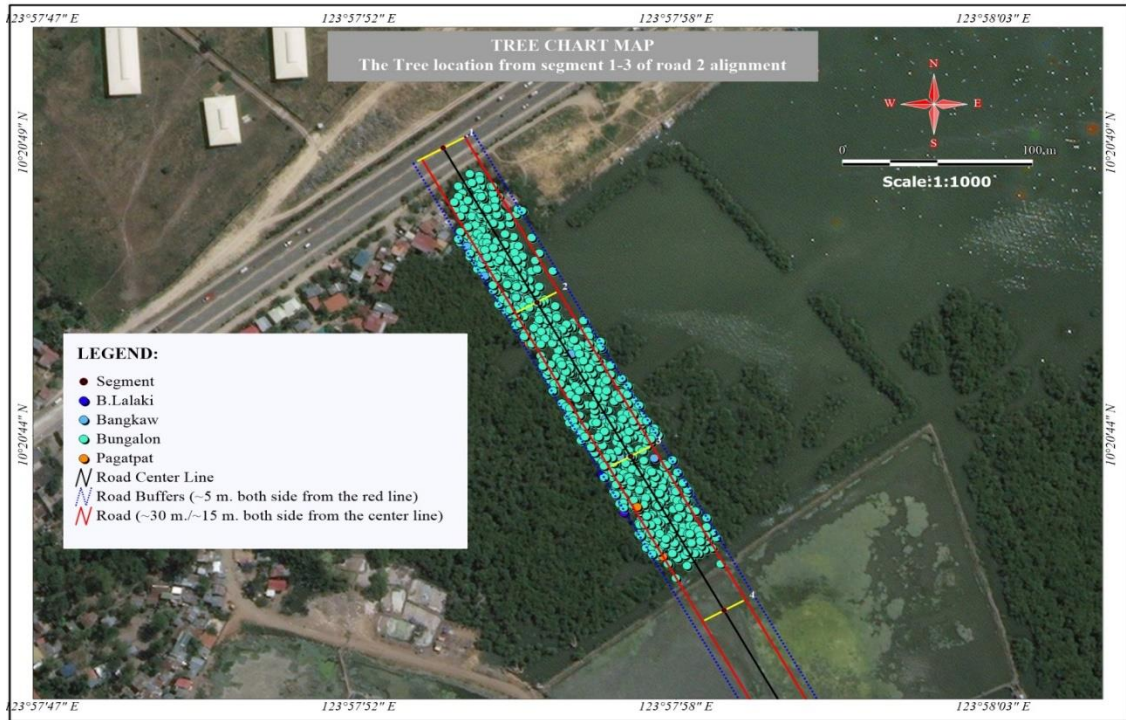


Figure 4.1.37 Chart map of mangrove trees inventoried and assessed in segment 1-3 of Road 2

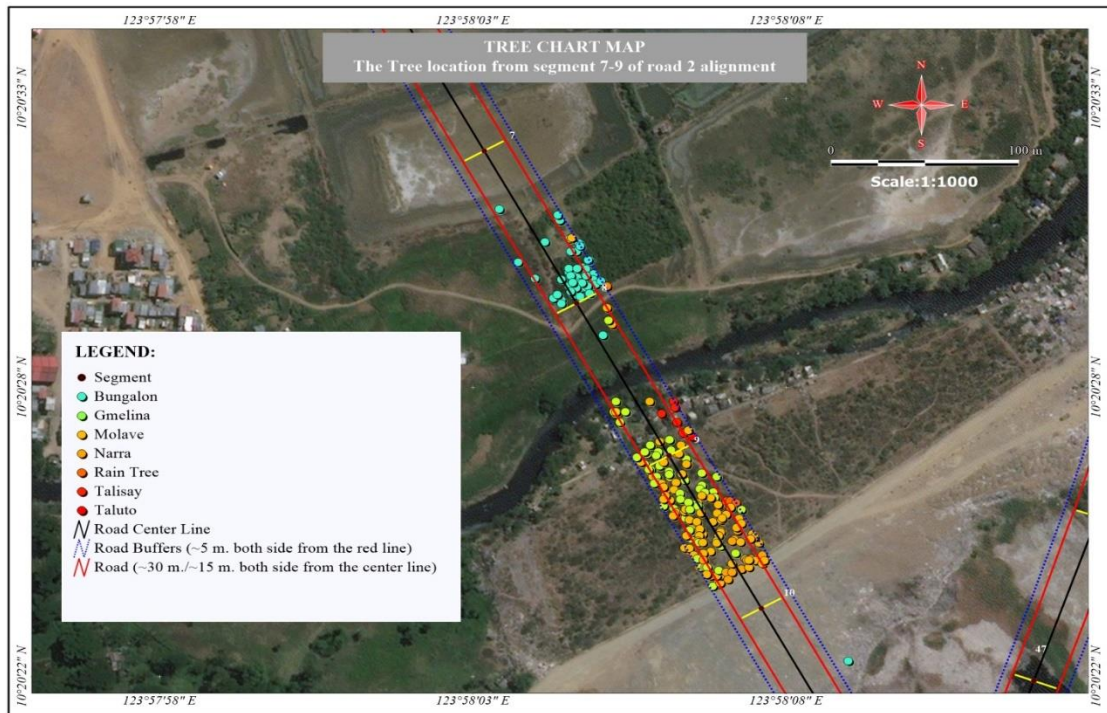


Figure 4.1.38 Chart map of mangrove and terrestrial trees inventoried and assessed in segment 7-9 of Road 2. City

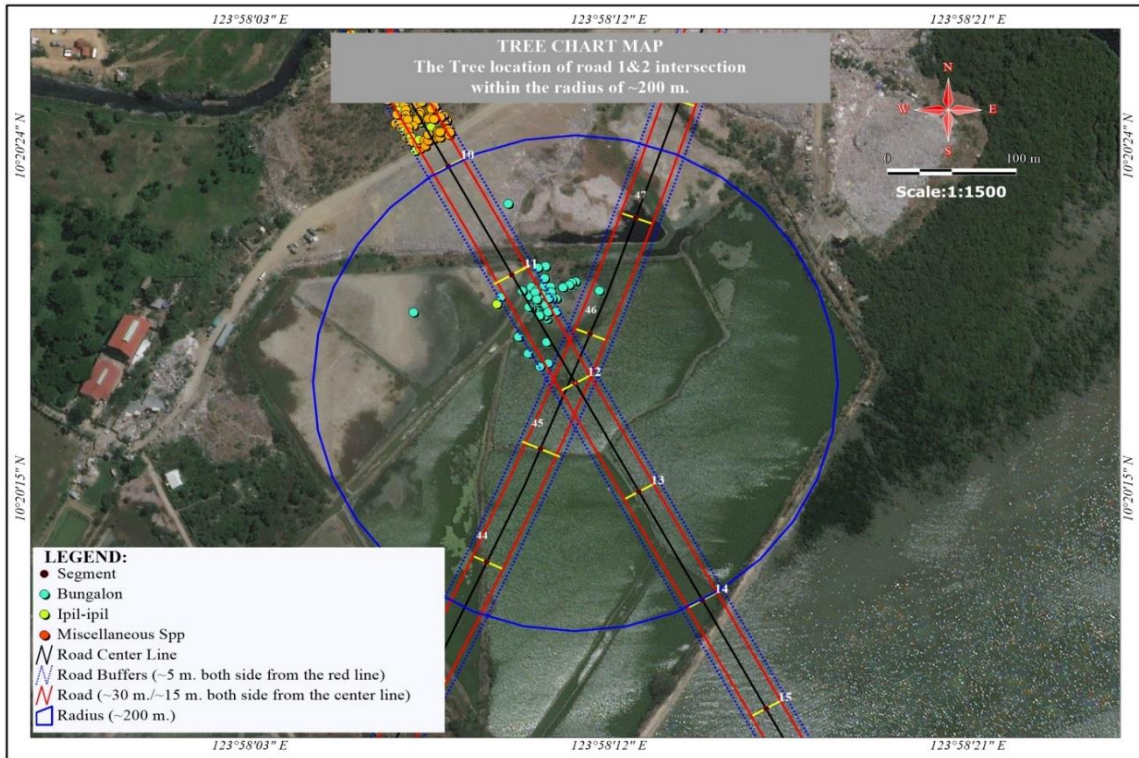


Figure 4.1.39 Chart map of mangrove trees inventoried and assessed in segment 11-13 of Road 1 and 2 intersections (200 m radius)

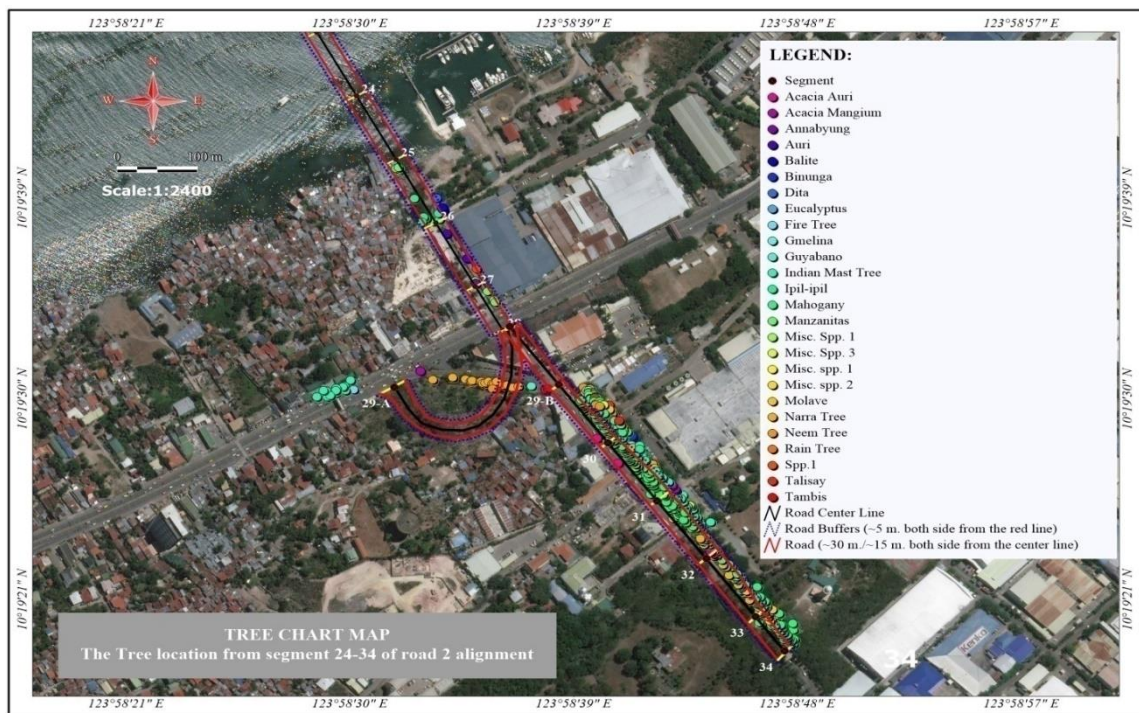


Figure 4.1.40 Chart map of terrestrial trees inventoried and assessed in segment 24-34 of Road 2 at Lapu-lapu City

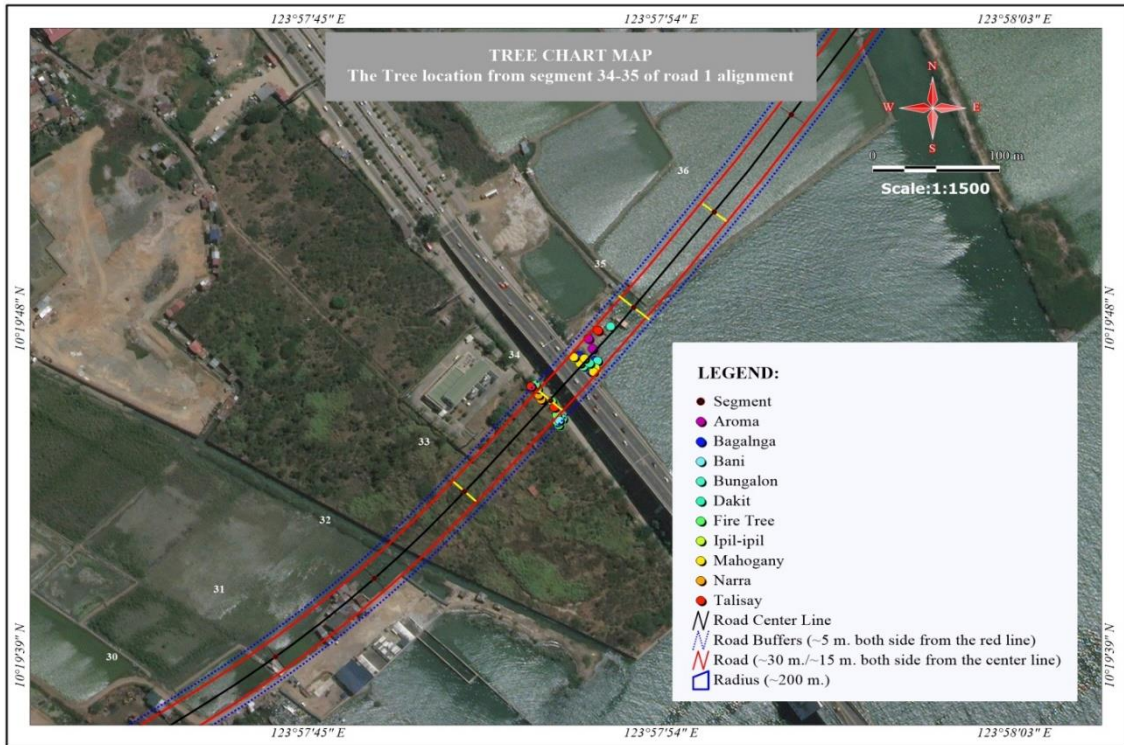


Figure 4.1.41 Chart map of terrestrial trees inventoried and assessed in segment 33-35 of Road 2 at Mandaue City

Table 4.1.20 Photos of terrestrial vegetation assessment





Panoramic view of the assessed terrestrial vegetation at Segment 9 of Road 2 near the open dumping site in Barangay Umapad.



Terrestrial tree inventory at Segment 34 of Road 1 below 2nd Mactan Bridge.



Shrub type of vegetation was noted between Segments 33 and 34 of Road 1. This is privately owned lot and fenced with barbed wire.

4.1.2 IMPACT IDENTIFICATION AND ASSESSMENT

4.1.2.1 Change in Land Use

(1) Change in Land use pattern/ zoning

Construction Phase

During Construction, changes in Land Use could occur as a result construction and related activities. Site Preparation (e.g., clearing and grubbing, excavation, placement of fill, cutting and grading, ditching) will result in the loss of land and changes to, or loss of, access to property.

The Installation of Structures (i.e., the widening of RROW, upgrading of road, pile-driving and footings/columns/piers for offshore and onshore viaduct) may result in temporary interruptions to recreational activities such as fishing in the immediate vicinity of the Project.

Surfacing and Finishing activities could cause interruption to surrounding land use activities (including recreational activities) due to increased noise and decreased air quality (e.g., increased dust and emissions).

Temporary ancillary elements associated with the Project (i.e., temporary access roads, borrow areas, petroleum storage areas) will result in temporary loss of land and changes to, or loss of, access. The Transportation of Materials and Equipment will result in increased truck traffic and associated noise. Storage of materials will result in a temporary loss of land and changes to, or loss of, access.

Operation phase

During Operation and Maintenance of the Project, the 4th Cebu-Mactan Bridge-Mandaue Coastal Road and its associated traffic may cause new area development. On the other hand, there is a possibility that a value of property and land use activities will fall as a result of noise, dust, and air emissions.

Positive environmental and social effects of the Project presence on Land Use include increase of economic opportunities due to enhance accessibility of the areas along the 4th Cebu-Mactan Bridge-Mandaue Coastal Road by both investors and market clientele.

(2) Cumulative Impacts from Mandaue Reclamation Project

1) Potential impact of each project

4th Cebu-Mactan Bridge Construction Project

Environmental and social impacts that may be caused by the 4th Cebu-Mactan Bridge Construction project are described in the Impact Management Plan.

Mandaue Reclamation Project

Identified environmental and social impacts of the Mandaue Reclamation Project are shown in the Table 4.1.21.

Table 4.1.21 Identified adverse impacts of Mandaue Reclamation Project

Land	<i>During Reclamation Work</i> Changes in land use, Encroachment in Environmental Critical Areas (ECA), Possible tenurial or land issues, Impacts to fauna and flora at the mangrove areas, and Loss of mangrove species <i>During Maintenance Phase</i> Soil Erosion and Contamination
Water	<i>During Reclamation Work/ During Maintenance Phase</i> Change in drainage morphology, inducement of flooding and water pollution of the Butuanon River and marine waters
Air	<i>During Reclamation Work</i> No significant impacts on the ambient air. <i>During Maintenance Phase</i> Fugitive dust generation during high wind and dry soil conditions.
People	<i>During Reclamation Work/ During Maintenance Phase</i> Displacement of land, Change in land ownership, Affected structures, Loss of business and/or income, Public access and access to sea water, Displacement of docking area, Threat of flooding, In-migration, Health hazards, Generation of solid waste, Increase in traffic, Disturbances on peace and order

Source: GlobalCity Mandaue Corporation and City Government of Mandaue, Executive Summary for the Public of Mandaue Reclamation Project

2) Cumulative impacts

Construction/Reclamation Work Phase

In case the construction/reclamation phases of the said two projects are overlapping, the following cumulative impacts are considered likely to occur.

- Increased land use change due to bridge/road construction and reclamation
- Increased noise generated from construction machinery frightens birds feeding in the vicinity of the construction site such as neighboring tidal flat and mangrove forest
- Increased water pollution of marine water affect marine fauna and flora
- Increased dust and emissions (i.e. degradation of air quality)
- Increased restriction of access to sea water by local fisher folks
- Increased traffic by construction vehicles

Operation phase

During the operation/maintenance phase of the said two projects, the following cumulative impacts are considered likely to occur.

- Reduction of tidal flat area as well as some mangrove trees that serve as birds' feeding ground
- Shrinkage of fishing grounds and restricted access to sea for local fisher folks

4.1.2.2 Change in Topography & Geology

Pre- Construction and Construction Phase

Modification of topography, soil disturbance and loss of top soil due to excavation (mostly of viaduct columns), will have negative and irreversible impacts, however the magnitude is considered as minor to moderate.

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road will be constructed as an elevated structure (viaduct) mainly, so that modification of topography due to cut-and-fill work will be limited and design and construction plan of viaduct columns will be optimized in the detail design stage.

The alignment of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road does not pass active fault. The project area and its vicinities in the Cities of Mandaue and Lapulapu, Cebu have low susceptibility to earthquake induced and rainfall induced landslides because the area is generally flat. The impact on this parameter is insignificant and negligible as the area along existing road is already developed land and opening of new road areas are limited used for fish ponds.

Loss of top soil is related to its inherent value for vegetative cover (greeneries, breathing space), however, the impact on this parameter is also insignificant and negligible as the area along existing road is already developed land. In opening of new routes there may be marginal and backyard crops cultivation and livestock raising activities which may be affected, but because the areas are within an urban area it is no longer significantly utilized for agricultural purposes.

The impact on change in sub-surface/ underground geomorphology due to pile-driving will be limited as construction plan of viaduct columns will be optimized to prevent subsidence at the point near the buildings such as a house or the factory, including the establishment of sand guards prior to construction. The detailed setting position is settled at the time of a detailed design.

There is a possibility that the construction work will cause disruption of natural drainage pattern due to modification of topography and increase in run-off due to exposed soils. (See 4.2.2.1)

Operation Phase

During operation stage, there will be no change in topography and geology in the project site.

4.1.2.3 Soil and Waste Generation

(1) Soil erosion

Construction Phase

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road will be constructed as an elevated structure (viaduct) mainly, so that modification of topography due to cut-and-fill work will be limited and the design and the construction plan of viaduct columns will be optimized in the detail design stage.

Eventhough, there is a possibility that soil runoff will result from limited cut and fill areas, waste soil disposal sites.

Operation phase

During operation stage, there will be no change in topography / geology and soil in the project site. There is a possibility that maintenance of roadway drainage systems, including culvert replacement or repair, which could result in erosion and sedimentation and changes in hydrology. Implementation of established and effective erosion and sedimentation controls will be used during all maintenance of roadway drainage systems, limiting the magnitude of any potential interactions.

(2) Soil Pollution

Construction Phase

There is a possibility that soil contamination from accidental releases of chemicals, fuel, oil, lubricants will occur due to the operation of construction equipment.

In addition, excavation work at current open dumping site should be taken care of soil pollution. Based on the Soil sampling, the value of copper at C-St1 near Umapad Dumpsite is within the US EPA Regional Screening Value (USEPA RSLs) with target hazard quotients (THQ) of 1.0, however it exceeded the Dutch Intervention Value (DIV) and Environmental Quality Standards for Soil Pollution in Japan.

According to the Executive Order No. 37 “An Order Declaring the Permanent Closure of Umapad Controlled Dumpsite and Institutionalizing the Synchronized Waste Collection and Disposal System (SWCDS)”, City of Mandaue has declared that Umapad Controlled Dumpsite in the City of Mandaue be permanently closed and rehabilitated. Solid Waste Management Board (SWMB) shall monitor and evaluate the execution of the closure and rehabilitation and direct the Department of General Services (DGS) to formulate and implement the Closure Plan for purposes of eliminating potential health hazards. Therefore, the project proponents shall coordination with these two entities, SWMB and DGS, and City Environment & Natural Resource Office (CENRO) closely.

Operation phase

There is a possibility that soil contamination from accidental releases of chemicals, fuel, oil, lubricants will occur due to the maintenance work.

(3) Solid Waste Generation

Pre-/Construction Phase

Pre-construction activities that will result in solid waste generation include the demolition of existing road structures.

During construction phase, excess soil from earthwork activities such as excavation, backfilling and embankment may be generated and domestic waste will also be generated from the construction camp yards.

Wastes generation, consisting of the following types:

- Surplus and construction wastes: scrap metals, concrete rubble etc.
- Domestic wastes (Biodegradable): food and kitchen wastes from temp. canteen
- Sanitary wastes from office and workers toilets, bathrooms
- Others (packaging wastes such as plastics, wood pallets, crates, metal wires, cardboard, sacks, containers, etc.)

Based on the construction plan, a total of around 18,500 m³ of construction debris will be for disposal (See Table 3.6.5).

Operation phase

The operations of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road project will not generate significant amounts of wastes. There could be trash litters from motorists who will throw trash from their vehicle windows.

4.1.2.4 Change in Terrestrial Flora and Fauna

(1) Evaluation on the “Critical Natural Habitat”

As explained in “4.1.1.2 (2) Important Bird Area and Key Biodiversity Area”, the entire project area is located in the ‘Mactan, Kalawisan and Cansaga Bays’ IBA/KBA. However, IBA/KBA itself is not necessarily regarded as a “Critical Natural Habitat” in the JICA Guidelines for Environmental and Social Considerations (2010) (hereafter, ‘JICA Guidelines’). Hence, whether the project site is regarded as a “Critical Natural Habitat” was evaluated based on the definitions stipulated in the JICA Guidelines and the IFC Performance Standard 6 “Biodiversity Conservation and Sustainable Management of Living Natural Resources” (2012) as shown in Table 4.1.22 . As a result of the evaluation, it is concluded that the project site does not fall into a “Critical Natural Habitat”.

Table 4.1.22 Evaluation on Applicability of Critical Natural Habitat

No	Definition	Applicability	Reason
1	Habitats important for the species that are classified into “Critically Endangered (CR)”, “Endangered (EN)”, “Vulnerable (VU)”, and “Near Threatened (NT)” under the International Union for Conservation of Nature (IUCN) Red List of Threatened Species	Not Applicable	<p>At Olango Island that is designated as a Ramsar site, located approximately 12 km from the project site in a straight-line distance, species that are classified into “Critically Endangered (CR)”, “Endangered (EN)”, “Vulnerable (VU)”, and “Near Threatened (NT)” were observed. However, the bird survey in December 2018 and March 2019 in the project area did not confirm the existence of the precious species itself and the use of the project site as a roost or feeding ground by the precious species. The existence of valuable species has not been observed in the past several years, even with existing materials. As a result of interviews with several experts who have experience of bird survey around the project area, it became clear that there is no data for long-term monitoring of migratory birds considering the seasonality around the project site.</p> <p>It became clear the following points according to the experiences of the experts.</p> <p>i) Migratory birds that pass through the Philippines, including endangered species, fly to their important refueling site, Olango Island, with the peak of the southward migration from December to February and the peak of the northward migration from September to October.</p> <p>ii) It is hard to think that the mangrove forest and tidal flat near the Cansaga Bay is still functional as feeding and roosting grounds as importantly as Olango Island and Jugan because the mangrove forest and tidal flat near the Cansaga Bay is so much degraded due to development, compared to 1980s,</p>

No	Definition	Applicability	Reason
			<p>when is the basis of IBA designation.</p> <p>iii) Nevertheless, it is also indicated that the possibility of endangered bird species flying to nearby project sites still cannot be denied because, when Olango Island is in full tide or when there is a shortage of feeding resources there, birds might use the tidal flats and mangrove forests of Jugan and near the mouth of the Cansaga Bay, both of which are outside ROW, as feeding and roosting grounds.</p> <p>In conclusion, since the area including project site is a development area unlike protected Olango Island and endangered species are not observed, the project site does not fall under a particularly "important habitat" for species that are classified into CR, EN, VU and NT.</p>
2	Habitats important for endemic species and/or limitedly distributed species	Not Applicable	<p>Although the woody endemic species (Molave) has been found, the project site is not a particularly important habitat for the species because the species is widely distributed in the Philippines and Indonesia and even in the project site particularly in the Lapu-Laou side. Hence, it is safe to say that the project site is not a habitats important for endemic species and/or limitedly distributed species.</p> <p>Source: http://www.worldagroforestry.org/treedb/AFTPDFS/Vitex_parviflora.PDF</p>
3	Internationally important habitats that support migratory species and/or flock-forming species	Not Applicable	<p>In the bird survey in December 2018, about 360 birds, including herons, sandpipers and terns that are migratory and flock-forming species, were observed in the mangrove forest and tidal flat adjacent to Cansaga Bay. In the bird survey in March 2019, about 175 birds were observed in the ROW passing through the aquaculture ponds and mangrove sparse forests near the Cansaga Bay Bridge. (Endangered species were not observed in both surveys). However, as mentioned in 1, the project sites in Cansaga Bay area are no longer functional as an important habitat for migratory and flock-forming species unlike Olango Island and Jugan. Hence, it is safe to say that the project site is not an internationally important habitats that support migratory species and/or flock-forming species.</p>
4	Critically endangered ecosystems and/or unique ecosystems	Not Applicable	<p>There is no past studies that proves that the project site is a critically endangered ecosystems and/or unique ecosystems.</p>
5	Areas related to important evolutionary processes	Not Applicable	<p>There is no past studies that proves that the project site is an areas related to important evolutionary processes</p>

Secondary information and the results of flora and fauna survey suggests that the project site is not a critical natural habitat for migratory birds due to a wide range of development activities, including fishpond and open dumping site, carried out over years. However, mangrove vegetation still exists and a certain number of migratory birds mainly Egret species and resident species are perching on mangroves and feeding on fishponds and surrounding tidal flat.

(2) Potential Impacts to the terrestrial flora and fauna

Construction Phase

Potential impacts from construction activities on the terrestrial flora and fauna include:

- Removal of up to 1,700 trees along the 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment, among which approximately 370 terrestrial trees are expected to be relocatable and approximately 700 mangrove trees and 1,000 terrestrial trees are inevitably cut. Terrestrial trees to be possibly relocated or removed include Molave (*Vitex parviflora*) classified under endangered category of the DAO No.1-2004, to which a particular consideration should be taken.

- Disturbance to IBA/KBA consisting mangrove, tidal flat and migratory birds:
 - i) Small-scale loss of bird habitat such as mangrove, fishpond and tidal flat
 - ii) Noise from construction work frightening migratory birds away from the IBA/KBA.
- Residual impacts of land use changes of the surrounding areas into commercial-residential development on the environment

Operation Phase

Potential impacts from operational activities on the terrestrial flora and fauna include:

- Bird kill caused by car-bird collision, especially at the interchange section in the vicinity of fishpond and mangrove forest, which serve as birds' feeding and potential roosting ground, respectively
- Lighting in the interchange area may give adverse impacts on the mangrove forest facing the Cansaga Bay, which is considered a potential birds roosting area.
- Noise disturbance from traveling vehicles to wildlife, especially to migratory birds
- Existence of viaduct as a barrier to movement of wildlife, especially to migratory birds

Given that the ROW of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road is within a generally already developed area and that there exist alternative natural habitats for migratory birds in adjacent areas, such as the mangrove forest and tidal flats facing the Cansaga Bay, Jugan and Olango Island, all of which are outside the ROW, adverse impacts on migratory birds are expected to be minor, if appropriate mitigation measures are taken in the construction and operation phases. With regard to noise disturbance to migratory birds during construction and operation phase, it was observed, during the bird survey in December 2018, that almost all the observed birds, including migratory Egret species, remained to feed on the tidal flat facing the Cansaga Bay even in a noisy environment (>60dB) caused by aircraft passage. It is thus assumed that migratory birds has adopted to such noisy environment. Nevertheless, appropriate mitigation measures are planned to minimize the impacts.

Based on the indication by the experts that some individuals of migratory birds may not fly to their destinations in the northern and southern hemispheres and overstay in the Central Visayas area, including Olango Island and Cansaga Bay area, and that birds dependent mainly on Olango Island, including endangered species, may use the Cansaga Bay area as an alternative roosting and feeding grounds, it would be advisable to conduct regular monitoring of birds in the construction and operation phases as an important parameters for the potential negative impacts on the KBA/IBA.

With regard to a terrestrial tree species 'Molave' (*Vitex parviflora*), although this species is classified under endangered category of the DAO No.1-2004, it is commonly distributed in secondary and open primary forests at low altitudes throughout the Philippines in most or all islands and provinces³. In addition, Molave is widely distributed in Bangladesh, Cambodia, India, Indonesia, Laos, Malaysia, Myammar, Phillippiens and Sri Lanka as a native species⁴. Taking into account the wide distribution of Molave in Philippines, cutting of Molave in the project area is not expected to generate a significantly adverse impacts on its distribution at the regional level, as long as compensatory planting is carried out properly.

³ STUARTXCHANGE.COM. 2019. Molave, *Vitex parviflora* Juss., small-flower chaste tree: Philippine medicinal herbs / alternative medicine. Retrieved August 26, 2013 from <http://stuartxchange.com/Molave.html>.

⁴ Orwa C, A Mutua, Kindt R, Jamnadass R, S Anthony. 2009 Agroforestry Database: a tree reference and selection guide version 4.0 (<http://www.worldagroforestry.org/sites/treedbs/treedatabases.asp>)

4.1.3 IMPACT MITIGATION AND ENHANCEMENT MEASURES

4.1.3.1 Countermeasure for Change in Land Use

(1) Control of Land use pattern/ Zoning

The local governments should promote sustainable urban developments, one of which is the introduction of new urban planning paradigm concepts of high-density concentrated, mixed-use, and redevelopments/reuse of previously developed land. The 4th Cebu-Mactan Bridge-Mandaue Coastal Road project provides an opportunity for the LGUs and City/Municipal planners to implement ‘Transit-Oriented Development (TOD)’

Construction phase

The proponent and its contractors instituted measures to reduce disturbance to neighboring residents around the secondary impact area, and is being guided by the following conditions.

- Scheduling heavy construction works during the daytime (avoiding noisy activities during the nighttime);
- Construction activities that necessitate utilizing portion of the road/street (such as concrete pouring) should be undertaken upon permission by the CITY TRAFFIC MGT and outside of traffic rush-hours;
- Construction activities should not in any way be a hindrance to the operations in neighboring area.

The Project is expected to have impact on existing landscape, too. The identified impact may be mitigated by proper design of the 4th Cebu-Mactan Bridge. In addition a new urban landscape that will be harmonized with the existing landscape along Mactan Channel and Mandaue Coastal Road facilities will be proposed.

Operation phase

As indicated, the operations of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road project will not significantly influence land use patterns in the area, as it is in conformance and in line with Metro Cebu’s sustainable urban development as envision in the Roadmap study. However, with or without the project there will be changes in the physical and biological environments as urban growth and expansion changes the physical, biological, economic and social landscape of the City.

With improve transportation and mobility, the cities of Mandaue, Lapu-lapu, and the rest of the localities of the province will open-up to investment opportunities and sustain economic growth and development. This will have a positive impact on the enhancement of the land use pattern of these localities.

(2) Cumulative Impacts from Mandaue Reclamation Project

Mitigation measures for Land, Water, Air and People for the 4th Cebu-Mactan Bridge Construction are described in this EIS.

However, mitigation measures of the 4th Cebu-Mactan Bridge Construction Project only may not be sufficient to mitigate the cumulative impacts above-described in 4.1.2.1.

It is thus recommended to the Mandaue Reclamation Project that their major mitigation measures to address the adverse and enhance beneficial impact relate to issues on land use, access to the sea, marine water quality, air pollution, mangrove areas, and socioeconomic aspects (livelihood, income loss, health, traffic). Measures to enhance the beneficial impacts relate to employment opportunities, economics, and LGU income through taxes.

Accordong to DENR- stanadards and related international standard, the impacts on increase of air quality, noise level and water quality should be mitigated by each project. In addition, impacts on land use and increase of traffic congestion should be mitigated by both projects in coordination with LGUs related section. Impacts on local economy (fishery) should be mitigated by each project, based on the project boundary and its impacts.

In addition, a bird expert from the Philippines Biodiversity Conservation Foundation stated that as reclamation will bring about significant impacts to bird habitat, maximum consideration shall be given from the environmental aspect, in particularly bird inhabitation.

(3) Development of Wetland Park surrounding the interchange section

Considering the technical insights from local experts, fishponds that are being used as alternative feeding grounds by birds other than Olango Island, are recommended to be maintained as any form of wetland, so that birds will be able to continue to use the ground. On the other hand, approximately 700 mangroves at maximum might be inevitably cut near the area where the bridge approach road connects to the existing Cansaga bay bridge, and for this inevitable tree cutting, compensatory plantation of mangrove is required in suitable places. As was recommended by the local experts, one of the keys to maintaining environment is to involve community and responsible organizations. Hence, aiming at restoring the natural environment after the construction (i.e. ecological functions of mangrove and wetland) and maintaining the area sustainable, redeveloping the fishpond area in the interchange section into a wetland eco park will be considered in the D/D phase.

Considering the connectivity to the existing mangrove forest and current land use as fishpond, the northern and eastern parts of the interchange section are recommended to be planted with mangrove or terrestrial species, while the southern and western parts should be maintained as wetland (see Figure 4.1.42). The mangrove forest to be expanded is expected not only to restore birds' habitat as potential roosting place, but also restore important mangrove's ecological services in this area, namely filtering pollutants leached from the closed dumping site into Cansaga Bay and Mactan Channel, and preventing sediment runoff into the Butuanon River. Fishponds may be redeveloped as park ponds with board walk along the existing borders of fishpond lots to minimize the adverse impacts on the ecosystem surrounding the fishponds. The Manko Waterbird and Wetland Center in Okinawa prefecture of Japan may be a good reference example because its environment (i.e. estuarine tidal flat and mangrove swamp), designation as internationally important site (i.e. Ramsar site), and role for the local communities (i.e. "Recreational Ecopark") are similar to the situation in the project area⁵. In addition, as mentioned in 4.1.3.2, bird-car collision prevention poles will be considered to be installed to prevent roadkill from vehicular collisions flying over the proposed wetland eco park.

The proponent and the Mandaue City confirmed that a basic agreement has been made on the basic concept of the wetland park development in the interchange area and the responsibility of the Mandaue City in its maintenance. It is also confirmed that the proponent and Mandaue City would coordinate closely to harmonize this 'Wetland Park Concept' and the 'Mandaue City Dumpsite Ecopark Concept' of the City, and that Mandaue City submit an official letter on this issue to the proponent.

⁵ Manko: A Ramsar Site in Japan
http://www.env.go.jp/en/nature/npr/ramsar_wetland/pamph/ramsarpamphen/RamsarSites_en_web56.pdf



Figure 4.1.42 Conceptual Zoning for Proposed Wetland Park

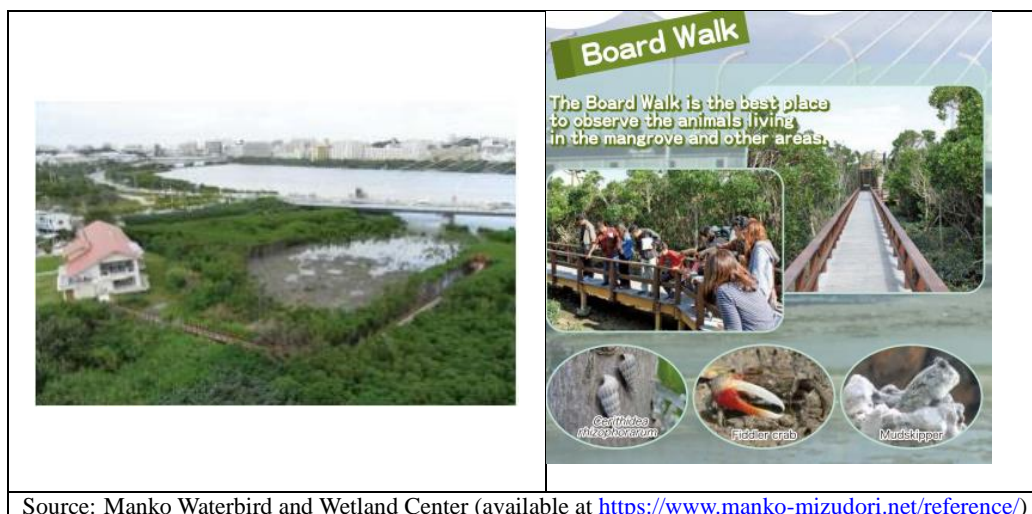


Figure 4.1.43 Manko Waterbird and Wetland Center

4.1.3.2 Countermeasure for Change in Topography & Geology

Pre-Construction Phase

Although historical seismic data from PHIVOLCS show that only small magnitude earthquakes occur in Cebu Island and the project area, the probability of occurrence of high magnitude earthquakes is not discounted, because of the presence of the tectonically active Negros Trench located southwest of Cebu and Negros Island. This trench may possibly produce high magnitude earthquakes and can trigger earthquake-induced geohazards such as ground shaking and liquefaction.

Mitigation measures to address impacts on ground shaking and liquefaction that are being considered are as follows:

- Undertake site-specific seismic risk characterization and estimates of how the ground beneath the structure will move in the final design of the structures; and
- Design and construct structures that will address seismic hazards

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road will be constructed as an elevated viaduct mainly, so that DPWH Guide Specifications LRFD Bridge Seismic Design Specifications (“BSDS”), 2013 is applied for the seismic design of structures.

Construction Phase

During Construction stage, the original topography of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment area changes due to excavation and filling for subgrade/base and road pavement for on-grade road and the columns for inland viaduct.

Mitigation measures to address impacts on topography that are being considered and implemented on site are as follows:

- Limiting land clearing and excavation within the affected areas of the primary impact area and excavating within the desired level only
- Proper and appropriate excavation and embankment protection techniques, such as sand guards”Yaita”

Operation phase

During Operation Stage, there will be no change in topography and soils in the project site, as the change in topography and soils resulting from the construction stage will be the final grade elevations of on-grade road and the coastal road alignment, as well as the columns for the viaduct all throughout the operations stage.

4.1.3.3 Countermeasure for Soil Erosion, Soil Contamination and Solid Waste Generation

(1) Soil erosion

Construction phase

During Construction stage, the original topography of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment area changes due to excavation and filling for subgrade/base and road pavement for on-grade road and the columns for inland viaduct.

Mitigation measures to address impacts on topography, slope failures and soil erosion that are being considered and implemented on site are as follows:

- Appropriate soil protection measures when doing excavation for foundation works
- Slope protection such as stone pitching or vegetation are adequate measures to be taken to prevent soil runoff
- Excavated soil (road sub-base, base, foundation works for viaduct columns, etc) be keep away from near banks, waterways
- Provision of drainage sump pits and silt traps
- Others (see mitigation measures for water quality impacts-hydrology/drainage)

Operations phase

During Operation Stage, there will be no change in topography and soils in the project site. Appropriate soil protection measures will be taken, when maintenance work will be conducted.

(2) Soil Pollution

Pre-/Construction phase

Soils may become contaminated during construction works due to leaks and accidental spills of fuels and lubricants from construction vehicles and machineries, as well as other hazardous chemicals like paints and solvents. Releases due to leaks may result in relatively insignificant amount of contaminants in the soil. Potential spills from the equipment and in hazardous materials storage areas could cause a more serious effect. However, given proper spill prevention measures, this event is more unlikely to cause negative adverse effects. The contractors must be required to:

- Establish and implement an emergency and contingency plan in case of spills as well as health and safety management plan
- Store bulk hazardous chemicals in an impermeable area and with appropriate secondary containment and,
- Comply with environmental permitting requirements for the storage, transport, treatment and handling of hazardous substances and wastes
- Conduct a semi-annual soil quality monitoring at 3-4 sampling sites in the interchange area

Regarding the soil contamination at Umapad Dumpsite, the project proponents should follow the Executive Order No. 37 “An Order Declaring the Permanent Closure of Umapad Controlled Dumpsite and Institutionalizing the Synchronized Waste Collection and Disposal System (SWCDS)”, and coordinate with the responsible entities of the City of Mandaue, Solid Waste Management Board (SWMB), Department of General Services (DGS) and City Environment & Natural Resource Office (CENRO) closely.

During the pre-construction phase, the project proponent will conduct a comprehensive soil quality survey for parameters mentioned in US EPA near the dumping site in the D/D stage to confirm the the level and the range of contamination and provide the results to the Mandaue City as a contribution to the rehabilitation of the dump site

During the construction phase, excarvation soil near Umapad Dumpsite will be separated from other excarvation materials and followed the instruction of DENR-EMB (Regional and Central office), DGS and CENRO.

Operations phase

During Operation Stage, there will be no change in topography and soils in the project site. There is a possibility that accidental spills of fuels and lubricants from maintenance vehicles and machineries will occur, but impacts of this will be limited and countermeasure will be sam as construction stage.

(3) Solid Waste Generation

Construction phase

According to Republic Act (RA) 6969-Toxic and Hazardous Substances and Republic Act (RA) 9003-Ecological and Solid Waste Management Act, the project proponents shall require to submit detailed waste management program (WMP) for proper handling, collection and disposal of solid, hazardous and liquid waste to EMB Regional/ Central office and LGUs such as Department of Public service (DPS) prior to construction. Proof of implementation shall be submitted together with Compliance Monitoring Report (CMR). The project proponents shall also require to detailed demobilization plan for the construction yards.

Solid wastes will be transported to materials recycling facility (MRF) for sorting and diversion of wastes to recycles and re-utilization. Construction debris is managed in a variety of ways, ranging from reuse to recycling to disposal in dumpsites/landfills.

Reuse

Most of the excavated excess earth materials from excavation works of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road project will be utilized to backfill depressed areas within nearby areas – thus, avoiding hauling-out and transporting excavated materials to far-away disposal areas.

Recycling

Recycling of wastes will be implemented, as much as possible, through sorting, stockpiling and containing recyclable wastes. Possible materials that could be recovered and recycled are concrete, asphalt, metals, and wood. While, the technologies to recover and process these materials for reuse are available in other countries, it is not yet commonly adopted locally, given the following major barriers: the cost of collecting, sorting, and processing; the low value of the recycled-content material in relation to the cost of virgin-based materials, and the low cost of landfill disposal. However, locally, buyers of scrap metals are well-established, which could be tapped to dispose saleable construction debris.

Disposal in dumpsites/landfills

In case the proposed WMP will be accepted by EMB Regional/ Central office and LGUs, construction debris or unsuitable material to be reused will be disposed within the Mandaue Interchange area. Other option for excess waste materials, contractors will secure hauling permits and dispose excess earth materials to approved-suitable disposal sites (e.g. projects already issued with ECCs).

During transport of excess/excavated earth materials for disposal the following will be implemented:

- Schedule equipment move-in to blend with regular non-peak hour day-time vehicular traffic
- Use only new or properly maintained vehicles, equipment
- Hauling trucks should be covered with tarpaulin or canvass
- Remove soil/mud from tires before leaving the area
- Detail street cleaners/sweepers
- Set aside funds to repair roads & other facilities which may be damaged by hauling trucks
- Secure hauling permits and dispose excess earth materials to approved-suitable disposal sites

In addition, proper and diligent management of solid wastes generated by the construction activities, including:

- Temporary stockpiles of excavated materials from foundation works must be properly covered and regularly hauled to DENR-approved disposal sites;
- No stockpiling of construction debris as these will not be utilized anyway;
- Litters and other types of domestic garbage from construction sites and camps must be properly kept in trash bins and regularly disposed through the City garbage collectors

Based on the general solid waste management strategy of Mandaue City, solid waste should be segregated into biodegradable, recyclable, residual, and special waste.

Operation phase

There is a possibility that trash littering from motorists who will throw trash from their vehicle windows. Motorists who will litter the 4th Cebu-Mactan Bridge-Mandaue Coastal Road shall be apprehended and appropriately charge of the violations through improvement/enhancement of current wastes disposal practices and implementation of the Solid Waste Management (SWM) plan

4.1.3.4 Countermeasure for Impacts to Terrestrial Flora and Fauna

Some of the trees affected along the alignment shall be replanted, if they are in considerable size or length. A corresponding replacement for the number of trees removed shall be planted by the proponent

or DPWH. The proponent as well as the LGUs shall undertake tree planting programs to more or less offset the GHG emissions from the 4th Cebu-Mactan Bridge-Mandaue Coastal Road project.

Based on the mangrove and other terrestrial flora fauna assessment, the mitigation measures and recommendations are shown below:

Pre-Construction Phase

- Providing a temporary fencing to vegetation for their protection to minimize clearing as much as possible.
- Approximately 370 terrestrial trees that are estimated to be at less than 1.5m height, including the threatened species ‘Molave’, shall be earth-balled and re-planted in areas adjacent to the road alignment to maintain urban greening or green-built zones.
- If clearing is inevitable, compensatory plantation of appropriate species of mangrove and terrestrial trees in compliance with DENR rules such as DMO 2012-02 (100 times of cutting trees), should be done in appropriate areas such as the vicinity of interchanges and/or along the Butuanon River for mangrove plantation and the vacant lot nearby the planned loop ramp and/or beside approach road to the new Mactan Bridge in the Lapu-Lapu side for other terrestrial species plantation. If the ‘100 times of cutting trees’ rule applies to all the species to be cleared, approximately 70,000 seedlings of mangrove and approximately 100,000 seedlings of other terrestrial tree species shall be planted.
- 4th Cebu-Mactan Bridge-Mandaue Coastal Road design should consider the disturbance to this KBA. The Biodiversity Study, or a detailed study on migratory bird and its habitats (i.e. mangrove and tidal flat), shall be conducted as input to Detailed Engineering Design and management of the KBA.

Construction Phase

- Conduct awareness campaign to all relevant construction workers about the careful consideration for IBA/KBA
- Adoption of lower noise and vibration construction method and machines
- Adoption of temporary jetty construction road to minimize adverse impacts on mangrove and tidal flat
- Conduct semi-annual bird monitoring

Operation Phase

- Installment of road sign warning with birds and KBA at the interchange area to reduce the risk of bird-vehicle collision and to raise awareness of the importance of the area among the public
- Installment of recessed road lighting at the interchange area near the mangrove forest potentially used as roosting ground by birds
- Consideration of installment of more than 4m ‘bird-car collision prevention poles’ or fences at the both sides of the balustrade of the coastal road and the bridge at intervals of around 2m based on the Biodiversity Survey (detailed bird survey) planned at the early stage of DD
- Conduct a semi-annual bird monitoring

At the beginning of the Detailed Design stage, i.e. by March at the very latest, the Biodiversity Study, or a detailed study on migratory bird and its habitats, shall be carried out. The result will be provided as an input to determining the design of the road and bridge and mitigation measures. The tentative outline of the Biodiversity Study is as follows.

Table 4.1.23 Outline of the Biodiversity Survey

a. Endangered bird species survey	
Target	Threatened species (i.e. Chinese Egret, Grey-Tailed Tattler and Great Knot)

Population Count	<p>Frequency 2 times between September to March during at early stage of DD phase</p> <p>Location 7 survey points</p> <ol style="list-style-type: none"> 1. Northern fishpond, 2. Southern fishpond, 3. Mangrove forest facing the Cansaga Bay, 4. Mangrove forest along the Cansaga Bay Bridge, 5. Tidal Flat along the Cansaga Bay, 6. Mangrove forest in the inner Cansaga Bay Area, 7. Jugan
Flying Route & Altitude Survey	<p>Frequency 2 times between September to March during at early stage of DD phase</p> <p>Location 7 survey points</p> <ol style="list-style-type: none"> 1. Northern fishpond, 2. Southern fishpond, 3. Mangrove forest facing the Cansaga Bay, 4. Mangrove forest along the Cansaga Bay Bridge, 5. Tidal Flat along the Cansaga Bay, 6. Mangrove forest in the inner Cansaga Bay Area, 7. Jugan
Roosting Area Survey	<p>Frequency 2 times between September to March at the early stage of DD phase</p> <p>Location 4 potential roosting sites</p> <ol style="list-style-type: none"> 1. Mangrove forest facing the Cansaga Bay, 2. Mangrove forest along the Cansaga Bay Bridge, 3. Mangrove forest in the inner Cansaga Bay Area, 4. Mangrove Forest in Jugan
b. Other Migratory Bird Survey	
Population Count	<p>Frequency 2 times between September to March at the early stage of DD phase</p> <p>Location 7 survey points</p> <ol style="list-style-type: none"> 1. Northern fishpond, 2. Southern fishpond, 3. Mangrove forest facing the Cansaga Bay, 4. Mangrove forest along the Cansaga Bay Bridge, 5. Tidal Flat along the Cansaga Bay, 6. Mangrove forest in the inner Cansaga Bay Area, 7. Jugan

One of the potential adverse impacts is roadkill caused by bird-car collisions on the viaduct, in particular, above the fishponds where a certain number of birds were observed feeding. To minimize the risk and mitigate the impact, the following mitigation measures may be taken: i) installment of road sign warning with birds and ii) recessed road lighting at the interchange area near the mangrove forest potentially used as roosting ground by birds. Furthermore, the following measures will be considered in the D/D phase: i) creation of wetland eco park near the interchange area (refer to 4.1.3.1(3)), and ii) installment of more than 4m ‘bird-car collision prevention poles’ at the both sides of the balustrade of the coastal road and the bridge at intervals of around 2m.

	
<p>'Bird-car collision prevention poles' installed on the highway along the heron's nesting sites in Niigata Prefecture, Japan</p>	<p>Road sign warning with herons installed on the highway along the heron's nesting sites in Niigata Prefecture, Japan</p>
<p>Source: Niigata Working Group, Kanto Branch, Japan (http://jsce-niigata.com/introduction/article/033/art033.html)</p>	<p>Society of Civil Engineering (available at http://jsce-niigata.com/introduction/article/033/art033.html)</p>
	
<p>Recessed Road Lighting</p>	
<p>Source: Panasonic Corporation</p>	

Figure 4.1.44 Potential Mitigation Measures

4.2 Water

4.2.1 Baseline Conditions

4.2.1.1 Hydrogeology/Groundwater Conditions

(1) Hydrogeology/Groundwater Conditions

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment is generally located at the coastal area and most portions hugged the coastlines of Mactan channel. Not only the offshore viaduct, but also the inland routes will have an impact on the Marine environment of these areas.

The Mactan Channel is the strait between main island of Cebu and the Mactan Island. The body of water is located within Metro Cebu separating Lapu-Lapu City on Mactan Island from Mandaue City and Cebu City in mainland Cebu. The channel receives water and wastewater from several principal rivers and creeks. The 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment will pass Batuanon River and its brunch that flow into the channel.

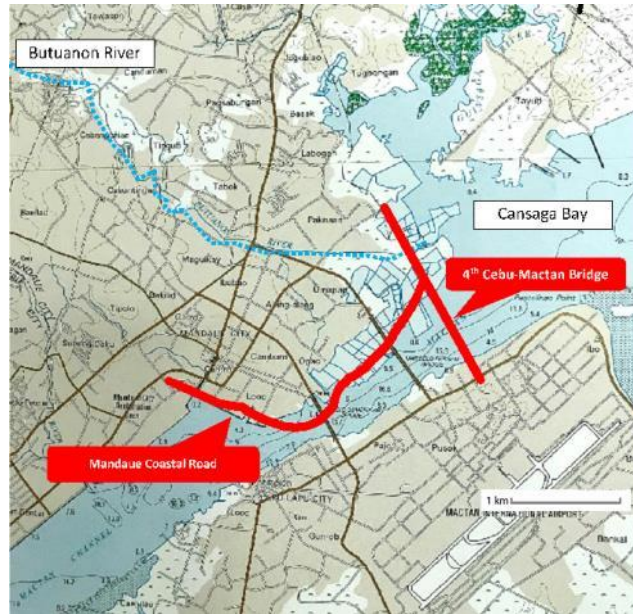


Figure 4.2.1 Topographic Map showing drainage system of the Project area

The main water source of Metro Cebu is groundwater, which constitutes 98% of the water supply. Surface water accounts for only a small fraction of 2% (*MCWD databook, 2013*).

Groundwater occurs and moves through interstices in the soil and rocks. This movement is governed by the rock's permeability that, in general, depends on the type and/or age of geological formations. Based on the occurrence and movement of groundwater, the geological formations are divided into three major hydrogeologic groups (*Bureau of Mines, 1986*): Rocks in which flow is dominantly intergranular; Rocks in which flow is through fracture and/or solution openings; Rocks with local or no groundwater

The identified aquifer in the area is within the underlying Carcar coralline limestone. This type of aquifer belongs to the second major hydrogeologic groups, rocks with major flow of the groundwater is through fractures and joints, secondary spaces and/or solutional cavities created by solvent action of the groundwater in the limestone rocks (Figure 4.2.2).

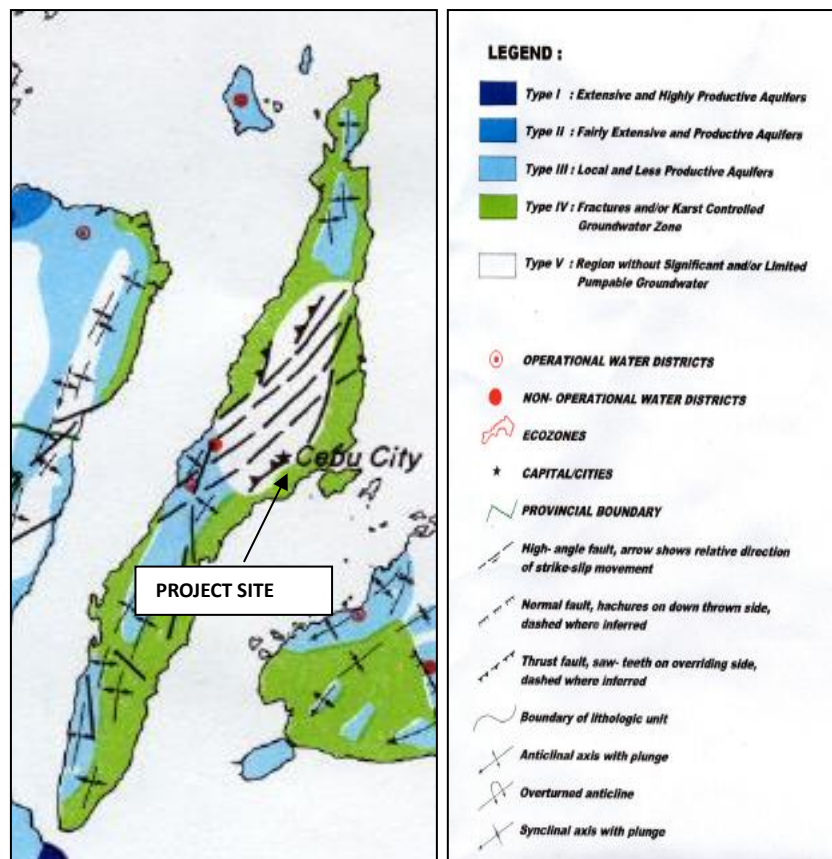


Figure 4.2.2 Regional Hydrogeologic Map of Cebu Island

Another identified minor aquifer in the area is within the overlying Quaternary Alluvium consisting of unconsolidated sediments of sand, silt, clay and gravel deposits of variable thickness and extent. This type of aquifer belongs to the first major hydrogeologic groups, rocks in which flow is dominantly intergranular. The rock units of this group generally consist of granular deposits wherein groundwater occurs and moves through pore openings between individual grains and to small extent, through fractures.

Groundwater generally moves from the highest elevation towards the lowest towards the coastline and commonly follows the water flow direction of surface drainage. In the Mandaue City side of the project area, groundwater tends to move from west to the east and exits toward the coastline of Mandaue City and drain into the Mactan Channel. On the other hand, the Lapulapu City side of the project, groundwater tends to move east to west and also exits towards the Mactan Channel.

(2) Water Supply

Metro Cebu’s water need is supplied by MCWD, which also covers the areas of Mandaue City, and Lapu-lapu City. It gets most of its water from the underground aquifer through its network of pumping stations. Table 4.2.1 shows the water supply in Metro Cebu.

Table 4.2.1 Existing Water Sources and Rated Production in Metro Cebu, 2013

Sources	Actual Supply (m3/day)	Ratio, (%)
(a) MCWD Service Area	209,252	92
Groundwater	173,183	76.1
Surface water	3,080	1.4
Bulk supply (Private supplier)	28,108	12.4
Desalination (Mactan Rocks)	4,881	2.1
(b) Non-MCWD Service Area	18,273	8
¹ Northern Areas- Danao	5,541	2.4
Southern Areas	12,732	5.6
² Minglanilla (Miwasco)	2,690	1.2
³ Naga (Abejo)	1,200	0.5
⁴ San Fernando (LGU)	1,271	0.6
⁵ Carcar (Water District)	7,571	3.3
Total Rated Production (m3/day)	227,525	100.0

Source: MCWD Databook.

Notes: 1 Danao Waterworks, 2 Miwasco, 3 Naga Planning, 4 San Fernando, 5 Carcar Water District.

(3) Natural Drainage

The drainage system in Metro Cebu is divided into the same categories for draining rainwater, such as (i) river, (ii) creek, and (iii) drainage. The flood-prone areas in Metro Cebu are identified by the respective LGUs. There are many flood-prone areas in the metropolis although flooding happens only when high tide and heavy rain occur at the same time. The project area and its vicinities in the Mandaue City side have high susceptibility to flooding (See Figure 4.2.4).

One of the major problems regarding rivers, creeks and drainages are the presence of informal settlements and irresponsible private property owners along the riverbanks, which generate an enormous amount of garbage that obstructs the flow of natural and man-made waterways. While it is understood that the responsibility to manage the rivers within their jurisdiction is devolved to the LGUs, the overall responsibility is not clearly delegated to a specific office. The presence of informal settlements was also identified at the riverbank of Butuanon River.



Source: JICA Survey Team

Figure 4.2.3 Informal Settlers residing along Butuanon River

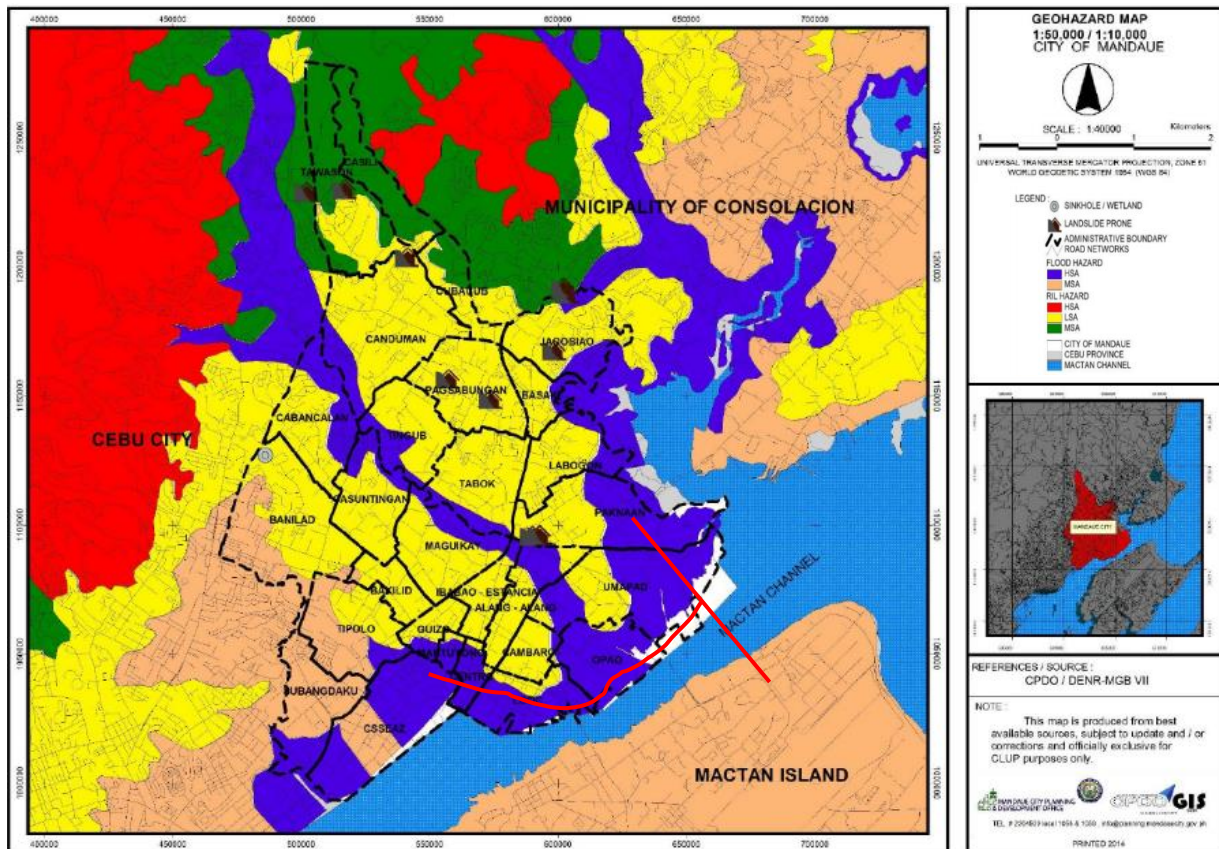
(4) Hydrogeologic/Hydrologic Hazards

The hydrogeologic and hydrologic hazards that were identified to have potential impacts on the proposed project include flooding, coastal hazards such as coastal erosion, storm surge/tsunami and coastal subsidence/sea level rise.

a. Flooding

Flooding results from different causes namely: prolonged periods of precipitation, human actions and other artificial causes such as loss of vegetations and constrictions of streams. Degree of damages brought about by floodwaters differs depending on the water velocity, depth of water, duration, rate of rise, sediment load, and frequency of occurrence and the seasonality of the floods.

Based on the Geo Hazard Map as prepared by the Mines and Geosciences Bureau (MGB-7), the project area and its vicinities in the Mandaue City side have high susceptibility to flooding (Figure 4.2.4). A section of the project in the Mandaue City side is located near the mouth of Butuanon River. During a combination of heavy and continuous rains with high tide, the coastal area near the mouth of the river is prone to flooding.



Source: Mandaue City, DENR MGB 7

Figure 4.2.4 Geo Hazard Map of the Project Site

b. Coastal Hazards

b.1 Coastal Erosion

All coastlines are susceptible to erosion or tidal inundation depending upon the elevation, topography, gradient and structural protections such as sea walls, groins and levees.

The coastline of the project site will be susceptible to coastal erosion during the development if ever areas near the shoreline will be backfilled with filling material. During the backfilling activities, it should be protected by sea wall or any other structures so that the filling material will not be easily eroded by waves to the sea during strong winds and storms.

b.2 Storm Surge/Tsunami

Storm surge is an abnormal rise in sea level accompanying a hurricane or other intense storm, and whose height is the difference between the observed level of the sea surface and the level that would have

occurred in the absence of the cyclone. Storm surge is usually estimated by subtracting the normal or astronomic high tide from the observed storm tide. When storm surge is combined with a normal astronomical high tide, a storm tide is created.

Tsunami or seismic sea waves on the other hand, are long waves generated by sudden displacement under water, most commonly the sudden displacement along a submarine fault associated with an earthquake.

Historical storm surges map of the Philippines showed that Cebu Island including the project site is not hit by any strong storm surges (Figure 4.2.5).

Tsunamis are not experienced in Cebu Island including the project basically due to its strategic location being geographically near Leyte and Camotes Islands on the eastern side.

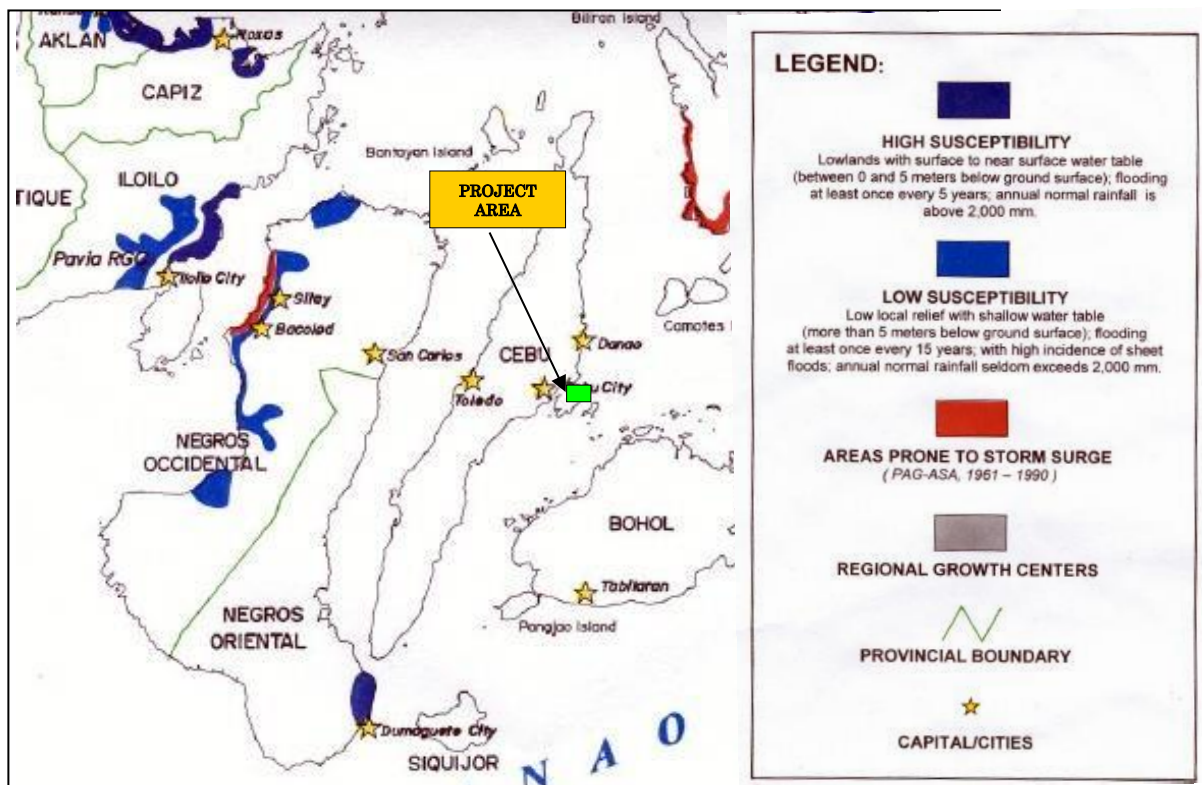


Figure 4.2.5 Historical Storm Surge Map of the Philippines (1961-1990) (DENR, DILG, LWUA, MGB, NAMRIA, NWRB & PAG-ASA)

If ever the coastal area of project will be hit by strong storm surges and tsunamis, it will be protected by the coastal configuration in which it is located in the inner section of the Mactan Channel. The coastal area of proposed project is protected by the nearby Mactan Island from typhoons coming from the east. The presence of several existing shipyards located further to the northwest of project towards the mouth of Cansaga Bay indicates that the coastal area within the project site is relatively safe from storm surges and/or tsunami.

b.3 Coastal Subsidence/Sea Level Rise

Coastal subsidence refers to large-scale lowering of the natural ground surface. One form of land subsidence results from very slow movements in the earth’s crust (tectonic movement) that cause a net lowering of the land surface over thousands of years. Another cause of subsidence results from the over extraction of water, oil or natural gas from underground aquifers. Ongoing extraction of this fluid can result in collapse (compaction) of the sedimentary strata forming the aquifer and hence lowering of the overlying land surface.

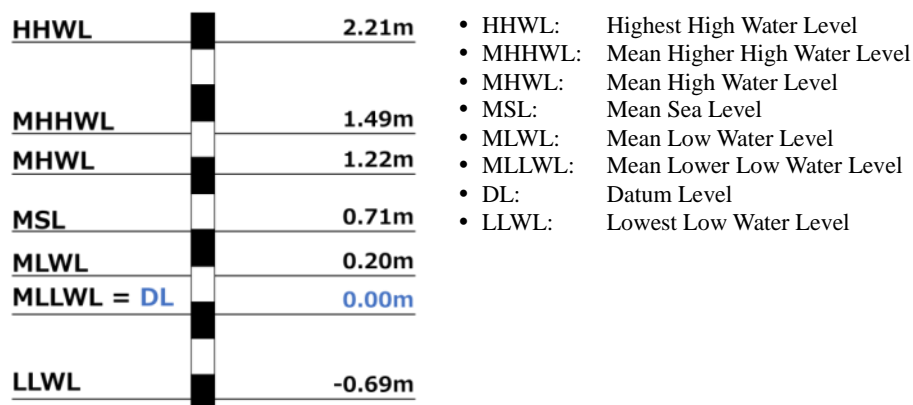
Coastal zones are particularly vulnerable to climate variability and change sea level rise which is an increase in sea level can be a product of global warming through two main processes: expansion of sea water as the oceans warm, and melting of ice over land. Global warming is predicted to cause significant rises in sea level over the course of the twenty-first century. The possible impacts of sea level rise in the coastal zone may include increased coastal erosion, higher storm-surge flooding, more extensive coastal inundation, increased flooding and potential loss of life, changes in surface water quality and groundwater characteristics. At present, there are no noticeable evidences of sea level rise in the coastal front of the project site. The coastline is not of submergent type which has experienced a rise in sea level, due to a global sea level change.

4.2.1.2 Oceanographical Conditions

(1) Tidal Level

As shown in Figure 4.2.6, the tide conditions in the project site are summarized based on the information obtained from National Mapping and Resource Information Authority (NAMRIA), which manages and measures tide gauges nationwide, and the tide data shown in "Tide and Current Tables Philippines 2019" published by NAMRIA.

As tide levels are arranged from the Mean Lower Low Tide Level (MLLWL) as the Datum Level (DL) in "Tide and Current Tables Philippines 2019", MLLWL is used as DL in this project as well. The tide level shown in "Tide and Current Tables Philippines 2019" is determined based on the data from 1989 to 2007 observed at Cebu Harbor Station (Latitude: 10° 17' N, Longitude: 123° 55' E) closest to the project area in the observatory (shown in Figure 4.2.7). The tidal type at the project site could be understood as semidiurnal with 2 high peaks and 2 low peaks in a day.

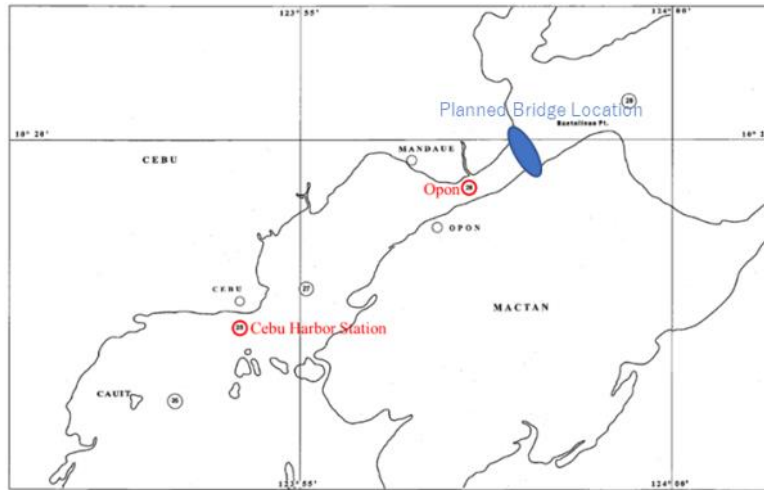


Source: Tide and Current Tables Philippines 2019, arranged by JICA Survey Team

Figure 4.2.6 Tidal Conditions and Historical Maximum/Minimum Tide Records in the Project Area

(2) Tidal Currents

According to "Tide and Current Tables Philippines 2019" published by NAMRIA, tidal current observation has been conducted at five locations in the Philippines (Basilan Strait Station, Iloilo Strait Station, Cebu Harbor Station, San Bernardino Strait Station, Hinatuan Station). "Cebu Harbor Station" (Latitude: 10° 17' N, Longitude: 123° 55' E) is closest to the project area in the observatory.



Source: Tide and Current Tables Philippines 2019

Figure 4.2.7 Location of Tidal Current Observation in the Project Area

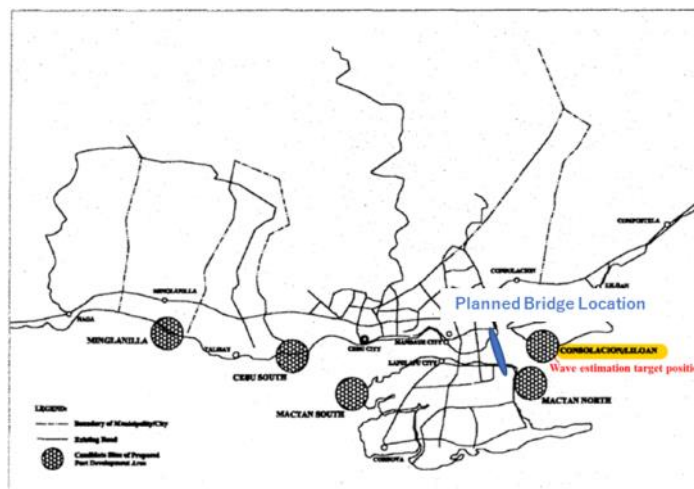
According to the Tide and Current Tables Philippines 2019, the methodology to convert the value of tidal current in the “Cebu Harbor Station” to those of “Opon” which is the closest location to the project area is mentioned.

Since the "Opon" station is located between Mactan island and Cebu island, the tidal current at “Opon” station becomes faster than that of “Cebu Harbor Station” due to the narrowed topography, and velocity of tidal current is to be estimated at 1.8 times rather than "Cebu Harbor Station" in the Tide and Current Tables Philippines 2019. In “Cebu Harbor Station”, the maximum value of tidal current is estimated at 0.73 m/s for both flood and ebb tides, and the average velocity of tidal current is estimated at 0.46 m/s.

Therefore, the maximum tidal current in the project area is converted to be 1.31 m/s for both flood and ebb tides, and the average velocity of tidal currents is converted to be 0.82 m/s.

(3) Waves

Wave prediction was conducted near the project for the planning of the new Cebu Port in the “The Study on the Integrated Port Development Plan in the Republic of the Philippines” (JICA, 2002). Figure 4.2.8 shows the location of wave prediction.



Source: The Study on the Cebu Integrated Port Development Plan in the Republic of the Philippines

Figure 4.2.8 Location of the Wave Prediction

The average daily wind speed and direction for 25 years were used in “The Study on the Cebu Integrated Port Development Plan in the Republic of the Philippines”. The results of wave prediction are summarized as shown in Table 4.2.2, below:

Table 4.2.2 Significant Wave Height $H_{1/3}$ in 50 Years Probability

H_0 (m)	T (s)	θ	$H_{1/3}$ (m)
5.17	7.7	NE	1.64 – 2.03
4.26	7.2	NNE	1.20 – 1.50

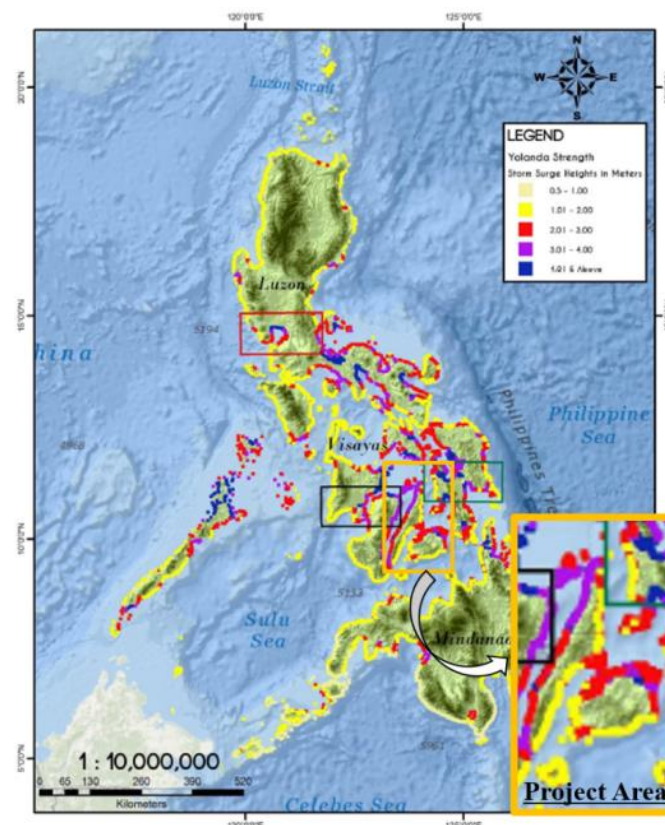
H_0 : Max. deep water wave height (m), T: Period (s), θ : Direction, $H_{1/3}$: Significant Wave Height
 Source: The Study on the Cebu Integrated Port Development Plan in the Republic of the Philippines

As the project area is located at inland from above mentioned the location of wave prediction, the influence of waves is estimated to be less impact than that of the location of wave prediction. Therefore, the significant wave height $H_{1/3}$ in the project area is assumed to be 2.03 m or less.

(4) Storm Surge

In “Identification of storm surge areas in the Philippines through the simulation of Typhoon Haiyan-induced storm surge levels over historical storm tracks” (Natural Hazards and Earth System Sciences, 2015), the predicted tide level is analyzed by storm surge simulation considering the Typhoon HAIYAN (see Figure 4.2.9).

According to the result of analysis, it is estimated that the maximum storm surge deviation in the project area is at most 3 m.

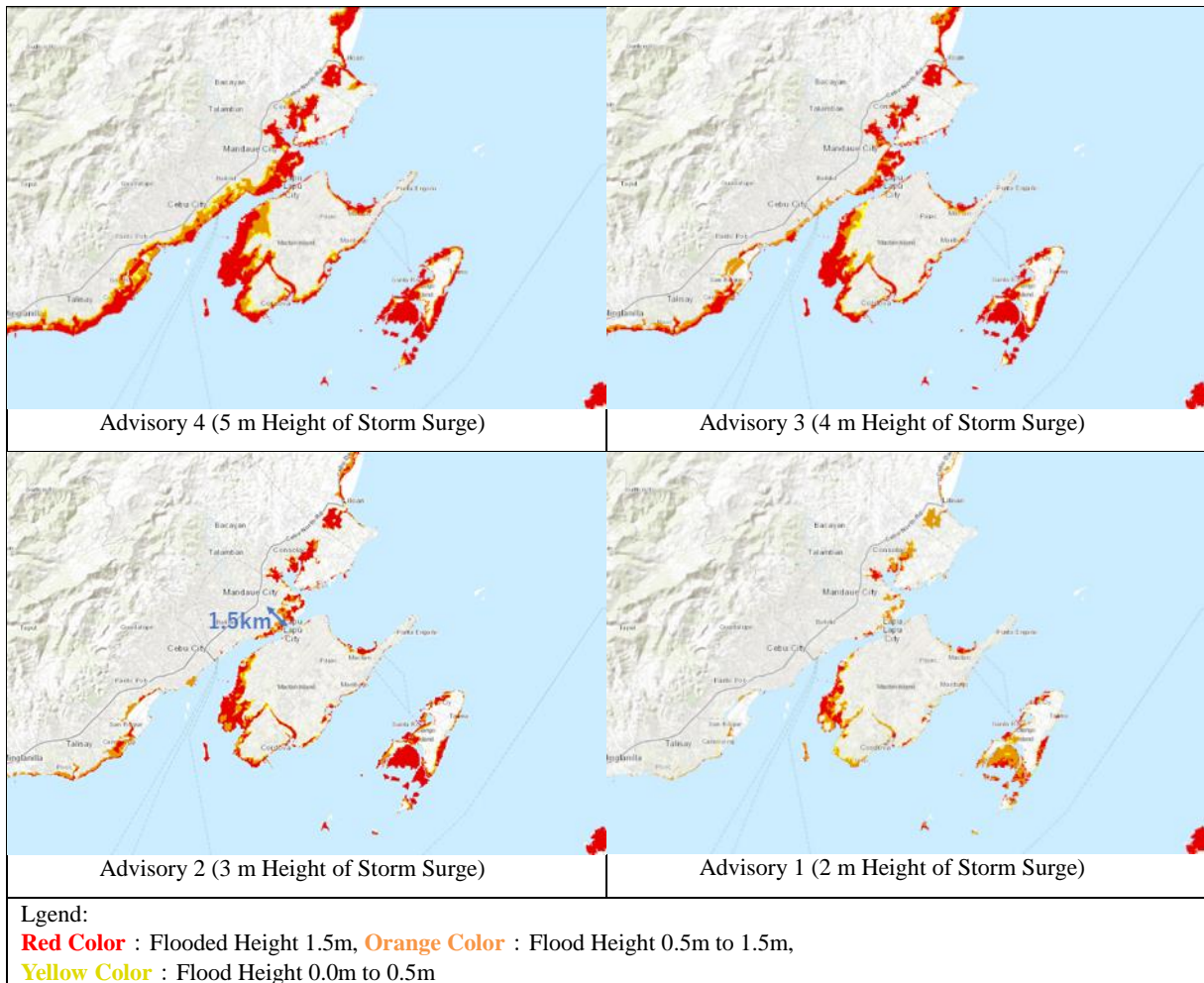


Source: Natural Hazards and Earth System Sciences

Figure 4.2.9 Simulation Result of Predicted Tide Level Caused by Typhoon HAIYAN

Figure 4.2.10 shows the hazard map of storm surge in the project area provided by Nationwide Operational Assessment of Hazards (NOAH). This hazard map was created by simulating the flooded area due to storm surge using the hydraulic model named FLO-2D developed by the United States Federal Emergency Management Agency (FEMA).

According to the hazard map, the storm surge advisory levels are divided into four levels from 1 to 4, and this figure shows the distribution of storm surge heights when storm surges of up to 2 m, 3 m, 4 m and 5 m hit, respectively. According to Figure 4.2.10, assuming that the storm surge deviation in the project area is 3 m when the typhoon HAIYAN was hit, the hazard map at Advisory Level 2 (3 m height of storm surge) indicates that approximately 1.5 km from the coast line may be flooded more than 1.5m.



Source: Nationwide Operational Assessment of Hazards (NOAH)

Figure 4.2.10 Hazardous Map of Storm Surge in the Project Area

4.2.1.3 Water Quality

The entire Metro Cebu area has no centralized Water Treatment Facility (WTF) or Sewage Treatment Plant (STP) and most of the establishments including households conveniently use the waterways as outfalls for untreated wastewater, thus, the poor environmental quality of the waters of Mandaue and Lapu-lapu.

Largo (2002) noted, that ‘nutrient levels of samples taken from the three stations within the channel, indicate high values for nitrogen (ammonia, nitrite and nitrate) and phosphorus (as phosphate). Possible sources of these nutrients could be from sewage effluents from domestic households and from agricultural fertilizers that wash out into the sea through river channels and from direct land run-off during rainy periods.

The baseline water quality survey was conducted at four (4) sites crossed and aligned by the proposed Project.

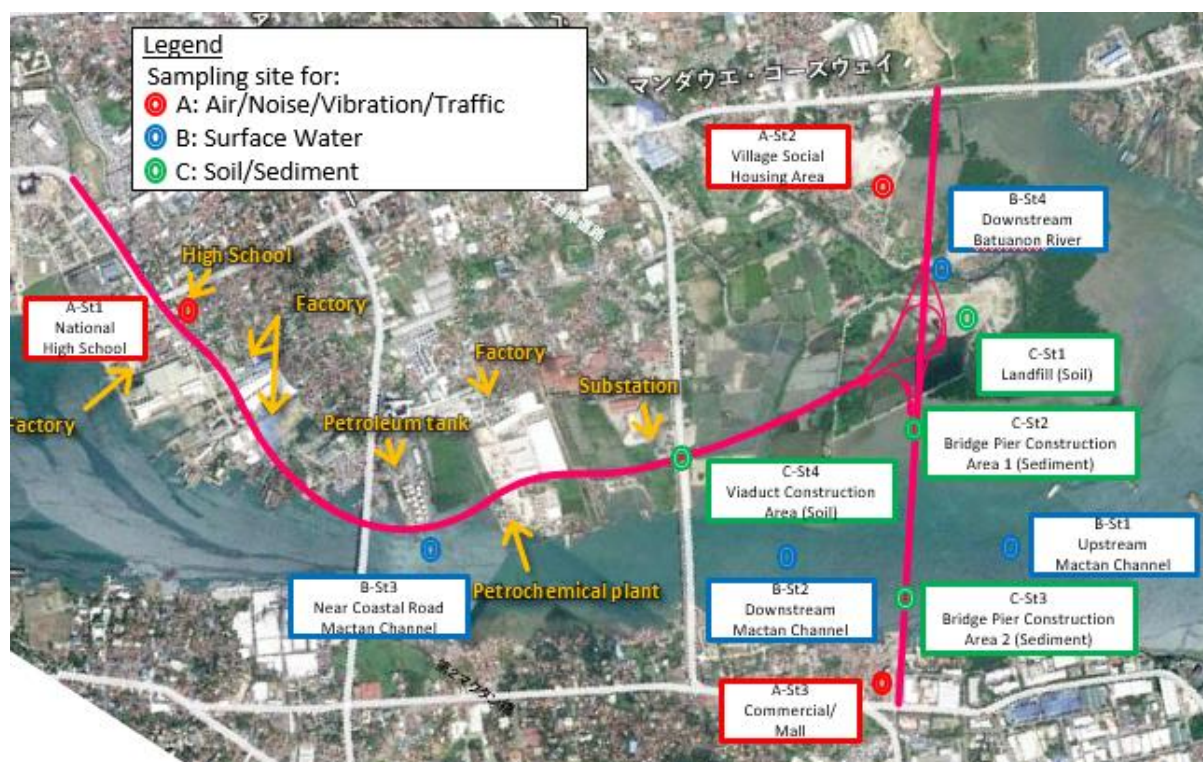


Figure 4.2.11 Water Quality Sampling points

The water quality benchmarks are prescribed Class D Waters for Butuanon River (Downstream), which is primarily used for the Navigable Waters, and Class SC Waters is used for Mactan Channel, which is primarily used for Fishery Water, Recreational water and Marshy and /or mangrove areas declared as fish and wildlife sanctuaries under DAO 2016-08. The results are shown below Table 4.2.3. Almost all parameters are within the standard except BOD of Butuanon River (Downstream).

Table 4.2.3 Sampling Results for Butuanon River (Downstream)

	PARAMETERS	UNITS	RESULTS	DENR Standard Class D*	Environmental Quality Standards for Soil Pollution in Japan River Water Class C**	IFC Indicative Values for Treated Sanitary Sewage Discharges(2007)
1	pH	-	7.2	6.0-9.0	6.5-8.5	6-9
2	Temperature	°C	29	26-30	-	-
3	BOD	mg/L	104	15	5	30
4	COD	mg/L	221	-	-	-
5	TSS	mg/L	73	110	50	50
6	Oil & Grease	mg/L	4	5.0	-	10
7	Salinity	g/kg	0.04	-	-	-
8	Total Phosphorous (P)	mg/L	1.09	5	-	2
9	Turbidity	NTU	27.9	-	-	-
10	Chromium (Cr)	mg/L	<0.02	0.02	0.01	-
11	Cadmium (Cd)	mg/L	<0.003	0.005	0.003	-
12	Lead (Pb)	mg/L	<0.01	0.1	0.01	-

Source: JICA Survey Team

Note: *Classified Water Bodies by EMB Region 7 http://water.emb.gov.ph/?page_id=777

Class D of DENR: Navigable Waters (Waters of the Philippines, including the territorial area and inland waters suitable for water transport)

**River water Class C of EQS in Japan: Fishery Class 3rd and Industry Class 1st

Table 4.2.4 Sampling Results for Marine Water Quality-Mactan Channel

	PARAMETERS	UNITS	RESULTS			DENR Standard Class SC*	Environmental Quality Standards for Soil Pollution in Japan Marine Water Class A**
			1 Upstream Mactan Channel	2 Downstream Mactan Channel	3 New Coastal Road Mactan Channel		
1	pH	-	8.2	8.3	8.3	6.5-8.5	7.8-8.3
2	Temperature	°C	30	30	28	25-31	-
3	BOD	mg/L	1	<1	1	n/a	-
4	COD	mg/L	<5	<5	<5	-	2
5	TSS	mg/L	40	39	32	80	-
6	Oil & Grease	mg/L	<1	<1	<1	3	N/D
7	Salinity	g/kg	40.1	36.4	39.9	-	-
8	Total Phosphorous (P)	mg/L	0.08	0.08	0.11	0.5	0.03
9	Turbidity	NTU	2.68	3.96	4.93	-	-
10	Chromium (Cr)	mg/L	<0.02	<0.02	<0.02	0.05	0.01
11	Cadmium (Cd)	mg/L	<0.003	<0.003	<0.003	0.005	0.003
12	Lead (Pb)	mg/L	<0.01	<0.01	<0.01	0.05	0.01

Source: JICA Survey Team

Note: * Classified Water Bodies by EMB Region 7 http://water.emb.gov.ph/?page_id=777

Class SC: 1) Fishery Water Class III - For the propagation and growth of fish and other aquatic resources and intended for Commercial and sustenance fishing

2) Recreational water Class II - For boating. Fishing or similar activities

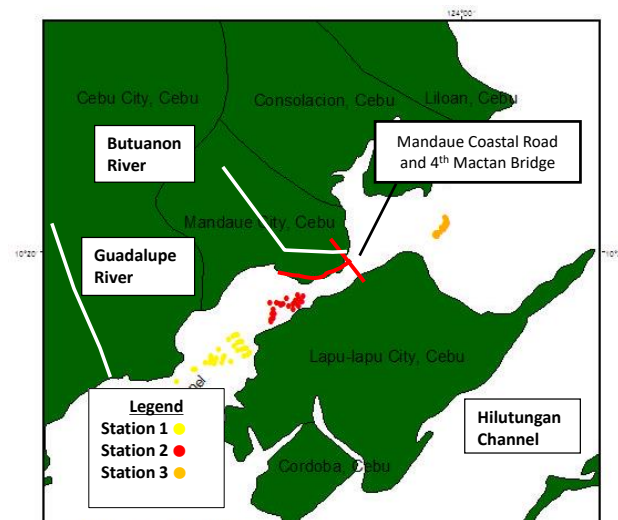
3) Marshy and /or mangrove areas declared as fish and wildlife sanctuaries

**Marine water Class A of EQS in Japan: 1) Fishery Water Class I, Recreational water and Natural conservation

4.2.1.4 Aquatic Flora and Fauna

(1) Secondary Data

A study by Largo (2002) initially identified and established sampling stations along the Mactan Channel. For purposes of monitoring only the waters stretching from the south of Cebu Harbor (near the Cebu South Reclamation Project) to the north (within Cansaga Bay area) have been monitored. Excerpted from this study are the following results mentioned in the following sections below.



Note)

Station 1: Vicinity of SRP,

Station 2: Near Mactan Bridge (in front of the Project site),

Station 3: Cansaga Bay Fronting MEPZ.

Figure 4.2.12 Largo Study Sampling Stations

Algae and Seagrass Components: Largo (2002) has identified approximately 30 species of macrobenthic algae and at least four species of seagrasses within the shallow coastal portions of Mactan side of the channel. In the sandy-rocky portions of Stations 1 and 3, seagrasses were found to co-exist with algae in an intermittent patchy distribution. An abundance of algae was notable during the colder months of January and February than in any other parts of the year (percent cover of 60-100%).

Fish: Mactan Channel still supports fishing activities by marginal fishermen. Carangids, wrasses, fusiliers, scorpaenids, goatfishes, and pomacentrids, among others, were observed in the study carried out by Largo (2002). Actual fishing by the researchers using gill nets and interviews made on the fishermen indicated that they could barely reach half a kilogram of fish catch in half a day's fishing effort. This is comparatively below the more or less two kilograms reported almost 25 years ago by Dominisac and Rau (1977). Some of their catches are only for their own consumption and the extra are sold in either Pasil or Carbon markets in Cebu City. It is not known whether the fish catch in the channel are from resident fauna or just the transient ones, i.e. those fish crossing only the channel on their way to the open and relatively clearer waters of Cansaga/Mactan Channels or to the Bohol Strait. Fish catch in the Channel was observed to be generally of small sizes.

Corals and other Benthic Invertebrates: Appraisal using a "manta-tow" to check the overall integrity of the corals in each station coupled with SCUBA diving observations revealed corals to be in various stages of deterioration. The remaining corals in Stations 1 and 3 is estimated to be at 26.5% live (total of 53 species) and 22% dead (total of 45 species). In station 1 alone, 5% (10 species) is comprised of live and 8.5% (17 species) dead. Predation by the "crown-of-thorns" (*Acanthaster planci*) was also found to contribute to this condition.

(2) Primary Data

Based on the secondary data mentioned above, to identify the present aquatic flora and fauna in the project site, two (2) ocular studies were undertaken in the rainy season (i.e. May 2019) and the rainy season (i.e. July 2019) as a part of this environmental impact assessment study. The survey items (i.e. on seagrass, sea weed, macro invertebrate and coral reef) were determined based on the scoping checklist agreed at the technical scoping with the EIA Review Committee. Based on discussions with local experts, it is concluded that aquatic flora and fauna survey needs to be carried out over two seasons (i.e. dry and rainy seasons) because its seasonal variation is notable in comparison to terrestrial flora (refer to 4.1.1.2 (4) Terrestrial Flora).

Survey Locations

Figure 4.2.13 shows the location for the coastal flora and fauna assessment carried out in May and July 2019 (i.e. seagrasses, seaweeds assessment, macro invertebrates, and coral reef). Survey Station 1 was set in the coastal areas near the fishpond and the Station 2 near the 1st Mactan Bridge, both in the Mandaue side.



Figure 4.2.13 Location map of the seagrass/seaweed assessed

(3) Seagrass

Method

Transect lines were laid parallel to the shore and was extended seaward up to the area where seagrasses no longer exist. Percentage cover of seagrasses were estimated using a 1 m x 1 m quadrat. The quadrat was placed every 10 m interval of the transect line.

Survey Results

Seagrass Species Composition and Distribution

Of the assessed area on the proposed Mandaue Coastal Road Project and Construction of the 4th Cebu-Mactan Bridge in Mandaue City and Lapu-lapu City, four (4) seagrasses species were found in the two

(2) sampling stations, namely: *Halodule pinifolia*, *Halophila ovalis*, *Halophila decipiens* and *Cymodocea rotundata* (Table 4.2.5). All these species are classified under ‘Least Concern’ in the IUCN Red List.

Among the seagrasses identified, *Halophila decipiens* and *Halodule pinifolia* were observed in both sampling stations assessed which are considered as the dominant seagrass species in the area. It was noted that four seagrass species listed in table were observed in station 1 while only 2 species (*Halophila decipiens* and *Halodule pinifolia*) were observed in station 2. Seagrass species in the assessed area is less diverse compared to other coastal community in the Province of Cebu.

Table 4.2.5 List of seagrass species composition and distribution

Family	Species	IUCN Red List Category	Sampling Site			
			Station 1		Station 2	
			Dry season	Rainy season	Dry season	Rainy season
Hydrocharitaceae	<i>Halophila decipiens</i>	Least Concern	Observed	Observed	Observed	Observed
	<i>Halophila ovalis</i>	Least Concern	Observed	N/A	Observed	N/A
	<i>Halodule pinifolia</i>	Least Concern	Observed	Observed	Observed	Observed
Cymodoceaceae	<i>Cymodocea rotundata</i>	Least Concern	Observed	N/A	Observed	N/A

Seagrass Percent Cover

In the dry season (i.e. May), Station 1 showed higher seagrass cover with 12.56% than Station 2 with 10.00% cover, whereas, in the rainy season, Station 2 showed higher cover with 8.61% than Station 1 with 7.46%. All the sites in all the seasons were still categorized in “Poor” reef condition based on Fortes (1989) classification of seagrass condition (Figure 4.2.14).

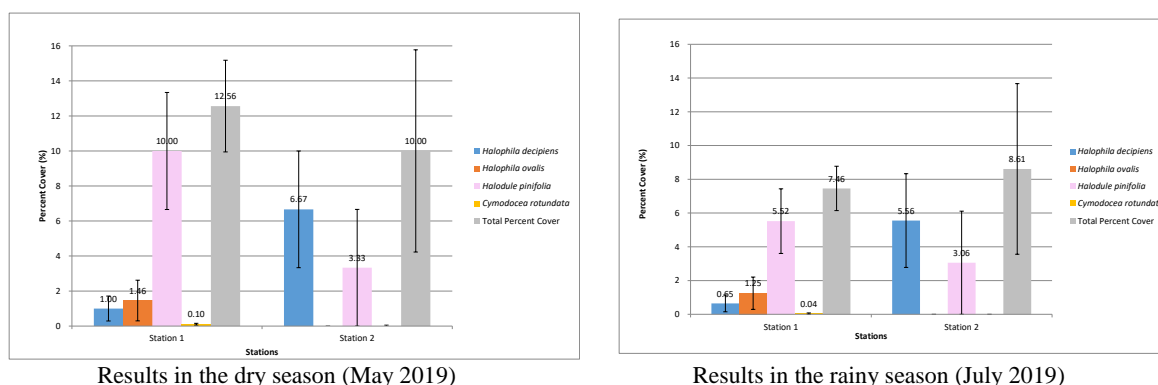


Figure 4.2.14 Mean seagrass percent cover within the project site

Based on the results of the survey in two assessment period, there’s no difference in term of species composition. Among the seagrasses identified, *Halodule pinifolia* and *Halophila decipiens* were both observed the dry and wet season which are considered as the dominant seagrass species recorded (Figure 4.2.15). *Halodule pinifolia* had the highest seagrass cover in the both seasons survey while *Cymodocea rotundata* has the lowest seagrass cover. The Seagrass species in the assessed area is less diverse compared to other coastal community in the Province of Cebu. In terms of percentage cover, there is a decrease of seagrass cover from 11.28% in May to 8.03 % in July, probably due to the floods and high levels of water turbidity that affects the light penetration to seagrass beds.

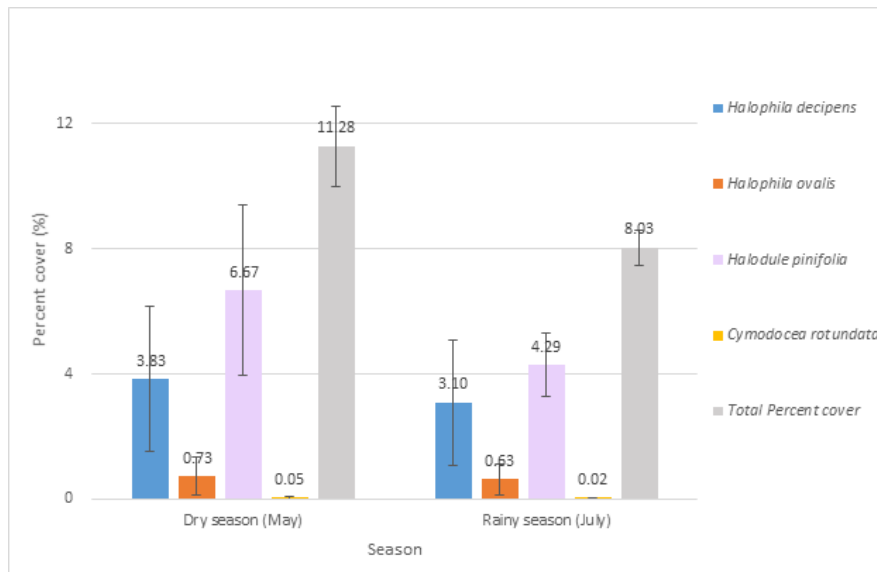


Figure 4.2.15 Mean comparison of seagrass percent cover over two seasons

The result indicates that the seagrass habitats of both stations are disturbed. The poor condition of seagrass was attributed to natural anthropogenic causes. Natural causes include light, temperature, substrate type, organic materials, water movement and sedimentation load. The low percent cover is thought to be caused by the high levels of turbidity which blocks the availability of sunlight for photosynthesis of seagrasses. Anthropogenic activities such as collection of edible marine organisms like mollusks and other anthropogenic factors such as conversion of the seagrass beds into reclamation area, development of port facilities are thought to have influenced the condition of the seagrass/seaweeds. Heavy siltation brought by Butuanon River during rainy season may be another contributing factor to destroy the habitat of seagrass.

(4) Seaweeds

Method

Transect lines were laid parallel to the shore and was extended seaward up to the area where seaweeds no longer exist. Percentage cover of seaweeds were estimated using a 1 m x 1 m quadrat. The quadrat was placed every 10 m interval of the transect line.

Survey Results

Seaweeds Species Composition and Distribution

A total of six (6) algae species were found in the two (2) stations: *Ulva reticulata*, *Ulva intestinalis*, *Ulva lactuca*, *Caulerpa sp.*, *Gracilaria sp.* and Filamentous algae (Table 4.2.6). Among the Algae species identified, *Ulva reticulata* and *Caulerpa sp.* were observed in both stations assessed which are considered as the dominant algae species recorded. None of the species identified is classified under the category equivalent or worse than near threatened (NT).

Table 4.2.6 List of seaweeds species composition and distribution

Family	Species	IUCN Red List Category	Sampling Site			
			Station 1		Station 2	
			Dry season	Rainy season	Dry season	Rainy season
Ulvaceae	<i>Ulva reticulata</i>	Not Evaluated	Observed	Observed	Observed	Observed
	<i>Ulva intestinalis</i>	Not Evaluated	Observed	N/A	N/A	N/A
	<i>Ulva lactuca</i>	Not Evaluated	Observed	N/A	N/A	N/A

Caulerpaceae	<i>Caulerpa sp.</i>	N/A	Observed	Observed	Observed	N/A
Gracilariaceae	<i>Gracilaria sp.</i>	N/A	Observed	Observed	N/A	N/A
N/A	Filamentous Algae	N/A	Observed	N/A	N/A	N/A

Percent Cover

Figure 4.2.16 shows the algae percentage cover of the two (2) stations assessed in Mactan, Cebu. In dry season, Station 1 had the higher algae cover of 21.75% than Station 2 with only 1% algae cover. Likewise, in rainy season, Station 1 showed a higher cover of 12.74% than Station 2 with only 0.63%.

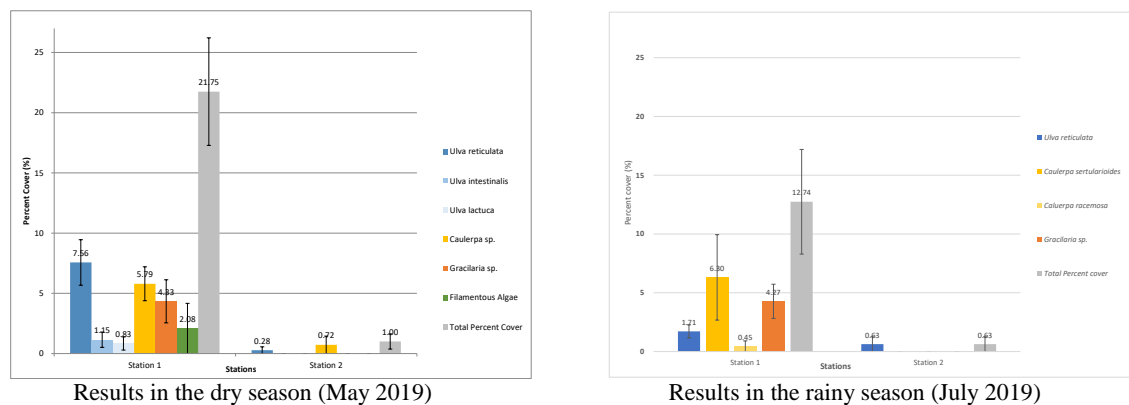


Figure 4.2.16 Mean seaweed percent cover within the project site

Figure 4.1.17 shows the algae percentage cover over two (2) seasons. Compared to the dry season (i.e. May), there's a decrease of algae cover in rainy season (i.e. July) by 4.7%. Low algae cover in rainy season may be caused by flood that washes away the algae in the area and also by the low sunlight.

Among the algae species identified, *Ulva reticulata*, *Caulerpa sp.* and *Gracilaria sp.* showed relatively high cover in both dry and rainy seasons. The cover of *Ulva sp.* decreases in rainy season, whereas *Caulerpa sp.* and *Gracilaria sp.* show consistent figures over seasons.

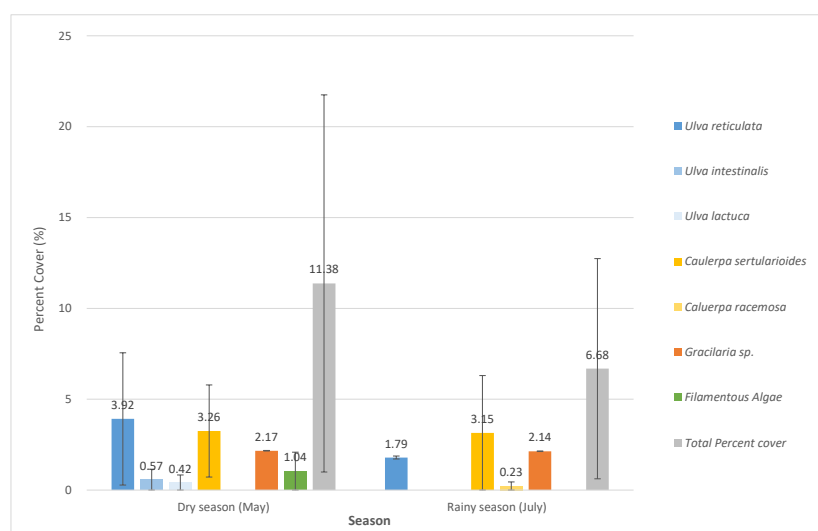



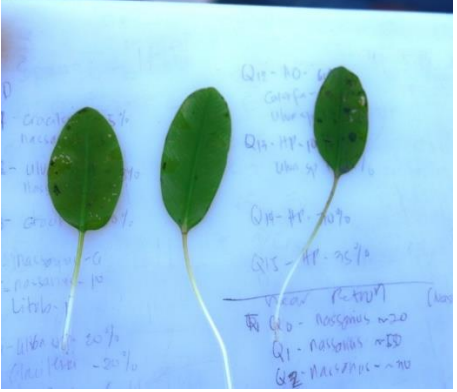






Figure 4.2.17 Mean comparison of seaweed percent cover over two seasons

Table 4.2.7 Photos of seagrass and sea weed assessment

	
<p>A transect line is laid out during seagrass assessment.</p>	<p>A 1m x 1m quadrat is laid out at every 10m in the transect line in Barangay Looc, Mandaue City where the coastal road passes through a viaduct at Mactan Channel.</p>
	
<p><i>Halophila decipiens</i> is a type of seagrass identified within the quadrat of the transect line laid out in Barangay Umapad, Mandaue City near the planned bridge construction site.</p>	<p>Leaves of <i>Halophila ovalis</i> was closely examined during the seagrass assessment in Mandaue City side.</p>
	
<p><i>Ulva lactuta</i> recorded in the coastal water of the Mandaue City side.</p>	<p><i>Gracilaria spp.</i> recorded in the coastal water of the Mandaue City side.</p>
	
<p><i>Ulva spp.</i> recorded in the coastal water of the Mandaue City side.</p>	<p><i>Caulerpa taxifolia</i> recorded in the coastal water of the Mandaue City side.</p>

(5) Macro Invertebrate

Method

The method used in assessing the macro-invertebrates followed the transect lines used in assessing the seagrass, seaweed and coral reef. All macro-invertebrates organisms within the quadrat for seagrass and seaweed assessment; an imaginary line of 10 meters width of transect for fish and coral were identified and counted.

Survey Results

Species Composition

Table 4.2.8 shows that Station 1 recorded 7 species of macroinvertebrate while Station 2 recorded only 1 species. *Nassa* Mud snails had the highest number of individuals recorded in both stations. Knowing the biology of *Nassa* mud snails, it usually inhabits on intertidal and sublittoral, temperate to tropical, soft bottoms (“*Nassariidae-Nassa* mud snail,” 2010⁶).

Presence of invertebrates has a positive impact on growth and settlement of corals as they remove algae which can potentially compete against coral for space (McClanahan et al., 1994⁷). Invertebrates grazing open up solid substrates upon which corals settle (Ogden, 1978⁸). It was realized that echinoids are dominant invertebrate species and are vital for maintaining the delicate balance between algae and coral dominated reefs (Sammarco, 1982⁹).

Table 4.2.8 Macro invertebrate species composition and distribution

Species	IUCN Red List Category	Sampling Site			
		Station 1		Station 2	
		Dry season	Rainy season	Dry season	Rainy season
<i>Anadara</i> sp.	N/A	Observed	Observed	Not Observed	Not Observed
<i>Anomalocardia squamosal</i>	Not Evaluated	Not Observed	Observed	Not Observed	Not Observed
<i>Bulla</i> sp.	N/A	Not Observed	Observed	Not Observed	Not Observed
<i>Nassarius</i> sp.	N/A	Observed	Observed	Observed	Observed
<i>Portunus</i> sp.	N/A	Not Observed	Observed	Not Observed	Not Observed
<i>Rhinoclavis</i> sp.	N/A	Not Observed	Observed	Not Observed	Not Observed
<i>Sponge</i> sp.	N/A	Observed	Not Observed	Not Observed	Not Observed

Population Density

Figure 4.2.19 Mean comparison of showed that the results of *Nassarius* spp in dry season and rainy season showed a great different in terms population density. At the Station 1, *Nassarius* spp showed a total of 21 individuals in dry season, while 131 individuals in rainy season. On the other hand, at the Station 2, *Nassarius* spp showed a total of 78 individuals in dry season, while 14 individuals in rainy season. This may be explained by the strong wave action and water current observed during the assessment in dry and rainy seasons, respectively.

Macro invertebrates are a remarkably diverse group of animals due to the variety of functions they perform such as nutrient recycling, the removal of detritus material, and the consumption of invading algae. Disturbance of marine invertebrates can result in negative ecological impacts upon the reef, such

⁶ “*Nassariidae-Nassa* mud snail”. SeaLifeBase, 09, September 2010. Retrieved from <http://www.sealifebase.ca/Summary/FamilySummary.php?id=2012&lang=eng>.

⁷ McClanahan, T. R. (1994) Kenyan coral reef lagoon fish: effects of fishing, substrate complexity, and sea urchins. *Coral Reefs*, [Online] 13 (4), 231-240.

⁸ Ogden, J. C. & Lobel, P. S. (1978) The role of herbivorous fishes and urchins in coral reef communities. *Environmental Biology of Fishes*, [Online] 3 (1), 49-63.

⁹ Sammarco, P. W. (1982) Echinoid grazing as a structuring force in coral communities: Whole Reef Manipulations. *Journal of Experimental Marine Biology and Ecology*, [Online] 61, 31-55.

as algae blooms and invertebrate plagues leading to a reduction in coral cover (Dumas et al., 2007¹⁰, Hutchings, 1986¹¹).

Based on anecdotal evidence from aquaria, they are generally thought to be primarily opportunistic scavengers, perhaps being even saprophytic, but as also been observed to apparently feed on algae and microbial films as a non-selective surface grazer (World Association of Zoos and Aquariums).

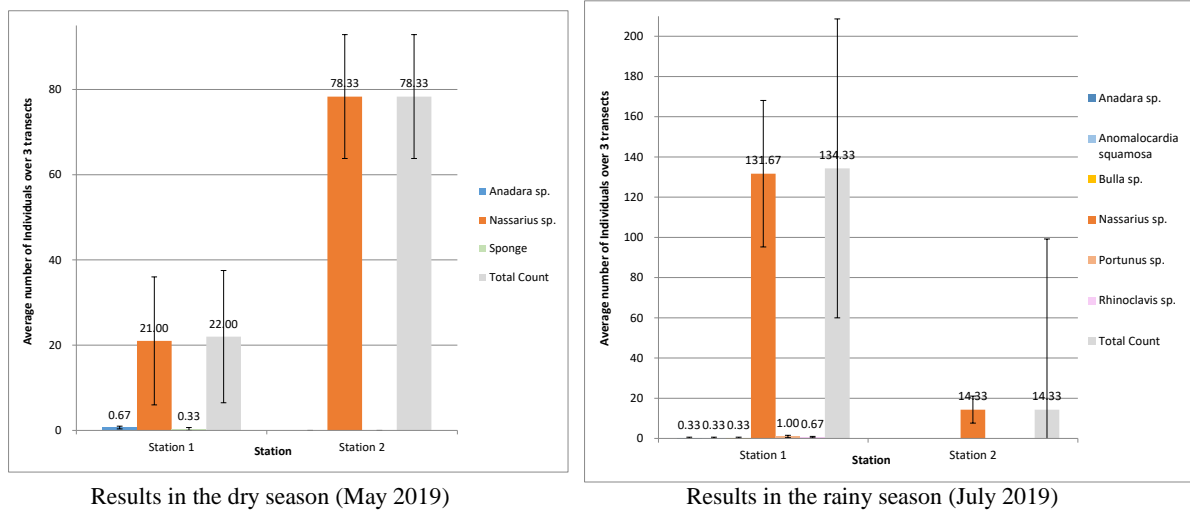
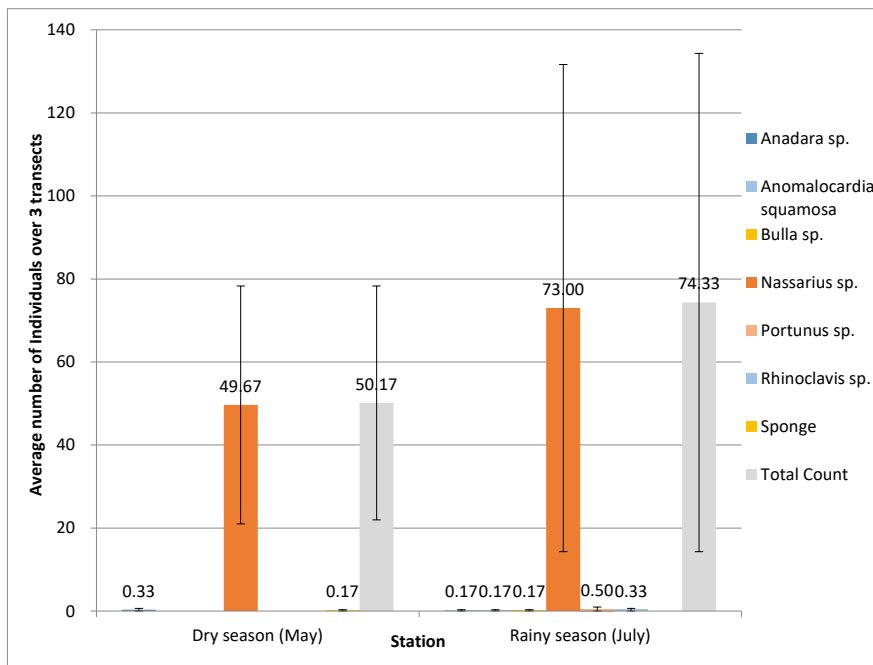


Figure 4.2.18 Mean population density of macro invertebrates within the project site

Figure 4.2.19 showed that the rainy season has a higher mean population density of 74.33 individuals than the dry season with 50.17 individuals.





¹⁰ Dumas, P., Kulbicki, S., Chifflet, S., Fichez, R. & Ferraris, J. (2007) Environmental factors influencing the urchin spatial distributions on disturbed coral reefs (New Caledonia, South Pacific). [Online] Journal of Experimental Marine Biology and Ecology, (344), 88-100.

¹¹ Hutchings, P.A. (1986) Biological destruction of coral reefs. [Online] Coral Reefs 4:239-252.

Figure 4.2.19 Mean comparison of population density of macro invertebrates over two seasons

Table 4.2.9 Photos of macro invertebrate assessment

	
<p>A cockle or locally known as “Litob” (<i>Tegillarca granosa</i>) is one of the seashells identified during the assessment of coastal water in Barangay Umapad, Mandaue City. Some subsistence fishermen gather this in the area for home consumption as source of protein.</p>	<p>Nassa mud snail (<i>Nassarius spp.</i>) had the highest number of individuals recorded in both station 1 and Station 2.</p>

(6) Coral Reef

Method and Survey Locations

A detailed assessment of coral cover was conducted using Point Intercept Transect (PIT). Two (2) transect lines measuring 50m were laid parallel to the shoreline with at least 5m interval between transect lines. All coral life forms intercepted at the point of every 0.50 m of the transect lines were identified and recorded. Corals were then identified up to the genus level. The percentage cover of each life form category was calculated using the following formula:

$$\text{Percent Cover} = \frac{\text{Total No. of Individual Lifeform}}{\text{Total No. of Point-Sampled}} \times 100$$

Coral reef condition was classified into four distinct categories based on the percentage of hard coral cover using the following reference shown in Table 4.2.10.

Table 4.2.10 Coral Category index¹²

Status	Percentage
Poor	0-25%
Fair	26-50%
Good	51-75%
Excellent	76-100%

Figure 4.2.20 shows the location of the sampling stations of coral reef assessment.

¹² English, S., Wilkinson, C., and Baker, V. (1997). Survey Manual for Tropical Marine Resources. Australian Institute of Marine Science. Townsville, Australia.







Figure 4.2.20 Location map of the coral reef assessment

All sampling stations have no corals and reef fishes observed in the area during the two (2) assessment conducted during the dry season (i.e. May) and the rainy season (i.e. July). This is probably due to the heavily silted thus, mud deposit are settled on the seafloor. The mud deposit in the entire reef is attributed to heavy siltation brought by Butuanon River during rainy season. The area is very turbid and low visibility of about 0.50 m and it has an average depth of 5.33 m. Other observation on site condition and characteristics of the surveyed sites are presented in Table 4.2.11.

Table 4.2.11 Condition/characteristics of the sampling sites for coral reef assessment

Station No.	Site Condition/Characteristics
1 & 2	<ul style="list-style-type: none"> The surveyed site was located in Barangay Umapad, Mandaue City side. Water is very turbid with visibility of around 0.50 meter only. Depth of assessed area for coral reef is about 4 meters. Sea bed is heavily silted thus, mud deposits are found on the seafloor. Thickness of mud ranges from 20-30 cm. No corals (soft and hard) were observed in the sampled site.
3 & 4	<ul style="list-style-type: none"> The surveyed site was located in Barangay Ibo, Lapu-Lapu City side near Cebu Yacht Club and a mini-port. Water is turbid with visibility of around 0.50 meter only. Depth of assessed area for coral reef is about 8 meters. Sea bed is heavily silted thus, mud deposits are found on the seafloor. Thickness of mud ranges from 20-30 cm. No corals (soft and hard) were observed in the sampled site.
5 & 6	<ul style="list-style-type: none"> The surveyed site was located in Barangay Looc, Mandaue City side (the 1st Mactan Bridge) near informal settlers and fuel terminal/oil depot of Petron Corporation-Visayas Cluster. Water is very turbid with visibility of around 0.50 meter only. Depth of assessed area for coral reef is about 4 meters. Seawater current in this particular site is quite strong. Sea bed is heavily silted thus, mud deposits are found on the seafloor. Thickness of mud ranges from 20-30 cm. No corals (soft and hard) were observed in the sampled site.

Table 4.2.12 Photos of coral reef assessment

 <p>51 P 606591 1142348 accuracy: 2m Altitude 8 m W 300 5/1/19 3:40 PM</p>	 <p>51 P 606767 1142050 accuracy: 2m Altitude 10 m E 120 5/1/19 4:03 PM</p>
<p>A Scuba diver team conducted coral reef assessment within the project site.</p>	<p>A sample of mud soil was taken in the sea floor from the assessed area for coral reef in Mandaue City side. There was no coral observed in the surveyed site.</p>
 <p>51 P 606569 1142941 accuracy: 2m Altitude 6 m S 210 240 5/1/19 3:04 PM</p>	 <p>51 P 604681 1141107 accuracy: 2m Altitude 210 240 W 5/1/19 5:02 PM</p>
<p>A mud soil was also recorded in the coastal water of Barangay Ibo, Lapu-Lapu City wherein the particular area is directly affected by the bridge construction.</p>	<p>The assessment team found out mud soil in Barangay Looc, Madaue City where the Mandaue Coastal Road passes through a viaduct. The team did not observe the existence of coral in the area due to heavy siltation.</p>

(7) Fish

Method

Fish visual census could not be carried out due to high turbidity at the same sampling sites as coral reef assessment. Hence, basic information on fish in the project site was collected through an interview to the fisherman in connection with their daily fish catch.

Survey Results

Table 4.2.13 shows the list of fish catch within the surveyed sites. A total of ten (10) fishes belonging to five (5) families were caught by the fishermen. Fishes and macro-invertebrates that are usually caught by fishermen in Mactan are Mullet fish, Pony fish, Cardinal fish, Goby fish, Shrimp and Crab. These marine species are euryhaline where they are able to adapt to a wide range of salinities. In the assessed sites exists a river where the salinity level changes regularly.

Table 4.2.13 List of fish catch based on the interview to the fishermen

Family Name	Species		
	Scientific Name	Common Name	Local Name
<i>Fish</i>			
Mugilidae	<i>Valamugil buchanani</i>	Bluetail Mullet	Gisaw/ Banak
	<i>Valamugil seheli</i>	Bluespot Mullet	Gisaw/ Banak
	<i>Ellochelon vaigiensis</i>	Squartail Mullet	Gisaw/ Banak
Leognathidae	<i>Secutor insidiator</i>	Pugnose Ponyfish	Potpot
	<i>Leiognathus equulus</i>	Common Ponyfish	Potpot
Apogonidae	Apogon spp.	Cardinal fish	Ibis
Unknown	Unknown	Unknown	Bugo
<i>Macro invertebrates</i>			
Penaeidae	Metapenaeus spp.	Shrimp/Prawn	Pasayan
	Penaeus spp.	Shrimp/Prawn	Pasayan/Lukon

	Litopenaeus spp.	Shrimp/Prawn	Pasayan
Portunidae	Thalamita crenata	Crenata swimming crab	Kasag

4.2.2 IMPACT IDENTIFICATION AND ASSESSMENT

4.2.2.1 Hydrogeology and Water quality

(1) Change in Hydrology

Construction Phase

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road will be constructed as an elevated viaduct mainly, so that modification of topography due to cut-and-fill work will be limited. However, the construction will have negligible to moderate impacts on the hydrology.

The identified causes of impacts on hydrology during construction stage include:

- Disruption of natural drainage pattern due to modification of topography
- Increase in run-off due to exposed soils, disturbance of soils which may result to localized flooding, sedimentation, etc.;
- Ponding of water in and around foundation excavations and subgrades supporting slabs on fill

Before the construction, existing informal settlers at the the riverbank of Butuanon River will be provided the compensation and assistance as described in 4.4.4.1. The construction site of the ramp of the interchange is next to this area. Even though localized flooding may happen when high tide and heavy rain occur at the same time, there are no impacts to this area.

Operation Phase

The presence of viaduct of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road may change the flow conditions of Butuanon River, and it will disrupt the drainage pattern and transport/accumulate sediments. The impacts on the change of the flow conditions of seawater are described in 4.2.2.2.

(2) Water pollution

Construction Phase/ Operation Phase

The identified causes of impacts on water quality during construction stage include:

- Increase of turbidity, siltation/sedimentation of Mactan Channel due to movement of loose underwater sediments, soil from construction of viaduct footings/columns (especially, during rains)
- Accidental releases of fuel, oil, lubricant and other chemicals due to road construction and maintenance work may end up contaminating groundwater and surface waters.
- Further bacteriological contamination of the esteros due to improper management of domestic and solid wastes
- Contamination/degradation of water quality may be generated due to drainage outfall

(3) Water resource

Construction Phase/ Operation Phase

Water usage for construction work will impact to water usage in local community.

Potential environmental effects of the Project on groundwater resources may occur as a result of construction vibrations from heavy equipment and excavation can temporarily affect well water quality (ex. Turbidity and discoloration). However, there would be no significant impact given the following:

- The nearest National Water Resource Board (NWRB) water permittee to the project site (i.e. Deep well at San Miguel Corporation) is located at 1.2 km, which is distant from any activities of the

project that may impact on water resources¹³. Hence, the project is unlikely to affect any source of water supply.

- The area in the vicinity of the project site is also suffering from salt water intrusion, which makes deep wells in the area no longer viable to supply domestic water to the community.

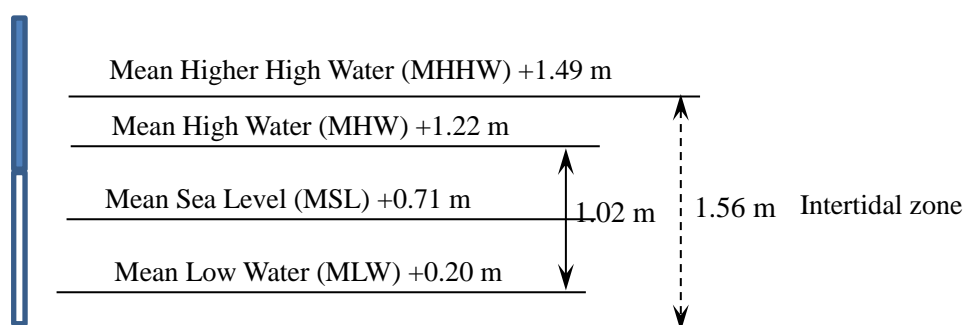
4.2.2.2 Oceanographical Conditions

Construction Phase/ Operation Phase

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road will be constructed as an elevated viaduct mainly, so that modification of topography due to cut-and-fill work will be limited. However, the modifications of topography/terrain may disrupt drainage pattern, causes erosion/transport of sediments and pollutants to surface waters are considered adverse impacts to coastal processes and change of the characteristics of beach if not mitigated properly. Hydraulic impact on oceanographical conditions, the intertidal zone in particular, is described based on literature and charts.

As described in 4.2.1.2 (1), the tide conditions in the project site are shown in Figure 4.2.4. The tide component of Cebu is dominated by the components of the semi-diurnal tides. It also has a tendency of diurnal inequality where the tide level at high tide / low tide, which occurs twice a day, sometimes changes differently. The difference between Mean High Water (MHW) and Mean Low Water (MLW) of the day is 1.02 m.

The definition of tidal flat in Japan refers to the intertidal zone between mean monthly highest water level and mean monthly lowest water level. On the other hand, in tide statistics in Cebu, only Mean Higher High Water (MHHW) is defined. Therefore, the difference between Mean Lower Low Water (MLLW) and MLW is equal to the difference between Mean Higher High Water (MHHW) and MHW. In addition, MLLW is set to -0.07 m, and 1.56 m of difference between MHHW and MLLW is defined as an intertidal zone (See Figure 4.2.21).



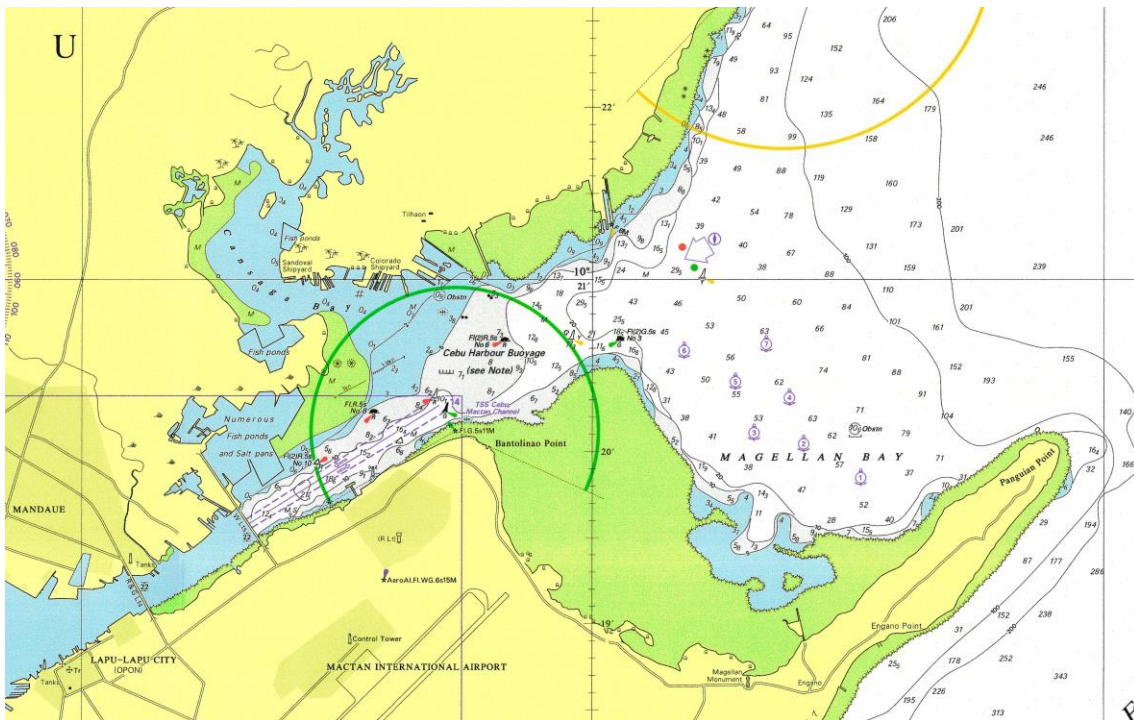
Source: Tide and Current Tables Philippines 2019, arranged by JICA Survey Team

Figure 4.2.21 Tide water level (Intertidal zone)

Based on the hydrographic chart (see Figure 4.2.22), the velocity of tidal current at the piers is 1 knot (0.51 m / sec) in the southwest direction when the tide is high, and 1.8 knots (0.93 m / s) in the northeast direction when the tide is low. However, this is near the channel, and is not the velocity of tidal current at the tidal flat where mangrove grows naturally.

The deepest bottom of the new bridge is -19.8 m, and in Mactan side, there is a tidal flat where mangroves grow naturally over 800 m and its elevation is equivalent to intertidal zone.

¹³ National Water Resource Board (available at <http://www.nwrp.gov.ph/index.php/products-and-services/water-permittees>)



Source: United Kingdom Hydrographic Office

Figure 4.2.22 Hydrographic chart

In the case that piers are installed in the water area, the ground surface around the piers will be lowered due to scouring the bottom by the flow around the piers. The size of the scouring phenomenon relates to parameters such as the bridge width and other shapes, the velocity of tidal current, and water depth. In the case that the water depth is shallow and the velocity of tidal current is low, the amount of scouring is generally small.

The water depth near the bridge pier located in the tidal flat is less than 1 m from the MHHW. At shallow water depths in tidal flat, the velocity of tidal current is estimated to be very low due to the flow resistance of the mangrove ground roots.

Therefore, its hydraulic influence and topographical change of tidal flat are considered to be minor.

4.2.2.3 Aquatic Flora and Fauna

Construction Phase

Potential impacts from construction activities on the aquatic flora and fauna include:

- Removal of or direct physical injury to aquatic flora and fauna (e.g. seagrasses and sea weeds in Cansaga Bay and Mactan channel) through activities associated with construction of offshore viaduct and bridge;
- Vibration/disturbance from pile-driving
- Turbidity, siltation/sedimentation of Mactan Channel due to movement of loose underwater sediments, soil from construction of viaduct footings/columns
- Release of contaminants, such as fuel and hydraulic fluid from equipment/vehicles for construction; chemicals such as paint; liquid wastes; and sediment-laden run-off from uncleaned/dirty area of construction work sites

Operation Phase

Potential impacts from operational activities on the aquatic flora and fauna include:

- Lighting along the bridge may give adverse impacts on fish in the ocean, which subsequently affect the small-scale fishery being carried out near the project site
- Deterioration of habitat due to release of contaminants, chemicals, liquid wastes, and sediment-laden run-off from uncleaned/dirty area of maintenance work sites

4.2.3 IMPACT MITIGATION & ENHANCEMENT MEASURES

4.2.3.1 Hydrogeology and Water quality

Construction Phase

To reduce minor impacts to less significant/negligible impacts of road construction development works on 'water environment' the following measures shall be implemented:

(1) Change in Hydrology

There is a possibility that the construction work will cause disruption of natural drainage pattern due to modification of topography and increase in run-off due to exposed soils. The adequate drainage system such as the crossing drainage pipe will be set to avoid or mitigate these impacts. The concepts of the drainage system are shown below:

1. Coastal Road: Near its starting point inside the urban area

Road drainage will be connected to the existing underground drainage system. The drainage from the viaduct will be connected to the bridge girder, bridge pier and drainage pipe on the ground using a polyvinyl chloride drainage pipe.

2. Coastal Road: Offshore section

Drainage from the viaduct will flow into the sea. This practice is common in Japan, and was also applied at the time of the construction of the second Mactan Bridge.

3. Coastal Road: Undeveloped section

The basic idea is the same as '1', but since there is no existing drainage facility, drainage will flow to the rivers and waterways to be crossed.

4. 4th Cebu-Mactan Bridge: Lapu-Lapu side

As in '1', a drainage facility will be installed in ROW. Since the slope of the terrain is inclined toward the sea side, there is no problem in securing the drainage function only in the ROW.

Furthermore, construction methods with less impact will be adopted. For pier column work, pile bent type will be adopted, where possible, to minimize excavation. For piling work, casing pipe will be installed within which excavation work and concreting work will be carried out.

In addition, the following mitigation measures will be implemented.

- Limiting the area of exposed soil
- Building of bund/dikes effectively enclosing water-areas prior to landfilling for coastal road
- Implementation of erosion control measures, including temporary diversion berms/sandbagging, drainage swales and siltation basins
- Loose earth materials stockpile be kept away from banks and near waters (waterways, sea)

(2) Water pollution

Mitigation measures on impact to oceanographical conditions are similar with “Change in Hydrogeology” shown in above section.

- Prepare temporary drainage plan with sump pits/sedimentation pond to trap sediments and wastes
- Use of silt fences and sediment traps, cover exposed earth especially before heavy rains are expected.
- Proper handling of oil and lubricants to prevent spillage and contamination of surface and ground waters; (Storage of oil and lubricants in secure areas/places)
- Heavy equipment and machineries shall be well-maintained to prevent discharges from engines and regularly checked for fuel and oil leaks.
- During repair/maintenance of equipment and machinery, containers/drip trays shall be used to collect leakage
- Paint residues and paint (including lacquer, varnishes, glue/epoxy, and other chemicals) containers shall be disposed properly and arrangement will be made with the suppliers for such containers to be return for their proper disposal
- Contractor/Project Management provides toilet/washroom facility for construction workers and require proper sanitation practices
- Provision of garbage bins at the construction areas;
- Regular disposal of wastes generated by the personnel to city approved disposal sites;
- Conduct weekly inspection of the construction areas to ensure proper management of the wastes generated by the construction personnel and
- Adequate maintenance of drainage line/canal (e.g. desilting) and putting-up of catch basins (silt trap) at regular interval.
- Care and maintenance of greeneries, ground cover – specifically, those along the riverbanks and shorelines that would retard storm water run-off and screen discharge of pollutants to surface waters
- Set up filters and catch basins for storm drains, to prevent possible pollutants from being flushed into the sea
- Conduct a quarterly water quality monitoring

(3) Water Resource

- Sourcing of water from outside of the communities within the project area
- Implement water saving/conservation measures of water use for construction works/activities
- Recycled water or water from waterways and marine waters shall be used for ground sprinkling or dust-suppression measures

Operations Phase

In the detailed design, the impacts on the river and the current shall be taken into consideration so that the placement of the bridge pier be optimal.

Potential effects on surface water quality may come from increased stormwater run-off due to decrease in permeable areas that would increase outfall to coastal waters of Mactan Channel and Cansaga Bay.

As above-described, proper drainage and stormwater management to prevent the 4th Cebu-Mactan Bridge-Mandaue Coastal Road from causing flooding, contamination of surface and ground waters should be conducted (same as Construction Phase).

4.2.3.2 Oceanographical Conditions

Construction/ Operations Phase

Mitigation measures on impact to oceanographical conditions are similar with “Change in Hydrogeology” “Water Pollution” shown in above section.

Regular and constant monitoring of coastal/marine areas for possible deterioration of aquatic resources and marine water quality, and oceanographical conditions should be implemented by the contractor and the project proponent.

- Adopt construction methods with less impact (i.e. For pier column work, pile bent type to be adopted where possible to minimize excavation. For piling work, casing pipe to be installed within which excavation work and concreting work will be carried out)
- Building of bund/dikes effectively enclosing water-areas prior to landfilling for coastal road
- Proper handling of Oil and lubricants to prevent spillage and contamination of surface and ground waters; heavy equipments and machineries shall be well-maintained to prevent discharges from engines
- Paint residues and paint (including lacquer, varnishes, glue/epoxy, and other chemicals) containers shall be handled & disposed properly and arrangement will be made with the suppliers for such containers to be return for their proper disposal
- Regular maintenance of drainage system (e.g. desilting)
- Care and maintenance of greeneries, ground cover –specifically, those along the shorelines that would retard run-off from flowing into open waters

4.2.3.3 Aquatic Flora and Fauna

Construction Phase

For impacts on the marine environment, the following are the suggested measures:

- Conservation efforts on the seagrasses have to be pursued by the government (local and national) and the private sector, as these ecological resources are being threatened by the impacts of coastal development and fishing related activities.
- Monitor the distribution and health of surrounding intertidal habitats along or near the vicinity of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment.
- Offsets to be implemented such as development of marine sanctuary, planting of mangroves in nearby available coastal areas (if applicable)

The proponent should strictly enforce its contractors to utilize ‘Best Management Practices’ in pile-driving operations in the marine/offshore areas of the port project, which will meet the following criteria: maximize environmental protection and avoidance of contravention with environmental and safety guidelines and regulations.

When in an aquatic environment, contractors will employ the following basic best management practices:

- Adoption of temporary jetty construction road to minimize adverse impacts on aquatic environment
- All equipment will be maintained in good proper running order to prevent leaking or spilling of potentially hazardous or toxic products. This includes hydraulic fluid, diesel, gasoline and other petroleum products.
- Storage of fuels and petroleum products will comply with safe operating procedures, including containment facilities in case of a spill.
- Pile cut-offs, waste or any miscellaneous unused materials will be recovered for either disposal in a designated facility or placed in storage. Under no circumstances will materials be deliberately thrown overboard.

- Contractors will have emergency spill equipment available whenever working near or on the water.
- Avoid pile-driving methodology with sound & vibration impacts destructive to marine env/ habitats & disruptive to fish spawning
- Contractors, where possible, will position their water borne equipment in a manner that will minimize damage to identified fish habitat (mangrove, seagrasses, and coral reefs).
- Coordinate with Bureau of Fisheries and Aquatic Resources (BFAR) on pile-driving schedule that it will not occur or be disruptive during fish spawning season
- Monitoring of sound and vibration level during driving any type of piles with in mind its impacts on fish and their habitat.

Operations Phase

For impacts on the marine environment in the operation phase, the followings are the suggested measures:

- Set up a type of light which does not irradiate the sea surface and outside of the bridge
- Proper handling of oil and lubricants to prevent spillage and contamination of sea water (i.e. storage of oil and lubricants in secure areas/places)

4.3 Air

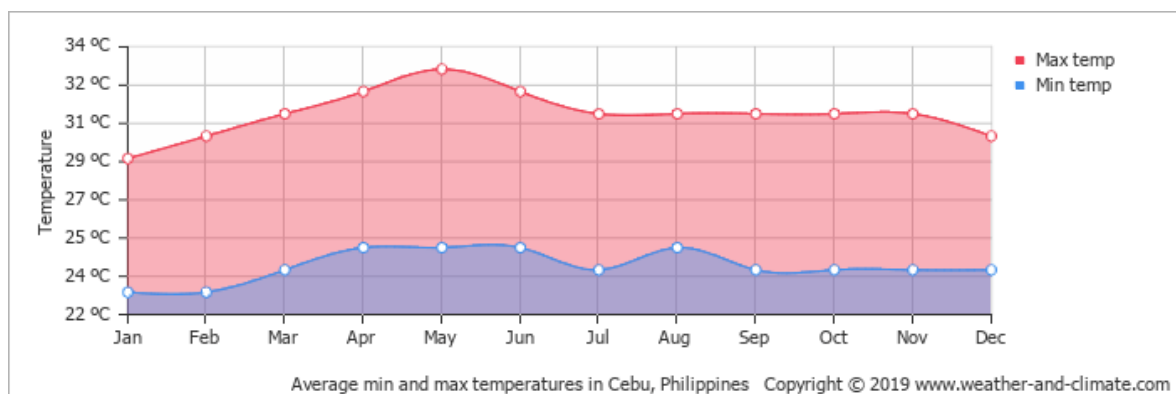
4.3.1 BASELINE CONDITIONS

4.3.1.1 Climate

(1) Climate Classification

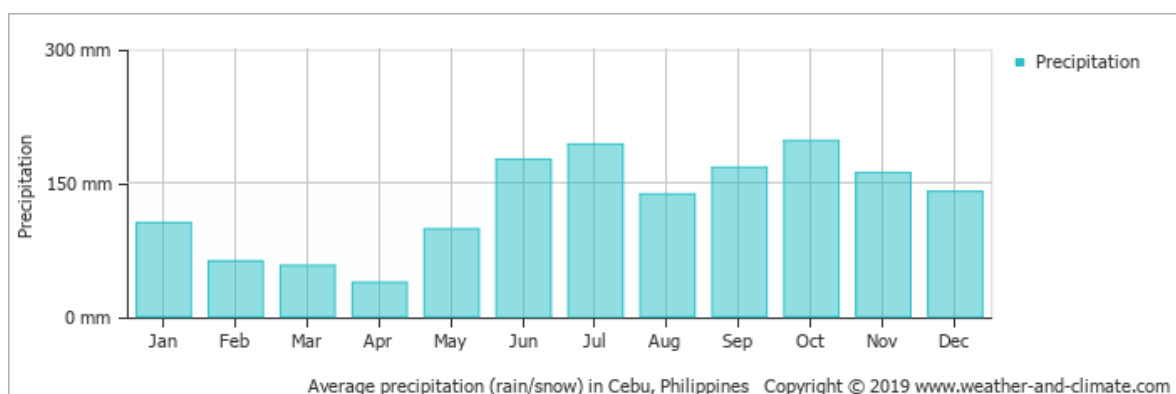
The climate in Metro Cebu (which includes the Mandaue) belongs to the Type IV of the Modified Coronas Classification of Philippine Climates. It is relatively dry from November to April and wet during the rest of the year. Average annual rainfall in the PAGASA Airport Station is about 1,500 mm.

Mandaue City and Lapu-Lapu City belong to Am (i.e. tropical monsoon climate) under Koeppen’s Climate Classification Map. Temperature in Cebu Island reaches its lowest point in January with a minimum and maximum temperature of approximately 23 degrees and 29 degrees Celsius, and its highest point in May where the minimum and maximum temperatures are approximately 25 degrees and 33 degrees Celsius. In general, however, it can be said that it is warm throughout the year. The area has a rainy and dry season and the average precipitation level in a month during the rainy season (i.e. June to December) is just above 150 mm while that in the dry season (i.e. January to May) is approximately 50 to 100 mm. The average monthly maximum and minimum temperature and precipitation level in Cebu Island are shown in Figure 4.3.1 and Figure 4.3.2, respectively.



Source: World Weather & Climate Information (available at: <https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine,mandaue-city-ph,Philippines>)

Figure 4.3.1 Maximum and Minimum Average Monthly Temperature in Cebu Island



Source: World Weather & Climate Information (available at: <https://weather-and-climate.com/average-monthly-Rainfall-Temperature-Sunshine,mandaue-city-ph,Philippines>)

Figure 4.3.2 Monthly Precipitation Level in Cebu Island

(2) Ambient Temperature

The climate of Cebu Mactan area is categorized as tropical rainforest climate, being high temperature and high humidity throughout the year. There is no significant difference between seasons in the Cebu Mactan area all the year round, and the fluctuation of temperature is small.

The temperature is observed at the Cebu PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration) Complex station (hereinafter, Mactan Station) located near the Mactan-Cebu International Airport. The location of Mactan Station is shown in Table 4.3.1.

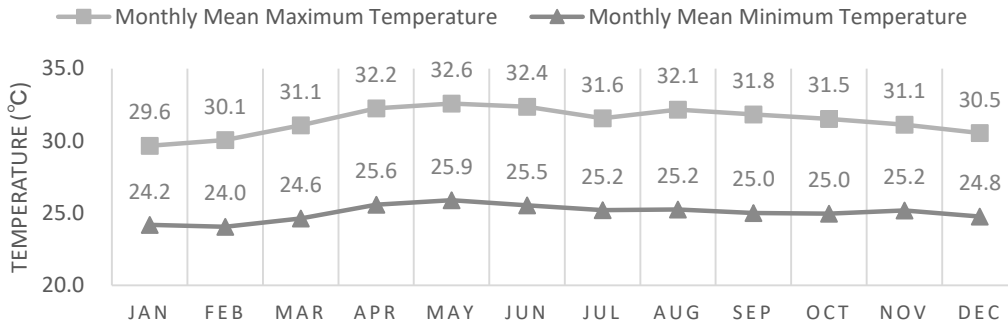
Table 4.3.1 Position of Mactan Station

Name of the observatory	Latitude (North)	Longitude (East)	Elevation (m)
Mactan Station	10.32°	123.98°	23

Source: JICA Survey Team

The data of Monthly Mean Maximum and Minimum Temperatures during the period from 1982 to 2018 in Mactan Station was obtained in this survey. However, only the observation data from 2006 to 2018 was used here, since some data before 2006 has been missing. Figure 4.3.3 shows the Monthly Mean Maximum and Minimum Temperature datum at Mactan Station. “Monthly Mean Maximum and Minimum Temperatures” are defined as monthly average of daily maximum and minimum values during from 2006 to 2018. The highest Monthly Mean Temperature at the station was 32.6°C in May, and the lowest was 24.0°C in February. Since the fluctuation of temperature is small throughout the year, the difference between the Monthly Maximum and Minimum Temperatures in the same month is also small at 5°C to 7°C.

According to the records at the Mactan Station, the past maximum temperature was 37.0°C observed on 31st May 2010 and the lowest temperature was 19.2°C on 16th January 1992. The difference between the minimum and the maximum temperatures is 17.8°C.

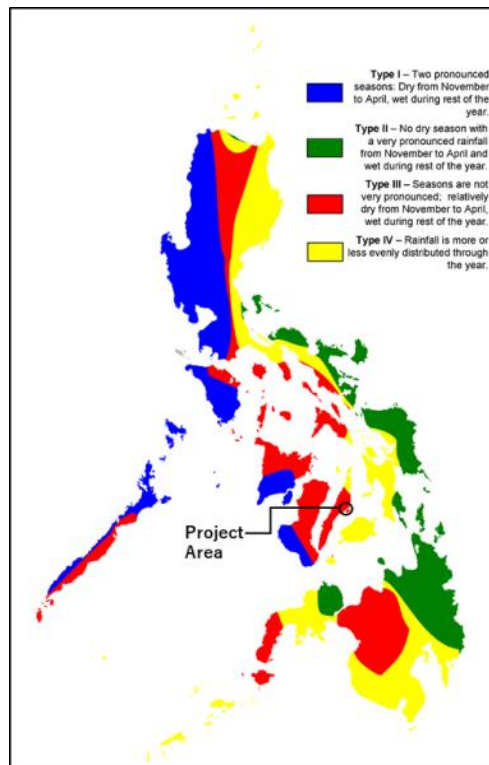


Source: Observed data at Mactan Station, arranged by JICA Survey Team

Figure 4.3.3 Monthly Mean Maximum and Minimum Temperatures during 2006 - 2018

(3) Rainfall

Figure 4.3.4 shows the climate classification map throughout the Philippines. The project area belongs to the category of Type III; “Seasons are not very pronounced; relatively dry from November to April, wet during rest of the year”.

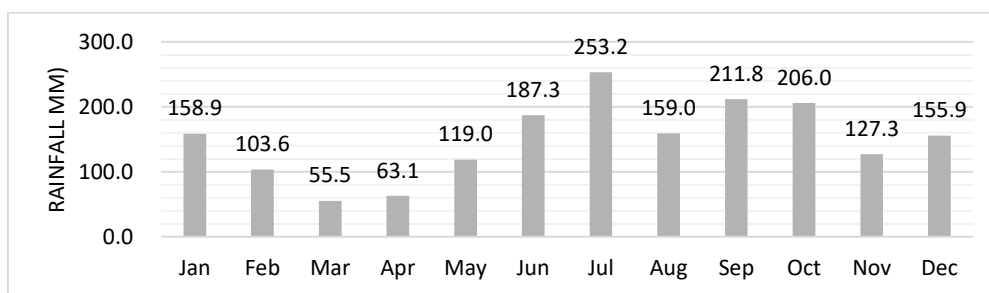


Source: PAGASA

Figure 4.3.4 Climate Classification Map throughout the Philippines

Figure 4.3.5 shows the Monthly Mean Rainfalls observed at Mactan Station during the period from 1982 to 2018. “Monthly Mean Rainfall” is defined as monthly average of the daily rainfall data for 37 years (1982 to 2018). The dry season from November to April has low rainfall, and its averaged Monthly Mean Rainfall was 91.7 mm/month. On the other hand, averaged Monthly Mean Rainfall from May to October was 168.3 mm/month. Annual mean rainfall at the Mactan Station from 1982 to 2018 was 1,636.3 mm/year.

According to the records at the Mactan Station, the past highest daily rainfall was 276.1 mm/day on 12th November 1990 when Typhoon MIKE landed on Cebu Island.



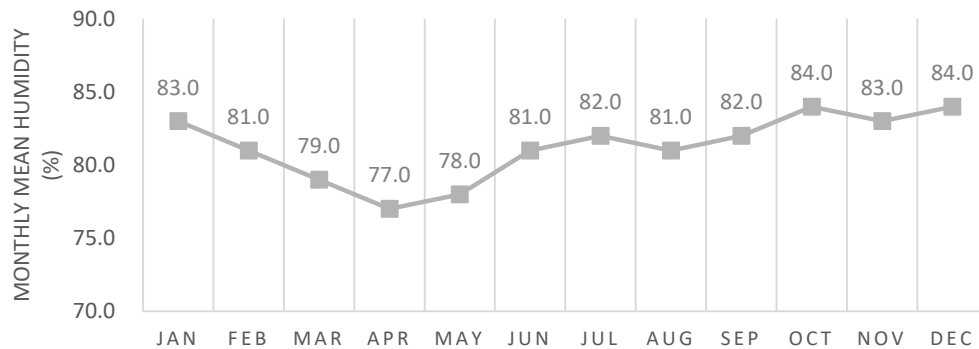
Source: Observed data at Mactan Station, arranged by JICA Survey Team

Figure 4.3.5 Monthly Mean Rainfall during 1982 - 2018

(4) Humidity

The data of Monthly Mean Humidity for 30 years from 1988 to 2017 at the Mactan Station was obtained in this survey. “Monthly Mean Humidity” is defined as monthly average of daily average humidity values during from 1988 to 2017. Figure 4.3.6 shows the value of Monthly Mean Humidity averaged for 30 years. Although the Monthly Mean Humidity was below 80% from March to May due to low

rainfall, there is no significant difference between humidity at each month throughout the year. The average value of humidity for 30 years was 81%.



Source: Observed data at Mactan Station, arranged by JICA Survey Team

Figure 4.3.6 Monthly Mean Humidity during 1988 – 2017

(5) Wind

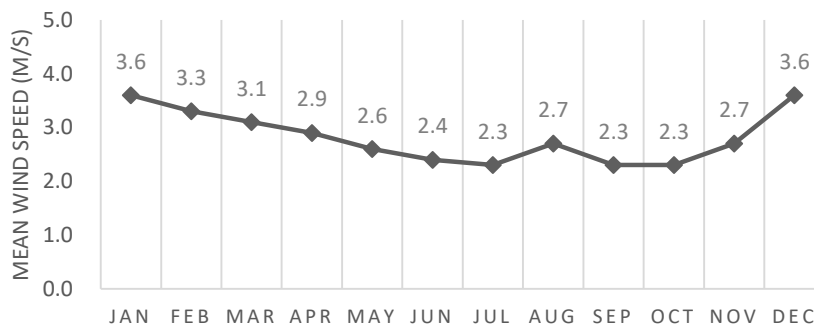
Observed Data

The data of Monthly Mean Wind speed for 30 years from 1981 to 2010 and the data of maximum wind speed and its direction by months for 46 years from 1972 to 2017 at Mactan Station were obtained in this survey. PAGASA records hourly wind data by averaging the data measured for 10 minutes. The observation height is at 10m above ground level. “Monthly Mean Wind speed” is defined as monthly average of daily average wind speed for 30 years.

Wind Speed

Figure 4.3.7 shows the 30-year average value of Monthly Mean Wind speed from 1981 to 2010. The annual average wind speed was 2.8 m/s, and the wind speed exceeding the annual average was recorded from December to April.

In addition, the past maximum wind speed (10 minutes averaged wind speed) from 1972 to 2017 was 55.0 m/s when typhoon MIKE landed on 12th November 1990.

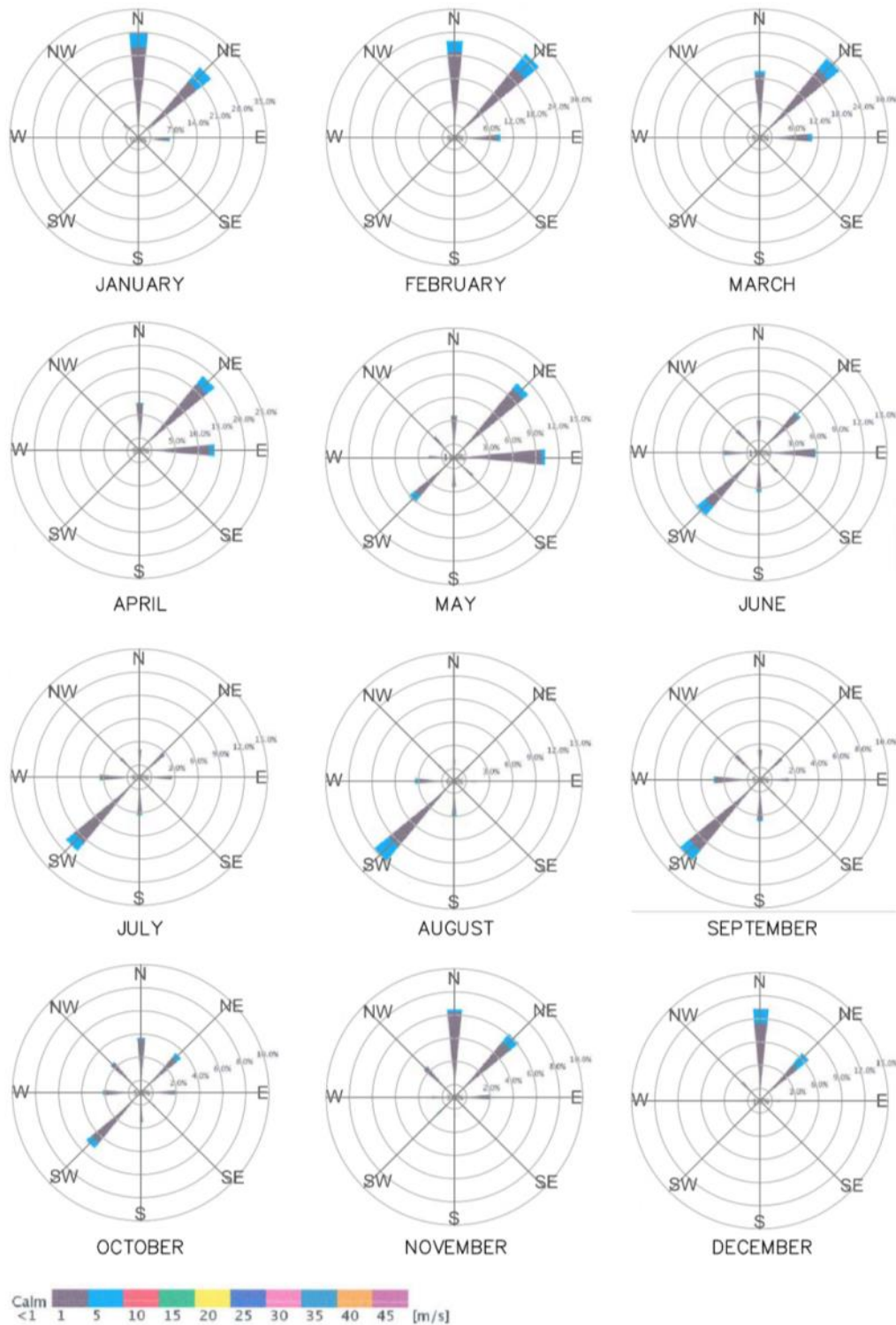


Source: Observed data at Mactan Station, arranged by JICA Survey Team

Figure 4.3.7 Monthly Mean Wind Speed during 1981 – 2010

Wind Direction

Figure 4.3.8 shows wind direction with its frequency (Wind Rose) in each month. The Wind Rose is described based on the data observed hourly every day from 1981 to 2010. From June to October, the wind from southwest was dominant due to the influence of the southwest monsoon. On the other hand, from November to May, the wind from north and northeast was dominant due to the influence of the northeastern monsoon.



Source: Observed data at Mactan Station, arranged by JICA Survey Team

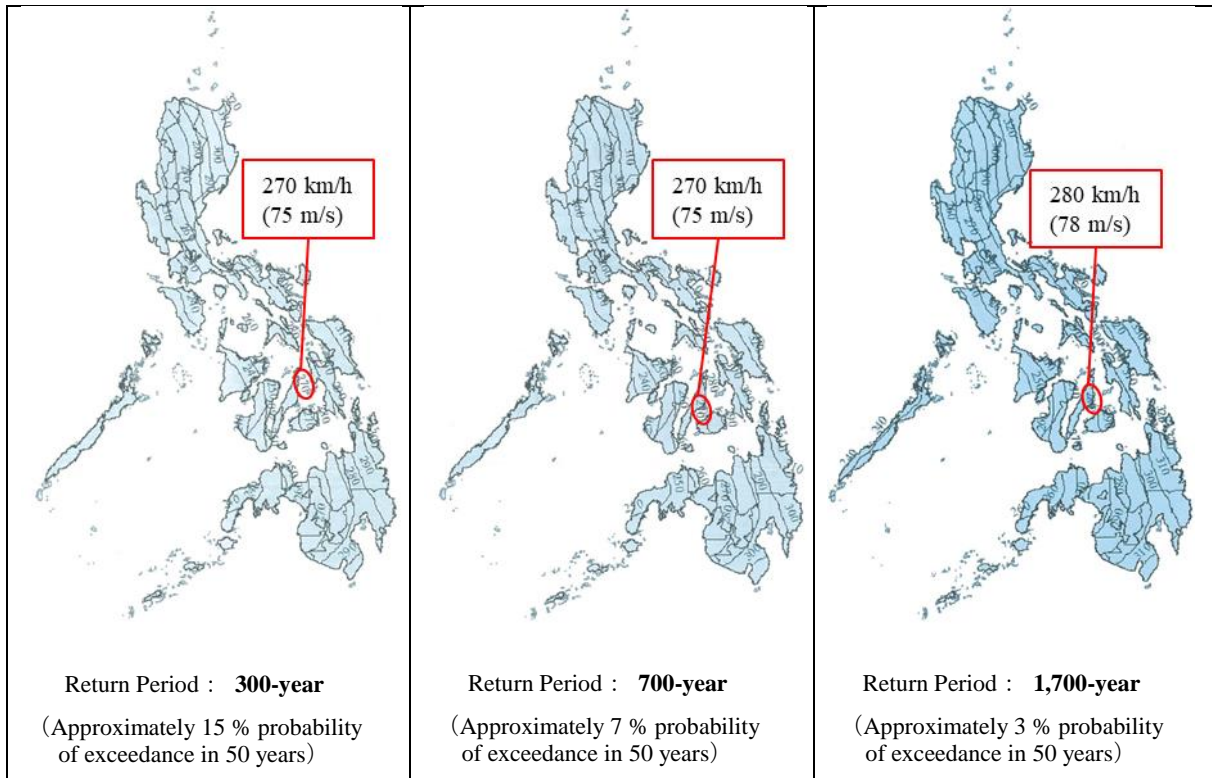
Figure 4.3.8 Wind Rose during 1981 – 2010

NSCP (National Structural Code of the Philippines)

Figure 4.3.9 shows the 300-year, 700-year, and 1,700-year return period of maximum wind gust speed maps shown in the National Structural Code of the Philippines (NSCP 2015). The values shown in Figure 4.3.9 were determined based on the maximum wind gust speed which represents the maximum

of the three-second averaged wind speed observed at a height of 10 m above the ground. Each figure shows wind speed values (km/h) with approximately 15 % probability (return period: 300-year), 7 % probability (return period: 700-year), 3 % probability (return period: 1,700-year) of exceedance in 50 years, respectively.

In the project area, the maximum wind gust speed of return period 300-year, 700-year and 1,700-year are 270 km/h (75 m/s), 270 km/h (75 m/s) and 280 km/h (78 m/s), respectively



Unit : km/h
 Source: NSCP 2015

Figure 4.3.9 Maximum Wind Gust Speed Maps

(6) Typhoon

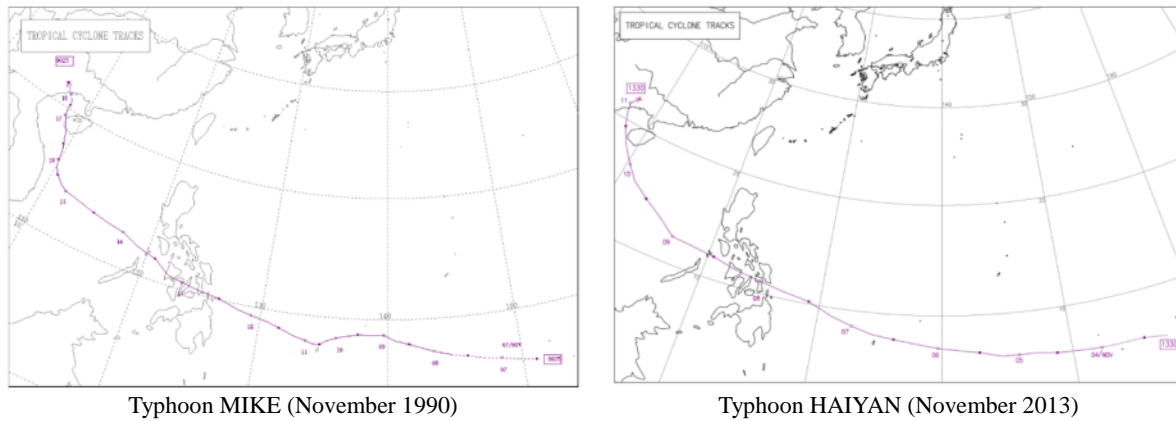
According to the “Disaster Management Reference Handbooks 2015 and 2018 edition” published by the Center for Excellence in Disaster Management & Humanitarian Assistance (CFE-DM), annually, approximately 80 typhoons develop above tropical waters, 20 of them enter the Philippine region, and 6 to 9 of them make landfall on Cebu island. The typhoons which landed on Cebu island from 1983 to 2017 are shown in Figure 4.3.4 A total of 41 typhoons landed in Cebu during the 35 years from 1983 to 2017 (1.2 on average a year), of which 49% hit the island in November and December.

Among them, the maximum wind speed of Typhoon MIKE (RUPING) which hit Cebu island in 1990 was 150 kts (77.2 m/s), and the lowest central pressure was 885 mb. In addition, the maximum wind speed of typhoon HAIYAN (YOLANDA) which landed in November 2013 was 170 kts (87.5 m/s), and the lowest central pressure was 895 mb. The maximum wind speed of HAIYAN was the fastest typhoon recorded from 1983, and its maximum wind speed was 56 m/s at the Mactan Station. Typhoon HAIYAN passed the Medellin district in the northern part of Cebu island, and many houses were destroyed. However, according to the results of interviews with DPWH (Department of Public Works and Highways), Mandaue City and PAGASA Mactan Office, it was reported that there were almost no human or structural damage by storm surge or strong wind caused by typhoon HAIYAN in the project area.

Table 4.3.2 Typhoon Landed on Cebu Island (1983-2017)

Year	Month	Name	Maximum Intensity (kts)	Minimum SLP (mb)
1983	Jun	SARAH	35	-
	Apr	NELSON	105	-
1984	Sep	IKE	125	-
1986	Dec	MARGE	95	-
	Dec	NORRIS	90	-
1988	Jun	VANESSA	45	-
1990	Nov	MIKE (RUPING)	150	885
1991	Mar	SHARON	60	-
	Apr	VANESSA	45	-
	Oct	THELMA	45	-
1992	Nov	FORREST	125	-
1993	Nov	KYLE	95	-
	Dec	NELL	70	-
1994	Apr	OWEN	75	-
	Dec	AXEL	115	-
1995	May	-	25	-
	Nov	ZACK	120	-
	Sep	-	30	-
1996	Mar	-	30	-
	Oct	ERNIE	50	-
1997	Nov	LINDA	65	-
2001	Feb	-	25	-
	Nov	LINGLING	115	927
	Dec	KAJIKI	35	-
2002	Mar	-	30	1000
2003	Jul	KONI	65	976
2004	Jun	CHANTHU	75	967
2005	Mar	ROKE	80	963
	Dec	-	45	991
2007	Nov	HAGIBIS	80	963
2008	Apr	NEOGURI	100	948
	Nov	MAYSAK	55	982
2011	Oct	BANYAN	30	1000
2012	Oct	SON-TINH	105	944
	Dec	WUKONG	35	996
2013	Nov	THIRTY	35	996
	Nov	HAIYAN (YOLANDA)	170	895
2014	Nov	SINLAKU	55	982
	Dec	JANGMI	45	989
2016	Nov	TOKAGE	80	963
2017	Jan	ONE	30	1000

Source: Joint Typhoon Warning Center (JTWC)



Source: Japan Meteorological Agency

Figure 4.3.10 Tracks of Main Typhoon Hitting Cebu Island

4.3.1.2 Air Quality

The CIADMP (1994) study noted that air quality as measured in terms of Total Suspended Particulate (TSP) has deteriorated (in Metro Cebu). The study indicated that “[b]lamed for this condition is the increasing number of motor vehicles majority of which are diesel-fed...[a]lso responsible are stationary sources of air pollutants, e.g., power plants, industries, and manufacturing firms.. [a]ttendant to air pollution is noise and traffic nuisance.”

Based on the 2015 Regional Emissions inventory, the transport sector (mobile source) is the major source of pollution in Region VII. It was estimated that 10% of pollutants came from stationary sources, 77% from mobile sources, and 13% from area sources. However, ambient air quality monitoring results show that air quality in the region is in “good to fair” condition since concentrations of PM10 and TSP are within RA 8749’s guideline values.

According to an inventory survey carried out in 2015 by the Environmental Management Bureau (EMB) of DENR, the source of air pollution in Central Visayas (Region VII), which includes the project site, is mainly the transportation sector. The share of such mobile sources accounts for approximately 77% of the total emissions level. This is much higher than the share of stationary sources (i.e. 10%). Nevertheless, the level of air pollution in the project area is considered generally favorable and values for PM10 and TSP have been both below the standards set under the Republic Act No. 8749.

According to Sinogaya et al. (2019), the medium value measured for NO₂ over a six month period between December and June¹⁴, and that measured for SO₂ over a nine month period between December and September in both Mandaue and Lapu-Lapu City are shown below. All values are below the environmental standards of the Philippines.

Table 4.3.3 Level of NO₂ and SO₂ in Mandaue and Lapu-Lapu City

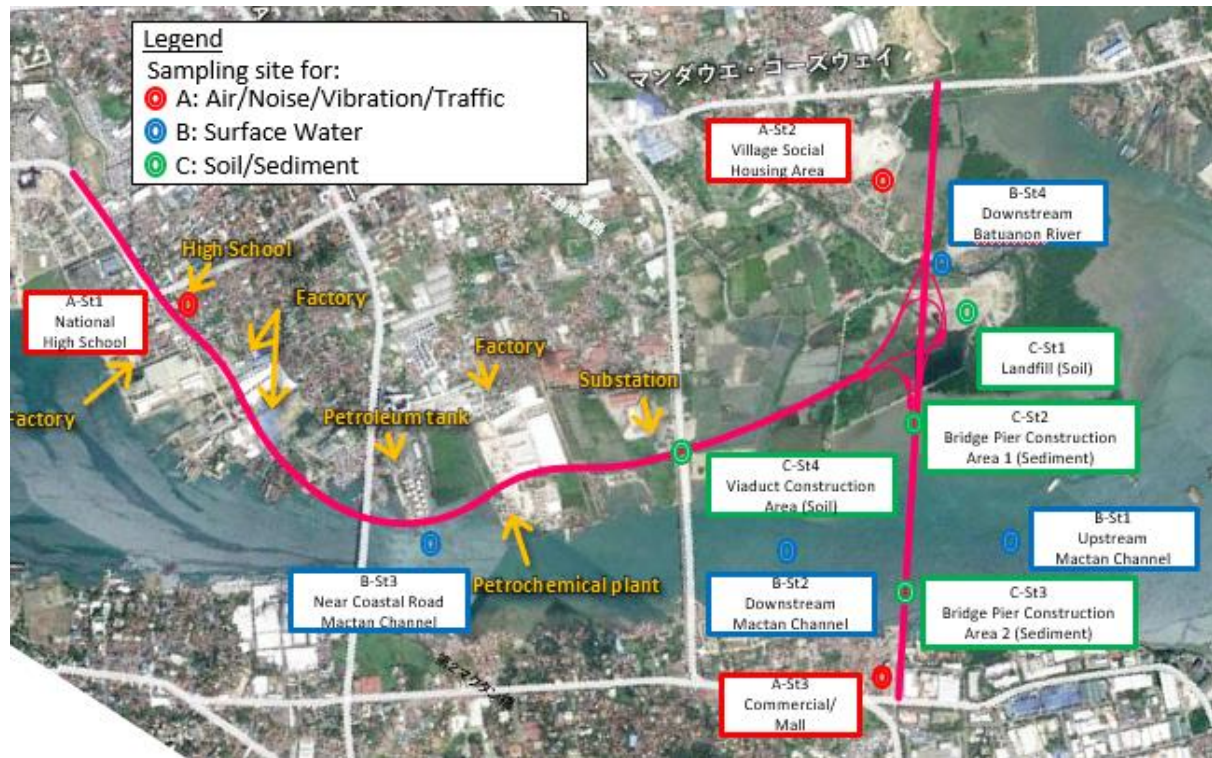
Sampling Point/Guideline Value in the Philippines	NO ₂	SO ₂
Mandaue City	15 ppb	30 ppb
Lapu-Lapu City	20 ppb	20 ppb
Guideline Value in the Philippines	80 ppb	70 ppb

Source: Sinogaya et al. 2019

Since no secondary data could be obtained on ambient air quality that can serve as a baseline data for the project, air quality was measured under this study.

¹⁴ The paper does not specify the year in which the data was collected.

Baseline survey for air quality and noise was performed at three sampling sites along the proposed 4th Cebu-Mactan Bridge route. Figure 4.3.11 shows the location of each sampling site.



Source: JICA Survey Team

Figure 4.3.11 Sampling points for ambient air quality, noise, and vibration measurements

As shown on Table 4.3.4, all the parameters passed within the standard limit set by the National Ambient Air Quality Standards for Source Specific Air Pollutants from Industrial Sources / Operations of the Department of Environment and Natural Resources Administrative Order No. 2000-81 (Implementing Rules and Regulations of the Philippine Clean Air Act of 1999) except for the analysis of Particulate Matter 10 conducted at Mandaue City Comprehensive National High School, Village/Social Housing Area and Commercial Area in Lapu-Lapu City, Cebu.

Table 4.3.4 Baseline Survey: Measured 1-hr Average Values of Air Quality Parameters Measured at 3 Different Sites along the Proposed 4th Cebu-Mactan Bridge Route

	PM ₁₀	PM _{2.5}	NO ₂	SO ₂	CO
Unit	ug/N·cm	ug/Ncm	ug/Ncm	ug/Ncm	ppm
Method of measurement	Gravimetric	Gravimetric	Griess-Saltzman	Pararosaniline	Direct reading, electrochemical sensor
Mandaue Comprehensive National High School (Time of measurement 10:55-11:55 PST)	248	<3	4	9	<1
Village/Social Housing Area (Time of measurement 13:20-14:20 PST)	353	<3	1	16	<1
Commercial Area/Mall (Time of measurement 15:31-16:31 PM)	235	<3	<1	8	<1
Philippine Standard DAO 2000-81 Standards	TSP 300		260	340	30
WHO Air quality guidelines	-	-	200 µg/m ³	-	-

Source: JICA Survey Team

Table 4.3.5 Baseline Survey: Measured 24-hr Average Values of Air Quality Parameters Measured at 3 Different Sites along the Proposed 4th Cebu-Mactan Bridge Route

	PM ₁₀	PM _{2.5}	NO ₂	SO ₂	CO
Unit	ug/N·cm	ug/Ncm	ug/Ncm	ug/Ncm	ppm
Method of measurement	Gravimetric	Gravimetric	Griess-Saltzman	Pararosaniline	Direct reading, electrochemical sensor
Mandaue Comprehensive National High School	27	0.3	<0.02	23	<1
Village/Social Housing Area	33	0.3	<0.02	25	<1
Commercial Area/Mall	59	0.5	<0.02	22	<1
Philippine Standard DAO 2000-81 Standards	TSP 150		50	150	180
WHO Air quality guidelines	50 µg/m ³	25 µg/m ³	-	20 µg/m ³	-

Source: JICA Survey Team



Figure 4.3.12 Ambient Air Sampling Point at Mandaue Comprehensive National High School



Figure 4.3.13 Ambient Air Sampling Point at Village/Social Housing Area



Figure 4.3.14 Ambient Air Sampling Point at Commercial Area/Mall

4.3.1.3 Noise Level

There are three areas where noise sampling was collected as shown in Figure 4.3.11. The three areas represent sampling in a variety of surroundings such as a school, a residential area and a commercial area.

The noise standards for the different areas are indicated in Table 4.3.6. The national high school, village social housing and commercial mall belong under the AA category, A category and B category, respectively. Since the location of the national high school is directly facing an industrial site, it can be expected to result in a higher noise value. Furthermore, the village social housing and commercial mall are currently directly facing two-lane roads. With the construction and operation of the proposed route, the two-lane roads are expected to increase into four-lane roads, thereby, resulting in additional noise. The corresponding noise standards for four-lane roads are indicated in Table 4.3.7.

Table 4.3.6 Philippine Noise Standards for General Areas

Category of area	Morning (5 am - 9 am)	Daytime (9 am - 6 pm)	Evening (6 pm - 10 pm)	Nighttime (10 pm - 5 am)
AA - area which requires quietness such as an area within 100 m from school sites, nursery schools, hospitals, places of worship and special homes for the aged	45	50	45	40
A - General residential areas	50	55	50	45
B - Commercial area	60	65	60	55
C - Light industrial area	65	70	65	60
D - Heavy industrial area	70	75	70	65

Source: National Pollution Control Commission, 1980

Table 4.3.7 Philippine Noise Standards for Areas Directly Facing Four-Lane Roads

Category of area	Morning (5 am - 9 am)	Daytime (9 am - 6 pm)	Evening (6 pm - 10 pm)	Nighttime (10 pm - 5 am)
AA - area which requires quietness such as an area within 100 m from school sites, nursery schools, hospitals, places of worship and special homes for the aged	50	55	50	45
A - General residential areas	55	60	55	50
B - Commercial area	65	70	65	60
C - Light industrial area	70	75	70	65
D - Heavy industrial area	75	80	75	70

Source: Vergel, K., Cacho, F., Capiz, C., 2004

Measurement of the noise quality in the three areas was conducted for 15 days in April 2019. The results of the sampling are indicated in Table 4.3.8. Two areas resulted in noise values exceeding the noise standards. As noted in the previous section, the national high school is directly facing a light industrial area. This could have contributed to additional noise generation. Additionally, since it is expected that the proposed route will be a four-lane road the noise standard values will be increased. However, it can also be expected that higher noise values will be generated within these areas in the future.

Table 4.3.8 Measured 1-hr Average Values of Noise Quality Measured at 3 Different Sites along the Proposed 4th Cebu-Mactan Bridge Route

Location	Station	Sampling period	Result (dBA)	Standard for General Area (dBA)	*Standard for areas directly facing four-lane roads (dBA)
Mandaue Comprehensive National High School (Class AA area)	A-ST1	10:55 AM - 11:55 AM	54	50	55
Village Social Housing (Class A area)	A-ST2	01:20 PM - 02:20 PM	57	55	60
Commercial Area Mall (Class B area)	A-ST3	03:30 PM - 04:30 PM	57	65	70

Source: JICA Survey Team

In 24 hours noise level monitoring, all locations conducted exceeded the standard limit set by National Pollution Control Commission No. 002 Series of 1980 for Class AA, Class A and Class B in various time zone.

Table 4.3.9 Measured 24-hr Average Values of Noise Quality Measured at 3 Different Sites Along The Proposed 4th Cebu-Mactan Bridge Route

Location	Station	Sampling period	Result (dBA)	Standard for General Area (dBA)	*Standard for areas directly facing four-lane roads (dBA)
Mandaue Comprehensive National High School (Class AA area)	A-ST1	Morning (5 AM - 9 AM)	53	45	50
		Daytime (9 AM - 6 PM)	62	50	55
		Evening (6 PM - 10 PM)	56	45	50
		Nighttime (10 PM - 5 AM)	57	40	45
Village Social Housing (Class A area)	A-ST2	Morning (5 AM - 9 AM)	57	50	55
		Daytime (9 AM - 6 PM)	50	55	60
		Evening (6 PM - 10 PM)	56	50	55
		Nighttime (10 PM - 5 AM)	48	45	50
Commercial Area Mall (Class B area)	A-ST3	Morning (5 AM - 9 AM)	62	60	65
		Daytime (9 AM - 6 PM)	62	65	70
		Evening (6 PM - 10 PM)	55	60	65
		Nighttime (10 PM - 5 AM)	50	55	60

Source: JICA Survey Team



Figure 4.3.15 Noise Level Sampling point at Mandaue Comprehensive National High School



Figure 4.3.16 Noise Level Sampling point at Village/Social Housing Area



Figure 4.3.17 Noise Level Sampling point at Commercial Area/Mall

4.3.2 IMPACT IDENTIFICATION AND ASSESSMENT

4.3.2.1 Air Quality

Construction Phase

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road project's construction has the potential to cause changes in Air Quality. Further, during construction, the installation of structures has the potential to cause changes in Sound Quality and the development of Temporary Ancillary Elements has the potential to cause changes in Air Quality.

Emissions from heavy construction equipment (*e.g.*, trucks, front-end loaders, pavers, and other equipment) will occur from the operation of internal combustion engines, which are typically diesel-fueled.

In addition to combustion gases, there is potential for fugitive dust emissions from activities during Construction. Fugitive dust is particulate matter that originates primarily from the movement of mobile equipment on unpaved surfaces, especially during dry and windy periods.

The potential for dust generation would occur most frequently during periods of high winds or extreme dry periods.

It is anticipated that air contaminant emissions during Construction are likely to represent a very small fraction of emissions when compared to the existing emissions in Metro Cebu

Fugitive dust from the movement of equipment on unpaved surfaces during Construction has the potential to cause adverse environmental effects to ambient air quality if dust mitigation measures are not used.

Operation Phase

During Operation of the Project, vehicle traffic on the 4th Cebu-Mactan Bridge-Mandaue Coastal Road realignment will result in emissions of air contaminants (primarily combustion gases) from fuel combustion. The forecasted traffic volume on 2039, which is employed by the forecast value calculation not only air pollution but also noise and vibration, is shown in Table 4.3.10.

Table 4.3.10 Forecasted Traffic Volume

Location	Station	Road Type	Direction	Large PCU/hour	Small PCU/hour	Total PCU/hour
Mandaue Comprehensive National High School	A-ST1	Flat Road (Current)	To North	2,377	13,471	15,848
			To South	2,318	13,138	15,456
		Elevated Road	To North	5,408	30,644	36,052
			To South	4,717	26,727	31,444
Village Social Housing	A-ST2	Elevated Road	To North	4,350	24,650	29,000
			To South	4,560	25,840	30,400
Commercial Area Mall	A-ST3	Elevated Road (Upper)	To North	975	5,525	6,500
			To South	825	4,675	5,500
		Elevated Road (Lower) (ON/OFF RAMP)	To North	2,475	14,025	16,500
			To South	2,670	15,130	17,800
		ON RAMP	To North	915	5,185	6,100

Source: JICA Survey Team

The Puff model, which is widely used in the analysis of air pollution in Japan, is adopted for quantitative analysis in this case with using traffic volume estimation in year 2039. Prediction points are same as background survey points as shown in Figure 4.3.11. The Puff-model is used to predict the road-contributed density. The result of quantitative forecast is shown in Table 4.3.11. Forecasted values of

PM10, NO₂ and SO₂ are satisfied with the Philippine Standard DAO 2000-81 Standards, meaning that the negative impacts of the project are at a negligible level.

For the reference, both baselines and forecasts of PM10 at the Commercial Area/Mall and NO₂ at all three survey points exceed the standards of the WHO Air Quality Guidelines. This fact indicates that there is a room for improvement of air quality to comply with an international standard in the future.

However, the impact of the project is minor because the baseline and forecast results are almost equal.

Table 4.3.11 Result of Air Pollution Forecast

Item, Unit		PM 10	PM 2.5	NO ₂	SO ₂	CO
Survey Points		µg/Ncm	µg/Ncm	µg/Ncm	µg/Ncm	ppm
Mandaue Comprehensive National High School	Baseline	27	0.3	<0.02	23	<1
	Forecast (2039)	27.7	-	8.8	23.7	-
Village/Social Housing Area	Baseline	33	0.3	<0.02	25	<1
	Forecast (2039)	33.1	-	0.8	25.1	-
Commercial Area/Mall	Baseline	59	0.5	<0.02	22	<1
	Forecast (2039)	59.0	-	2.9	22.4	-
Philippine Standard DAO 2000-81 Standards		TSP 150		50	150	180
WHO Air quality guidelines		50 µg/m ³	25 µg/m ³	-	20 µg/m ³	-

Source: JICA Survey Team

4.3.2.2 Greenhouse Gas (GHG) Emission

Construction Phase

Greenhouse Gas (GHG) Emissions from heavy construction equipment (*e.g.*, trucks, front-end loaders, pavers, and other equipment) will occur from the operation of internal combustion engines, which are typically diesel-fueled.

The amount of greenhouse gas emissions can be calculated through [reference formula 1]

[Reference formula 1]

$$PE_{E,y} = \sum CW_k \times EF_{cons}$$

- PE_{elec,y} : Emissions from Construction Work (tCO₂/year)
- CW_k : Construction Work by type k (km)
- EF_{cons} : Emission factor (gCO₂/km)

Table 4.3.12 Parameter of Construction Work by type

Parameter	Description	Value	Unit
CW _k	Embankment	2.33	km
	Bridge (steel)	2.25	km
	Bridge (PC)	7.61	km

Source: JICA Survey Team

Table 4.3.13 Parameter of Emission Factor

Parameter	Description	Value	Unit
EF _{cons}	Embankment	2,267.80	gCO ₂ /km
	Bridge (steel)	1,287.00	gCO ₂ /km

	Bridge (PC)	1,400.70	gCO2/km
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Source: Highway Technology Reserch Center, Japan

Removal of trees along the 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment and could have adverse environmental impacts, as these trees have a function of carbon sink. The impact from the reduction in existing green areas at the time of construction can be estimated from the change in the carbon accumulation, and calculated according to [formula 2].

[Reference formula2]

$$C_{LB} = B_{Total} \times A \times CF \times 44/12$$

$$B_{Total} = B_{AG} + B_{BG}$$

$$B_{BG} = B_{AG} \times R$$

C_{LB}	: carbon accumulation per unit area for Forest Area, etc. (tCO2)
A	: area of Forest Area, etc. (ha)
CF	: carbon content of trees in Forest Area, etc. (t-C/t-dm)
B_{Total}	: total biomass in Forest areas, etc. (t-dm/ha)
B_{AG}	: above-ground biomass in green areas, etc. (t-dm/ha)
B_{BG}	: below-ground biomass in green areas, etc. (t-dm/ha)
R	: ratio of below-ground biomass to above-ground biomass (below-ground/above-ground)

Table 4.3.14 Parameters for Carbon loss from Tree Cutting

Parameter	Description		Value	Unit	Source
A	Land area of organic soils		13.3884	ha	Study team
B_{AG}	Above ground biomass	Tropical forest	348	t-dm/ha	Table 3A.1.2, IPCC GPG-LULUCF
R	Root-to-shoot ratio	Secondary Tropical/Sub Tropical	0.42		Aneex 3A.1, Table 3A.1.8, IPCC GPG-LULUCF
CF	Carbon fraction of dry matter	Tropical/Sub Tropical	0.47	t-C/t-dm	2006 IPCC Guideline AFOLU, Table 4.3.

Note: CO2 Emission by Construction Activities is shown in **Table 4.3.15**. Total CO2 generated by construction work and tree cutting is 30,218 t CO2.

Table 4.3.15 Summary of CO2 Emission by Construction Activities

Activities	Type of Structure	Unit (CO2 t/km) for 4 lanes	Total Length (km)/ 4-lanes	Generated CO2 t
Construction work	Embankment	2,267.80	2.33	5,273
	Bridge (steel)	1,287.00	2.25	2,891
	Bridge (PC)	1,400.70	7.61	10,652
Tree cutting				11,402
Total				30,218

Source: JICA Survey Team

Operation Phase

During Operation of the Project, vehicle traffic on the 4th Cebu-Mactan Bridge-Mandaue Coastal Road will result in GHG emissions from fuel combustion.

Reference formula 3]

$$PE_{E,y} = \sum VK_{k,y} \times EF_{v,k}$$

$PE_{elec,y}$: Emissions from Vehicle (tCO2/year)

VK_k : Vehicle-km by type k (million veh*km/year)

$EF_{v,k}$: Emission factor by Vehicle type k, speed (gCO2/km)

Table 4.3.16 Summary of Traffic Demand Forecast (Tentative)

	Ave. Speed	Vehicle-km (million veh*km/day)
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		(km/h)	Passenger Car	Truck
2030	with project	20.1	31.60	1.48
	without project	19.9	31.79	1.49
2050	with project	20.0	34.20	2.41
	without project	19.5	34.40	2.41

Source: JICA Survey Team

Table 4.3.17 Emission factor by Vehicle type, Speed

Year	Vehicle type	Ave. Speed(km/h)		Emission factor by Vehicle type, Speed(gCO ₂ /km)			
		Without Project	With Project	Without Project		With Project	
				Small	Large	Small	Large
2019	2009	20.12	0.00	200.1	907.9		
2020	2010	20.10	0.00	175.7	907.9		
2021	2011 – 14	20.08	0.00	175.8	908.2		
2022	2011 – 14	20.06	0.00	175.9	908.5		
2023	2011 – 14	20.04	0.00	175.9	908.9		
2024	2011 – 14	20.02	0.00	176.0	909.2		
2025	2015 –	20.00	0.00	139.2	814.0		
2026	2015 –	19.98	20.12	139.2	814.0	138.9	812.3
2027	2015 –	19.96	20.12	139.2	814.0	138.9	812.3
2028	2015 –	19.94	20.11	139.2	814.0	138.9	812.4
2029	2015 –	19.92	20.11	139.2	814.0	138.9	812.5
2030	2020	19.90	20.10	160.2	869.3	159.5	866.2
2031	2020	19.88	20.09	160.3	869.5	159.5	866.3
2032	2020	19.86	20.09	160.4	869.8	159.5	866.4
2033	2020	19.84	20.08	160.5	870.1	159.5	866.5
2034	2020	19.82	20.08	160.5	870.4	159.5	866.6
2035	2020	19.80	20.07	160.6	870.7	159.5	866.6
2036	2020	19.78	20.07	160.7	871.0	159.6	866.7
2037	2020	19.76	20.06	160.8	871.3	159.6	866.8
2038	2020	19.74	20.06	160.9	871.6	159.6	866.9
2039	2020	19.72	20.05	161.0	871.9	159.6	866.9
2040	2030	19.70	20.05	140.9	821.7	139.7	816.9
2041	2030	19.68	20.04	141.0	822.0	139.7	816.9
2042	2030	19.66	20.04	141.0	822.3	139.7	817.0
2043	2030	19.64	20.03	141.1	822.5	139.7	817.1
2044	2030	19.62	20.03	141.2	822.8	139.7	817.2
2045	2030	19.60	20.02	141.2	823.1	139.7	817.2
2046	2030	19.58	20.02	141.3	823.3	139.7	817.3
2047	2030	19.56	20.01	141.4	823.6	139.8	817.4
2048	2030	19.54	20.01	141.5	823.9	139.8	817.5
2049	2030	19.52	20.00	141.5	824.1	139.8	817.5
2050	2030	19.50	20.00	141.6	824.4	139.8	817.6

Source: JICA Survey Team, based on the Ministry of Land, Infrastructure, transportation and Tourism, Japan

Table 4.3.18 Emission from Vehicle Operation

Interpolation between 2019 to 2050															
Year	Million-Vehicle-km					Average Travel Speed (kph)		CO2 Emission						Difference WO-W	
	W/o Project		W/ Project			W/o Project	W/ Project	W/o Project		Total/WO	W/ Project		Total/W		
	Small	Large	Small	large			Small	Large	Small		large				
2019	30.36	0.99				20.1	-	2,217,147.11	326,693.07	2,543,840.18	2,217,147.11	326,693.07	2,543,840.18	0.00	
2020	30.49	1.03				20.1		1,955,513.65	341,947.51	2,297,461.16	1,955,513.65	341,947.51	2,297,461.16	0.00	
2021	30.62	1.08				20.1		1,964,725.84	357,320.80	2,322,046.64	1,964,725.84	357,320.80	2,322,046.64	0.00	
2022	30.75	1.12				20.1		1,973,945.20	372,704.98	2,346,650.18	1,973,945.20	372,704.98	2,346,650.18	0.00	
2023	30.88	1.17				20.0		1,983,171.71	388,100.06	2,371,271.78	1,983,171.71	388,100.06	2,371,271.78	0.00	
2024	31.01	1.22				20.0		1,992,405.40	403,506.04	2,395,911.44	1,992,405.40	403,506.04	2,395,911.44	0.00	
2025	31.14	1.26				20.0		1,582,221.22	374,934.85	1,957,156.08	1,582,221.22	374,934.85	1,957,156.08	0.00	
2026	31.27	1.31	31.07	1.30		20.0	20.1	1,588,852.92	388,604.05	1,977,456.97	1,574,891.09	385,277.59	1,960,168.68	17,288.29	
2027	31.40	1.35	31.20	1.35		20.0	20.1	1,595,484.62	402,273.25	1,997,757.87	1,581,659.08	398,975.56	1,980,634.64	17,123.24	
2028	31.53	1.40	31.34	1.39		19.9	20.1	1,602,116.32	415,942.45	2,018,058.77	1,588,428.45	412,675.94	2,001,104.39	16,954.38	
2029	31.66	1.45	31.47	1.44		19.9	20.1	1,608,748.01	429,611.65	2,038,359.67	1,595,199.20	426,378.75	2,021,577.95	16,781.72	
2030	31.79	1.49	31.60	1.48		19.9	20.1	1,859,218.49	473,369.50	2,332,587.99	1,839,009.11	469,159.33	2,308,168.44	24,419.55	
2031	31.92	1.53	31.72	1.52		19.9	20.1	1,867,537.83	485,041.16	2,352,578.99	1,846,505.06	480,673.67	2,327,178.73	25,400.26	
2032	32.05	1.57	31.85	1.56		19.9	20.1	1,875,892.91	497,000.38	2,372,893.29	1,854,031.50	492,470.58	2,346,502.08	26,391.21	
2033	32.17	1.60	31.97	1.60		19.8	20.1	1,884,283.86	509,254.24	2,393,538.10	1,861,588.54	504,557.00	2,366,145.54	27,392.56	
2034	32.30	1.64	32.10	1.63		19.8	20.1	1,892,710.85	521,809.98	2,414,520.83	1,869,176.31	516,940.04	2,386,116.35	28,404.48	
2035	32.43	1.68	32.23	1.67		19.8	20.1	1,901,174.02	534,675.05	2,435,849.07	1,876,794.94	529,626.97	2,406,421.91	29,427.16	
2036	32.56	1.72	32.36	1.72		19.8	20.1	1,909,673.53	547,857.05	2,457,530.59	1,884,444.56	542,625.25	2,427,069.81	30,460.78	
2037	32.68	1.77	32.48	1.76		19.8	20.1	1,918,209.53	561,363.80	2,479,573.32	1,892,125.28	555,942.53	2,448,067.80	31,505.52	
2038	32.81	1.81	32.61	1.80		19.7	20.1	1,926,782.16	575,203.27	2,501,985.43	1,899,837.24	569,586.62	2,469,423.85	32,561.58	
2039	32.94	1.85	32.74	1.84		19.7	20.1	1,935,391.59	589,383.67	2,524,775.26	1,907,580.55	583,565.55	2,491,146.10	33,629.16	
2040	33.07	1.90	32.87	1.89		19.7	20.0	1,700,713.26	568,970.20	2,269,683.46	1,675,659.94	563,304.03	2,238,963.97	30,719.49	
2041	33.20	1.94	33.00	1.94		19.7	20.0	1,708,308.83	582,995.84	2,291,304.67	1,682,487.06	577,128.45	2,259,615.51	31,689.16	
2042	33.34	1.99	33.13	1.98		19.7	20.0	1,715,936.98	597,366.97	2,313,303.95	1,689,341.93	591,292.13	2,280,634.06	32,669.89	
2043	33.47	2.04	33.27	2.03		19.6	20.0	1,723,597.86	612,092.08	2,335,689.94	1,696,224.66	605,803.40	2,302,028.06	33,661.88	
2044	33.60	2.09	33.40	2.08		19.6	20.0	1,731,291.60	627,179.88	2,358,471.48	1,703,135.38	620,670.77	2,323,806.15	34,665.33	
2045	33.73	2.14	33.53	2.13		19.6	20.0	1,739,018.33	642,639.30	2,381,657.64	1,710,074.18	635,903.00	2,345,977.18	35,680.46	
2046	33.87	2.19	33.66	2.18		19.6	20.0	1,746,778.21	658,479.49	2,405,257.70	1,717,041.20	651,509.02	2,368,550.22	36,707.48	
2047	34.00	2.24	33.80	2.24		19.6	20.0	1,754,571.35	674,709.83	2,429,281.18	1,724,036.53	667,498.02	2,391,534.56	37,746.62	
2048	34.13	2.30	33.93	2.29		19.5	20.0	1,762,397.91	691,339.91	2,453,737.82	1,731,060.31	683,879.40	2,414,939.70	38,798.11	
2049	34.27	2.35	34.07	2.35		19.5	20.0	1,770,258.02	708,379.56	2,478,637.59	1,738,112.63	700,662.78	2,438,775.40	39,862.18	
2050	34.40	2.41	34.20	2.41		19.5	20.0	1,778,151.83	725,838.88	2,503,990.71	1,745,193.62	717,858.02	2,463,051.64	40,939.07	
														Total	750,879.55

Source: JICA Survey Team

Summary of CO2 emission and reduction by the Project by 2050 is shown in Table 4.3.19. The value will be 720, 662 t CO2.

Table 4.3.19 Summary of CO2 Emission by the Project

Activities	tCO2
Construction phase	30,218
Operation phase (-2050)	750,880
Diference	720,662

Source: JICA Survey Team

4.3.2.3 Generation of Noise and Ground Vibration

(1) Noise

Construction Phase

Noise and ground vibrations, particularly during construction stage will certainly affect nearby establishments of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignments.

Construction activities increases noise levels within and around the project area. Construction activities resulted to short term, local noise and ground vibration disturbances caused by heavy equipment operation on the site. People’s reactions on noise levels could be rated from acceptable, annoyance and discomfort (see Figure 4.3.18).

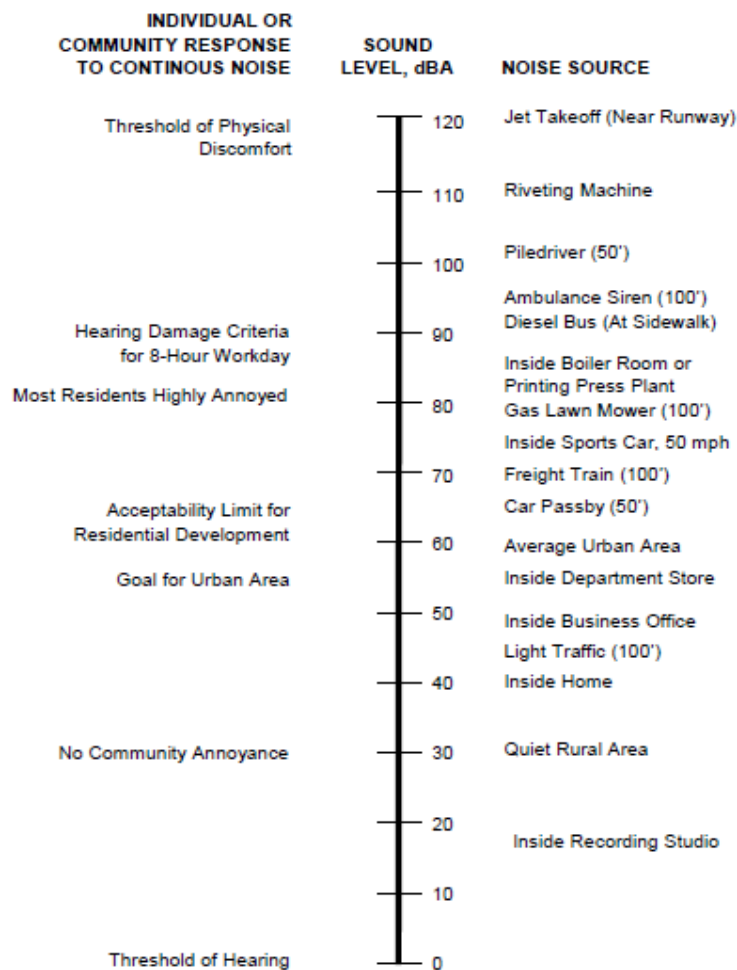


Figure 4.3.18 Typical Sound Levels of Noise Sources and Expected Reactions

Source: Advanced Engineering Acoustics (2010)

1) Forecast Methodology

The Noise during construction stage is coming from the operation of construction machines. The sound level is measured at 1 meters from the machines, the loudest noise from construction machines is 106 dB(A) for pilling work and driving of sheet pile by using earth drill. The noise level assessment during construction will consider sound level in different distances from the origins. Decay Formula Equation will be used in this assessment, which will be done on spare basis, as the Equation (1).

$$L_{p2} = L_{p1} - 20 \log(r_2/r_1) \dots \dots \dots (1)$$

When

L_{p1} = Sound level at distance r_1 from the origin

L_{p2} = Sound level at distance r_2 from the origin (forecasted value)

r_1, r_2 = Distance from the origin at sound level L_{p1} and L_{p2}

2) Forecast Point and Forecasted Values

Quantitative forecast is conducted at the points shown in Table 4.3.20. All forecasted point at all points exceed Japanese standards value during construction.

Table 4.3.20 Forecast Result of Noise during Construction

Location	Station	Sampling period	Baseline	Forecast*1	Japanese Standard dB(A)
			Result dB(A)	Result dB(A)	
Mandaue Comprehensive National High School (Class AA area)	A-ST1	Morning (5 AM - 9 AM)	53	103	85
		Daytime (9 AM - 6 PM)	62	103	
		Evening (6 PM - 10 PM)	56	103	
		Nighttime (10 PM - 5 AM)	57	103	
Village Social Housing (Class A area)	A-ST2	Morning (5 AM - 9 AM)	57	86	
		Daytime (9 AM - 6 PM)	50	86	
		Evening (6 PM - 10 PM)	56	86	
		Nighttime (10 PM - 5 AM)	48	86	
Commercial Area Mall (Class B area)	A-ST3	Morning (5 AM - 9 AM)	62	103	
		Daytime (9 AM - 6 PM)	62	103	
		Evening (6 PM - 10 PM)	55	103	
		Nighttime (10 PM - 5 AM)	50	103	

Note)

*1: Results compare the criteria. / **Red numbers** indicate exceeding the criteria.

Source: JICA Survey Team

Operation Phase

The forecast method used is the "ASJ RTN-Model 2013" which is a forecast method of road traffic noise. The forecasted year is 2039, which is more than 10 years in service. The forecast results are shown in Table 4.3.21.

Forecast result on Mandaue Comprehensive National High School (A-ST1) exceeds the IFC standard within 3 dB from the background level (Base Line level) for A-ST1, therefore mitigation measures will be implemented for A-ST1.

Table 4.3.21 Forecast Result in 2039 at 3 Different Sites along The Proposed 4th Cebu-Mactan Bridge Route

Location	Station	Sampling period	Baseline	Standard for baseline (dBA) *1	Forecast	Standard for forecast (dBA)
			Result dB(A)		Result dB(A)	
Mandaue Comprehensive National High School (Class AA area)	A-ST1	Morning (5 AM - 9 AM)	53	45	64	56 (*3)
		Daytime (9 AM - 6 PM)	62	50	66	65 (*3)
		Evening (6 PM - 10 PM)	56	45	64	59 (*3)
		Nighttime (10 PM - 5 AM)	57	40	61	60 (*3)
Village Housing (Class A area)	A-ST2	Morning (5 AM - 9 AM)	57	50	58	60 (*3)
		Daytime (9 AM - 6 PM)	50	55	52	60 (*2)
		Evening (6 PM - 10 PM)	56	50	57	59 (*3)
		Nighttime (10 PM - 5 AM)	48	45	50	51 (*3)
Commercial Mall (Class B area)	A-ST3	Morning (5 AM - 9 AM)	62	60	62	65 (*3)
		Daytime (9 AM - 6 PM)	62	65	62	70 (*2)
		Evening (6 PM - 10 PM)	55	60	56	65 (*2)
		Nighttime (10 PM - 5 AM)	50	55	52	60 (*2)

Note)
 *1: Standard for General Area, *2: Standard for areas directly facing four-lane roads, *3: IFC Standard EHS Guide Line within 3 dB from the background level (Base Line) (dBA) / **Red numbers** indicate exceeding the criteria.
 IFC Standard: Environmental, Health, and Safety (EHS) Guidelines Noise Management (April 2007)
 Source: JICA Survey Team

(2) Vibration

Construction Phase

1) Forecast Methodology

The Vibration during construction is coming from the operation of construction machines. The vibration level is measured at 1 meters from the machines, the highest vibration from construction machines is 56 dB(A) for pilling work and driving of sheet pile by using earth drill. The vibration level assessment during construction will consider vibration level in different distances from the origins. Decay Formula Equation will be used in this assessment, which will be done on spare basis, as the Equation (1).

$$L(r) = L(0) - 15\log_{10}(r/r_0) - 8.68\alpha(r-r_0) \dots \dots \dots (1)$$

When

- $L(r)$ = Vibration level at forecast point (dB)
- $L(0)$ = Vibration level at distance from the origin (vibration at reference point) (dB)
- r = Distance from vibration source to forecast point (m)
- r_0 = Distance from vibration source to the reference point (5m)
- α = Friction damping coefficient (0.01-0.04)

2) Forecast Point and Forecasted Value

Quantitative forecast is conducted at the points shown in Table 4.3.22. There is no forecast value exceeding Japanese standards value of construction vibration.

Table 4.3.22 Forecast Result of Vibration during Construction

Location	Station	Time	Forecast dB	Japanese Standard dB
Mandaue Comprehensive National High School	A-ST1	Day Time Average	46	75
		Night Time Average	46	
Village/Social Housing Area	A-ST2	Day Time Average	23	
		Night Time Average	23	
Commercial Area/Mall	A-ST3	Day Time Average	46	
		Night Time Average	46	

Source: JICA Survey Team

Operation Phase

1) Methodology and Forecast Points

The formulation which has been developed by Ministry of Land, Infrastructure, Transport and Tourism in Japan is used for quantitative traffic vibration forecast with using traffic volume estimation in the 2035. Prediction points are same as during construction points as shown in Figure 4.3.11.

2) Forecast Point and Forecasted Value

The result of quantitative forecast is shown in Table 4.3.23. With regard to applied standard value, Japanese traffic vibration standard is adopted since there are not any standard value on traffic vibration in Philippines. As the result of forecast, all forecasted values are satisfied with Japanese.

Table 4.3.23 Forecast Result of Vibration during Operation Phase

Location	Station	Time	Forecast dB	Japanese Standard dB
Mandaue Comprehensive National High School	A-ST1	Day Time Average	48	75
		Night Time Average	48	
Village/Social Housing Area	A-ST2	Day Time Average	43	
		Night Time Average	43	
Commercial Area/Mall	A-ST3	Day Time Average	46	
		Night Time Average	47	

Source: JICA Survey Team

4.3.2.4 Generation of Odor

During construction phase, general wastes from the base camp may generate offensive odors. On the other hand, no serious impact is expected because there is no activity planned that may generate offensive odor during operation stage.

4.3.3 IMPACT MITIGATION & ENHANCEMENT MEASURES

4.3.3.1 Air Quality

Construction Phase

Construction activities (Including the pre-construction demolition activity) that will cause minor to moderate negative air quality impacts in the area are: mobilization and site development works (clearing and grubbing, excavation backfilling). The rest of construction activities will have negligible impacts to air quality.

During construction stage, air quality concerns are more focused on the concentration of high levels of total suspended particulate (PM10) – which is generally, within the primary impact area. Given the project area's size which is not large enough to generate large amount of dust, diesel soot that would be dispersed by wind to the surrounding areas there is not much effects on the ambient air quality on the secondary impact areas.

Vehicular emissions, particularly, from vehicles coming in and out of the project site (notably, heavy dumptrucks/haulers) is expected to contribute to reducing air quality within areas along its road-trips (regional impact area). However, such contribution to the regional degradation of air quality in Metro Cebu is less significant to negligible.

Since, heavy concentration of dusts are primarily attributed to soil disturbance there will be negligible air quality impacts during building construction. As construction of superstructure/building rises, netting will be provided to contained dusts and construction debris from dispersing and falling into nearby areas. A chute will also be provided to convey construction debris from upper floors to lower ground.

With mitigation such as the following measures, air quality impacts are less than significant:

- Regular watering of areas considered as dust generators
- Use only new or properly maintained vehicles, equipment and conduct regularly check to regulate emissions within standard levels
- Transport of excess materials should be undertaken during off-peak traffic periods
- Hauling trucks should be covered with tarpaulin or canvass
- Conduct quarterly air quality level monitoring

Operation Phase

As the quantitative forecast of air quality for 2039 shows (see 4.3.2.1), the 4th Cebu-Mactan Bridge-Mandaue Coastal Road project is expected to bring about no significant adverse impacts on air quality. The fact that forecast results are almost same as the baseline figures indicates that the contribution of the project to the change in air quality is at a negligible level. Therefore, no special mitigation measures will be required for the operation phase. Instead, the project may be one of the measures to contributing improvement of air quality by addressing traffic congestion and thereby reducing vehicular emissions.

4.3.3.2 Mitigation of Greenhouse Gas (GHG) Emission

Construction Phase

The contractor shall implement the following measures to mitigate GHG emission which will include the following:

- Optimize the construction activities and material
- Use only new or properly maintained vehicles (Energy Efficient Vehicle), equipment
- Minimize the removal of trees along the 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment
- Replant the trees to mitigate the impact of the removal

Operation Phase

While the 4th Cebu-Mactan Bridge-Mandaue Coastal Road project is expected to address traffic congestion and influence smooth traffic flow that will reduce vehicular/CO₂ emissions-the continuous positive beneficial effects of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road operations is basically dependent on future vehicular traffic road density-which may also potentially cause traffic congestion within the 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment. Thus, an integrated Traffic Management Plan for the three (3) HUCs including and and a Metrowide Transport Master Plan are necessary to prevent future traffic congestion in the 4th Cebu-Mactan Bridge-Mandaue Coastal Road.

4.3.3.3 Mitigation of Noise and Ground Vibration level

(1) Noise

Construction Phase

In order to minimize the noise distribution levels during the construction phase, temporary noise barrier should be facilitated at all points as table below.

Table 4.3.24 Forecasted Value with Mitigation Measures

Location	Station	Sampling period	Baseline	Forecast	Japan ese Stand ard dB(A)	Mitigation Measure	Result with Mitigation Measure dB(A)	
			Result dB(A)	Result dB(A)				
Mandaue Comprehensive National High School (Class AA area)	A-ST1	Morning (5 AM - 9 AM)	53	103	85	Temporary Noise Barrier 3m	83	
		Daytime (9 AM - 6 PM)	62	103			83	
		Evening (6 PM - 10 PM)	56	103			83	
		Nighttime (10 PM - 5 AM)	57	103			83	
Village Social Housing (Class A area)	A-ST2	Morning (5 AM - 9 AM)	57	86		85	Temporary Noise Barrier 2m	76
		Daytime (9 AM - 6 PM)	50	86				76
		Evening (6 PM - 10 PM)	56	86				76
		Nighttime (10 PM - 5 AM)	48	86				76
Commercial Area Mall (Class B area)	A-ST3	Morning (5 AM - 9 AM)	62	103	85	Temporary Noise Barrier 3m	83	
		Daytime (9 AM - 6 PM)	62	103			83	
		Evening (6 PM - 10 PM)	55	103			83	
		Nighttime (10 PM - 5 AM)	50	103			83	

*1: Results compare the criteria. / Red numbers indicate exceeding the criteria.

Source: JICA Survey Team

Temporary noise barriers should be facilitated along the both sides of ROW at A-ST1 and A-ST2, while A-ST3 required it only left side which faces to residential area. The detail of mitigation plans is shown in Table 4.3.25.

Table 4.3.25 Detail of Temporary Noise Barrier

Location	Station	Length(m)	Height(m)
Mandaue Comprehensive National High School (Class AA area)	A-ST1	3,306	3.0
Village Social Housing (Class A area)	A-ST2	600	2.0
Commercial Area Mall (Class B area)	A-ST3	1,726	3.0

Source: JICA Survey Team

Apart from mentioned above, following should be implemented:

- Scheduling of equipment operations during daytime; no nighttime operations (7:00 a.m-7:00 p.m)
- Use only new or properly maintained vehicles, equipment
- Minimize the use of impact devices, such as jackhammers, pavement breakers, and hoe rams
- Installation of noise abatement devices such as mufflers and suppressors to all construction vehicles, machineries, and heavy equipment
- Locate stationary equipment, such as compressors as far as possible from noise sensitive areas.
- Conduct a semi-annual noise level monitoring at sensitive receptor areas

As pile-driving has been identified as the most noisy construction activity, it is recommended that impact-type pile driving should be avoided. Appropriate pile-driving technology for offshore viaduct shall also be required in noise-sensitive receptor area and bird habitat so that the pile-driving will have less disturbance and negative impacts.

Operations Phase

During operation stage, vehicles using the 4th Cebu-Mactan Bridge-Mandaue Coastal Road will generate noise which could cause disturbance especially in Noise-Sensitive Receptors (NSRs) such as churches/places of worships, schools, hospitals, government centers and other institutions. Natural barriers (such as trees/vegetation) and noise attenuation/reduction technologies shall be implemented/instituted in road sections near to NSRs.

As forecast results for the Mandaue Comprehensive National High School (A-ST1) exceeds the IFC standard within 3 dB from the background level (see **Table 4.3.26**), 2m-height noise barrier on the handrail (1m-height) shall be installed as a mitigation measure. The forecast results with the mitigation measure meet the IFC standards for daytime and nighttime and the Japanese standards for morning and evening time. Therefore, the impact of noise after construction will be sufficiently mitigated.

Table 4.3.26 Mitigation of Forecast Result in 2039 at Mandaue Comprehensive National High School (Class AA area) along the Proposed 4th Cebu-Mactan Bridge route

Location	Station	Sampling	Baseline	Standard	Forecast	Standard	Mitigation	Result	Standard
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		period	Result dB(A)	for baseline (dBA) *1	Result dB(A)	for forecast (dBA) *2	Measure	with Mitigation Measure dB(A)	for forecast with mitigation measure dB(A)
Mandaue Comprehensive National High School (Class AA area)	A-ST1	Morning (5 AM - 9 AM)	53	45	64	56	2m-height noise barrier on the handrail (1m-height)	62	70 (*3)
		Daytime (9 AM - 6 PM)	62	50	66	65		65	65 (*2)
		Evening (6 PM - 10 PM)	56	45	64	59		62	65 (*3)
		Nighttime (10 PM - 5 AM)	57	40	61	60		60	60 (*2)

Note)

*1: Standard for General Area, *2: IFC Standard EHS Guide Line within 3 dB from the background level (Base Line), *3: Japan: Ministry of Environment (1998) Environmental Standards for Noise / **Red numbers** indicate exceeding the criteria.

IFC Standard: Environmental, Health, and Safety (EHS) Guidelines Noise Management (April 2007)

Source: JICA Survey Team

Furthermore, setting up the wall can cover drivers' visibility to outside of the road, which contributes to protect the privacy and secure the safety of residential area and factories located along the coastal road. Therefore, it is recommended to install noise barriers, at least, covering from the sensitive area (i.e. schools and hospitals) to the factory area. The detail of mitigation plans is shown in Table 4.3.27.

Table 4.3.27 Detail of Noise Barrier

Beginning Point	End Point	Length(m)	Height(m)
Sta. 0+360	Sta. 3+000	5,280 (2,640 m x 2 sides)	2m-height noise barrier on the 1m-height handrail

(2) Vibration

Construction Phase

As mentioned above, there is no adverse impact on vibration during construction phase, thus no mitigation is required.

Operations Phase

As mentioned above, there is no adverse impact on vibration during operation phase, thus no mitigation is required.

4.3.3.4 Countermeasure for odor problem

During construction phase, general waste including used cans, glass bottles, paper, other office waste and packaging materials such as plastic and cardboard will be generated from the construction yards. The contractor will require the waste minimization program, recycling of these materials and proper treatment as part of their best practice.

4.4 People

4.4.1 BASELINE CONDITIONS

4.4.1.1 Demography

According to a census survey, the population in 2015 was 362,654 in Mandaue City (out of which 182,715 was male and 179,939 female) and 408,112 in Lapu-Lapu City (out of which 202,089 was male and 206,023 female). The rate of annual population growth between 2000 and 2010, and 2010 and 2015 were 2.46% and 1.73% in Mandaue City, and 4.91% and 2.94% in Lapu-Lapu City, respectively.

This is high compared to the population growth rate in Cebu City (1.88% and 1.21%, respectively). Table 4.4.1 shows the population in Mandaue City and Lapu-Lapu City in 2010 and 2015 by sex. Table 4.4.2 shows the annual population growth rate in the two cities and in the surrounding cities.

Table 4.4.1 Population in Mandaue City and Lapu-Lapu City (by sex)

Time of Census	Total Population	Male	Female	Number of Men in 100 of Women
Mandaue City				
2010	331,213	164,452	166,761	98
2015	362,654	182,715	179,939	101
Lapu-Lapu City				
2010	350,467	172,839	177,628	97
2015	408,112	202,089	206,023	98

Source: Freedom of Information (available at: <https://www.foi.gov.ph/requests/aglzfmVmb2kteGhyIAsSB0NvbnRlbnQiE1BPUENPTS05OTI2NTEyNDQ5ODEM>)

Table 4.4.2 Annual Population Growth Rate in Mandaue City, Lapu-Lapu City and surrounding Cities

Province, City	Annual Population Growth Rate	
	2000-2010	2010-2015
Bohol	0.97	0.87
Cebu (excluding Cebu City, Lapu-Lapu City and Mandaue City)	1.94	2.22
Cebu City	1.88	1.21
Mandaue City	2.46	1.73
Lapu-Lapu City	4.91	2.94

Source: Freedom of Information (available at: <https://www.foi.gov.ph/requests/aglzfmVmb2kteGhyIAsSB0NvbnRlbnQiE1BPUENPTS05OTI2NTEyNDQ5ODEM>)

Of the project affected Barangays in Mandaue City, it is Barangay Looc, having the highly densely populated with 189.32 pop/hectare. Brgy. Looc has also the highest number of Project Affected Families (PAF). Brgy. Pusok in Lapu-lapu is also the highly densely populated of the affected barangays in Lapu-lapu City.

Table 4.4.3 Population Density

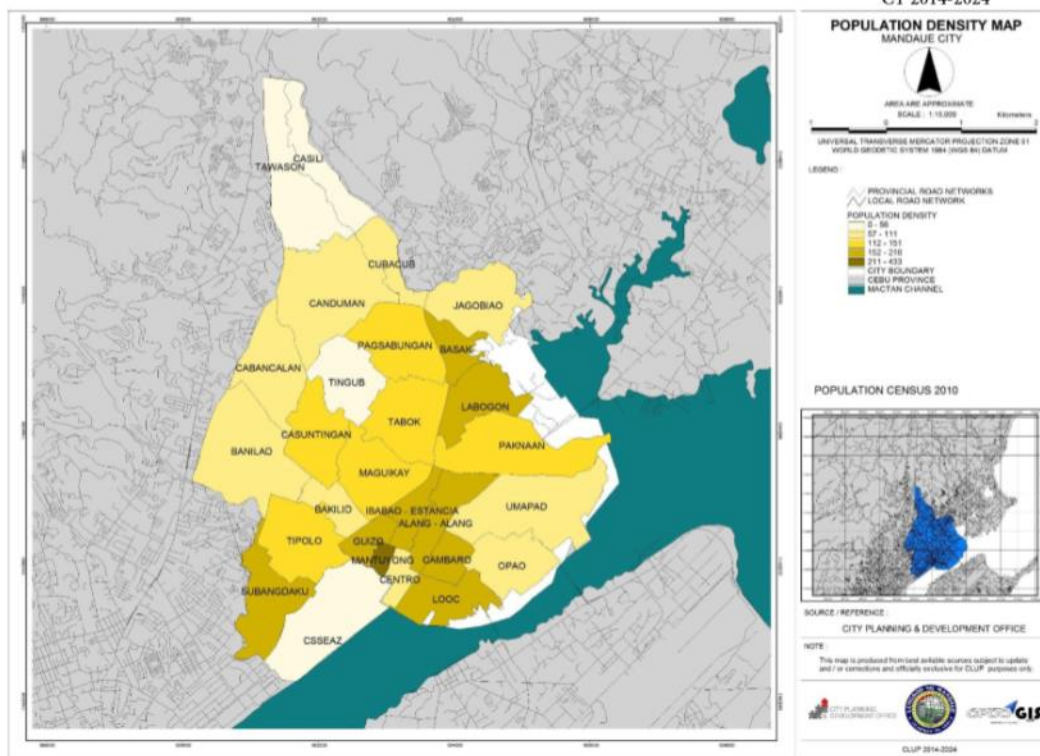
Barangay	Total Population 2015	Area (has)	Population Density	Barangay	Total Population 2015	Area (has)	Population Density
MANDAUE CITY	77,427			LAPU-LAPU			
Centro	3,383	29.29	115.52	Ibo	8,126	148.10	
Looc	17,143	90.55	189.32	Pusok	28,810	153.34	
Opao	11,457	103.68	110.51				
Umapad	18,501	209.74	88.21				
Paknaan	26,943	169.75	158.73				

Source: Mandaue City CLUP, Lapu-lapu City CLUP

Table 4.4.4 Population Number and Household Size

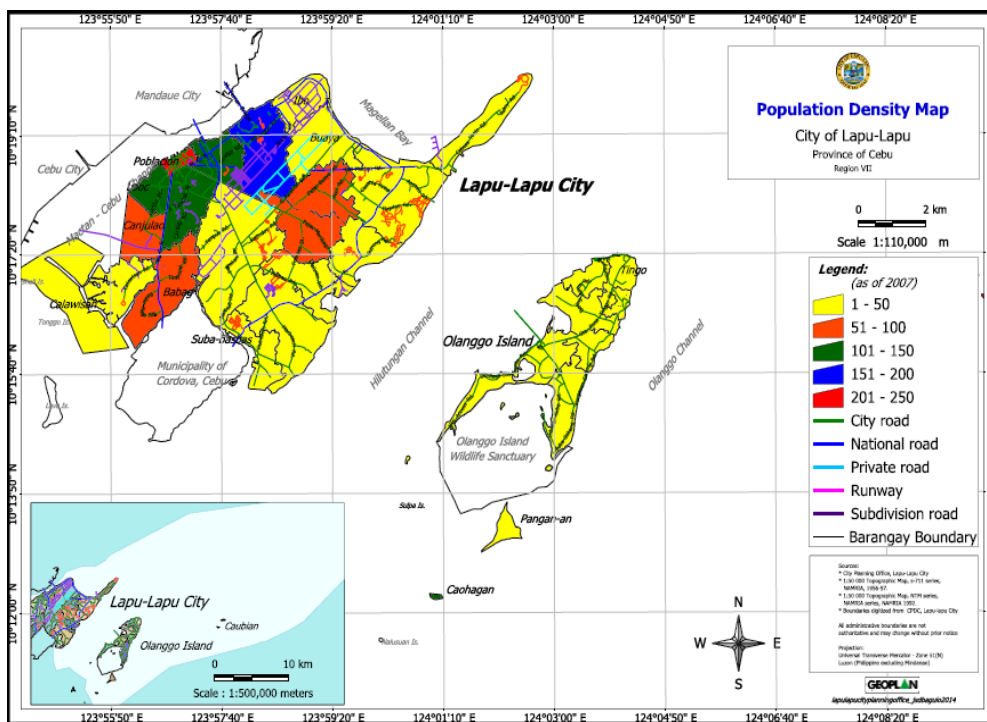
Barangay	2010 Pop	No. of HHs	Ave. HH Size	Barangay	2010 Pop	No. of HHs	Ave. HH Size
MANDAUE CITY	331,320	78394	4.23	LAPU-LAPU	350,467	80,913	4.33
Centro	3,236	725	4.46	Ibo	7,055		
Looc	14,438	3,184	4.53	Pusok	26,568		
Opao	9,907	2,152	4.60				
Umapad	17,454	3,923	4.45				
Paknaan	22,957	5,186	4.43				

Source: Mandaue City CLUP, Lapu-lapu City CLUP, 2010 Census of Population and Housing



Source: Mandaue City CLUP 2014-2024

Figure 4.4.1 Population Density Map of Mandaue City



Source: Mandaue City CLUP

Figure 4.4.2 Population Density Map of Lapu-Lapu City

4.4.1.2 Literacy of Household Population

Literacy of Household Population in Mandaue City and Lapu-Lapu City is shown below.

Table 4.4.5 Literacy of Household Population in Mandaue City and Lapu-Lapu

Age Group and City/Municipality	Household Population 10 Years Old and Over			Literate			Illiterate		
	Both Sexes	Male	Female	Both Sexes	Male	Female	Both Sexes	Male	Female
MANDAUE CITY									
Total	260,647	127,980	132,667	258,961	127,220	131,741	1,686	760	926
10-14	30,254	15,423	14,831	29,921	15,236	14,685	333	187	146
15-19	33,480	15,998	17,482	33,310	15,902	17,408	170	96	74
20-24	37,332	17,907	19,425	37,208	17,868	19,340	124	39	85
25-29	35,125	17,312	17,813	35,027	17,263	17,764	98	49	49
30-34	29,203	14,686	14,517	29,109	14,627	14,483	94	59	34
35-39	23,049	11,673	11,376	22,982	11,634	11,348	67	39	28
40-44	19,569	9,852	9,717	19,469	9,802	9,667	100	50	50
45-49	15,802	7,913	7,889	15,689	7,849	7,840	113	64	49
50-54	12,615	6,305	6,310	12,533	6,276	6,257	82	29	53
55-59	9,058	4,331	4,727	8,965	4,286	4,679	93	45	48
60-64	6,101	2,871	3,230	6,035	2,857	3,178	66	14	52
65 and over	9,059	3,709	5,350	8,713	3,621	5,092	346	88	258
LAPU-LAPU CITY									
Total	269,074	130,742	138,332	266,440	129,389	137,051	2,634	1,353	1,281
10-14	34,734	17,873	16,861	34,360	17,616	16,743	374	257	118
15-19	34,916	16,517	18,399	34,603	16,332	18,271	313	185	128
20-24	36,810	17,168	19,642	36,601	17,049	19,552	209	119	90
25-29	34,980	16,974	18,006	34,829	16,892	17,937	151	82	69
30-34	31,768	15,333	16,435	31,658	15,253	16,405	110	80	30
35-39	25,133	12,587	12,546	24,942	12,465	12,477	191	122	69
40-44	19,828	10,083	9,745	19,674	9,987	9,687	154	96	58
45-49	15,338	7,661	7,677	15,245	7,592	7,652	93	69	25
50-54	11,784	5,926	5,858	11,661	5,866	5,794	123	60	64
55-59	8,693	4,215	4,478	8,607	4,168	4,439	86	47	39
60-64	6,069	2,763	3,306	5,898	2,717	3,181	171	46	125
65 and over	9,021	3,642	5,379	8,362	3,452	4,910	659	190	469

Source: Mandaue City and Lapu-Lapu City

4.4.1.3 Livelihood/Occupation

In Mandaue City, the predominant number of workers is those working in the “plant and machine operators and assemblers”. Similarly, Lapu-Lapu City has also most of the workers are in “plant and machine operators and assemblers”.

Table 4.4.6 Gainful Workers 15 Years Old and Over by Major Occupation Group, Age Group, Sex, and City/Municipality: 2010

Major Occupation Group, and City/Municipality	Total Gainful Workers 15 Years Old & Over	Age Group										
		15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65 & over
MANDAUE CITY												
Total	128,418	5,546	19,495	23,102	20,310	16,360	14,044	11,166	8,466	5,341	2,648	1,939
Officials of Government and Special Interest Organizations, Corporate Executives, Managers, Managing Proprietors, and Supervisors	14,135	36	543	1,319	1,991	1,963	2,147	1,857	1,687	1,212	679	701
Professionals	7,274	-	1,082	1,661	1,328	941	820	490	438	268	152	94
Technicians and Associate Professionals	5,875	119	881	1,285	929	778	577	516	393	245	128	25
Clerks	9,052	231	2,230	2,486	1,645	914	602	449	265	173	37	20
Services Workers and Shop and Market Sales Workers	15,004	1,017	3,705	3,457	2,326	1,547	1,079	821	569	243	155	85
Farmers, Forestry Workers and Fishermen	633	15	38	33	69	48	49	79	142	62	31	68
Trade and Related Workers	24,353	727	3,008	3,981	3,961	3,571	3,041	2,636	1,733	975	381	339
Plant and Machine Operators and Assemblers	26,115	888	3,803	4,975	4,723	3,543	2,924	2,256	1,435	958	431	179
Laborers and Unskilled Workers	23,766	2,303	3,877	3,526	3,070	2,823	2,562	1,924	1,616	1,073	597	396
Armed Forces	5	-	-	-	-	-	-	5	-	-	-	-
Other Occupation Not Elsewhere Classified	113	-	10	10	29	19	10	20	10	5	-	-
Not Reported	2,092	211	318	368	240	214	233	114	176	128	58	31
LAPU-LAPU CITY (OPON)												
Both Sexes												
Total	128,606	5,636	18,585	23,200	21,914	17,587	13,883	10,536	7,581	4,884	2,573	2,227
Officials of Government and Special Interest Organizations, Corporate Executives, Managers, Managing Proprietors, and Supervisors	11,449	40	436	1,168	1,620	1,791	1,750	1,536	1,322	757	530	500
Professionals	6,697	-	1,053	1,601	1,200	934	756	424	348	219	122	39
Technicians and Associate Professionals	6,932	169	1,036	1,497	1,318	1,020	683	472	354	215	110	58
Clerks	6,662	173	1,379	1,682	1,225	730	483	487	274	156	55	18
Services Workers and Shop and Market Sales Workers	12,789	783	2,336	2,616	2,255	1,551	1,176	946	521	363	140	102
Farmers, Forestry Workers and Fishermen	6,110	363	626	554	826	716	770	681	496	395	302	382
Trade and Related Workers	24,916	830	3,416	4,412	4,397	3,653	2,767	2,035	1,495	1,065	504	343
Plant and Machine Operators and Assemblers	30,404	1,109	4,657	6,157	5,640	4,527	3,246	2,176	1,479	789	400	224
Laborers and Unskilled Workers	21,238	2,075	3,447	3,185	3,210	2,506	2,153	1,665	1,211	851	400	537
Armed Forces	5	-	-	5	-	-	-	-	-	-	-	-
Other Occupation Not Elsewhere Classified	50	-	10	20	5	-	5	5	5	-	-	-
Not Reported	1,355	93	191	305	219	159	95	110	76	74	10	24

Source: National Statistics Office, 2010 Census of Population and Housing

Table 4.4.7 Gainful Workers 15 Years Old and Over by Major Kind of Business or Industry, Age Group, Sex, and City/Municipality: 2010

Sex, Major Kind of Business or Industry, and City/Municipality	Total Gainful Workers 15 Years Old and Over	Age Group										
		15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65 and over
MANDAUE CITY												
Sex												
Total	128,418	5,546	19,495	23,102	20,310	16,360	14,044	11,166	8,466	5,341	2,648	1,939
Agriculture Forestry and Fishing	1,120	19	72	81	138	102	152	120	189	101	61	85
Mining of Quarrying	355	5	46	50	58	62	34	37	20	14	15	15
Manufacturing	36,247	1,680	6,682	7,596	6,268	4,475	3,413	2,701	1,751	979	394	310
Electricity, Gas, Steam and Air Conditioning Supply	293	-	10	76	55	67	23	9	16	22	14	-
Water Supply, Sewerage, Waste Management and Remediation Activities	399	20	52	36	49	69	83	15	36	26	10	5
Construction	10,217	188	849	1,394	1,684	1,566	1,460	1,288	886	550	193	160
Wholesale and Retail Trade; and Repair of Motor Vehicles and Motorcycles	25,540	1,194	3,963	4,065	3,556	3,115	2,787	2,246	1,954	1,206	730	723
Transportation and Storage	14,686	276	1,229	2,324	2,587	2,199	2,110	1,559	1,079	808	390	125
Accommodation Food Service	5,133	285	980	834	632	477	546	474	387	249	136	133
Information and Communication	1,412	43	242	357	346	158	141	55	31	14	14	9
Other Occupation Not Elsewhere Classified	2,252	35	382	528	376	366	208	181	87	65	19	5
Real Estate Activities	407	-	13	64	47	39	28	52	79	45	29	10
Professional, Scientific and Technical Activities	1,083	20	114	186	164	144	140	115	77	74	20	29
Administrative and Support Service Activities	8,343	114	1,722	2,131	1,636	998	667	441	348	159	60	67
Public Administrative and Defense; Compulsory Social Security	4,521	30	344	573	655	651	607	602	554	309	130	67
Education	3,201	-	443	771	493	409	424	218	158	110	139	35
Human Health and Social Work Activities	2,185	-	464	354	371	312	229	133	147	106	32	38
Arts, Entertainment and Recreation	476	25	87	107	78	89	24	35	22	9	-	-
Other Service Activities	2,209	66	315	430	327	249	296	220	138	66	70	31
Activities of Households as Employers and Undifferentiated Goods and Services and Producing Activities of Households for Own Use	7,395	1,354	1,310	986	698	766	628	617	424	365	164	83
Activities of Extraterritorial Organizations and Bodies	-	-	-	-	-	-	-	-	-	-	-	-
Not Reported	944	190	175	160	92	48	44	48	84	64	29	10

Sex, Major Kind of Business or Industry, and City/Municipality	Total Gainful Workers 15 Years Old and Over	Age Group										
		15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	65 and over
LAPU-LAPU CITY (OPON)												
Sex												
Total	128,606	5,636	18,585	23,200	21,914	17,587	13,883	10,536	7,581	4,884	2,573	2,227
Agriculture Forestry and Fishing	6,614	394	656	605	893	761	857	721	571	433	312	411
Mining of Quarrying	250	-	21	25	50	56	55	29	10	-	-	5
Manufacturing	38,348	1,667	7,546	8,856	7,274	4,866	3,328	2,085	1,267	768	375	315
Electricity, Gas, Steam and Air Conditioning Supply	233	-	15	38	44	36	35	25	25	15	-	-
Water Supply, Sewerage, Waste Management and Remediation Activities	315	42	48	80	28	36	34	19	9	5	5	9
Construction	11,799	278	1,149	1,671	2,034	1,888	1,488	1,302	955	585	278	169
Wholesale and Retail Trade; and Repair of Motor Vehicles and Motorcycles	19,172	790	2,327	2,727	2,860	2,602	2,152	1,853	1,538	1,016	624	682
Transportation and Storage	15,690	357	1,235	2,342	2,783	2,795	2,201	1,615	1,206	735	295	127
Accommodation Food Service Activities	6,230	288	1,067	1,296	1,006	782	621	499	356	134	105	73
Information and Communication	1,049	15	195	261	229	148	79	37	50	15	10	9
Other Occupation Not Elsewhere Classified	1,425	-	119	340	298	209	193	142	60	44	15	5
Real Estate Activities	284	-	10	24	50	31	50	44	45	15	5	10
Professional, Scientific and Technical Activities	773	10	54	97	149	126	136	97	60	14	16	14
Administrative and Support Service Activities	6,586	129	1,171	1,543	1,271	831	645	454	214	198	65	67
Public Administrative and Defense; Compulsory Social Security	4,786	46	380	668	764	639	642	557	435	365	187	103
Education	2,980	-	314	760	493	390	367	279	171	117	80	10
Human Health and Social Work Activities	1,805	25	486	366	299	256	135	44	80	73	15	25
Arts, Entertainment and Recreation	648	40	98	116	122	87	77	42	51	5	10	-
Other Service Activities	2,554	130	392	465	433	369	244	262	108	71	25	54
Activities of Households as Employers and Undifferentiated Goods and Services and Producing Activities of Households for Own Use	6,656	1,342	1,211	812	783	674	533	424	348	265	143	120
Activities of Extraterritorial Organizations and Bodies	5	-	-	5	-	-	-	-	-	-	-	-
Not Reported	405	83	91	103	49	5	10	5	25	10	5	20

Source: National Statistics Office, 2010 Census of Population and Housing

4.4.1.4 Industry

(1) General

Mandaue City

Commercial activities such as manufacturing and trading play a major role in Mandaue City's economy. As of 2013, there were a total of 13,372 commercial establishments and 1,317 industrial establishments located in the city's 27 barangays. The annual revenue from these commercial and industrial establishments were approximately Php 92 billion and Php 49 billion in 2014. Further, there are five shopping malls and the largest brewery in the country (i.e. San Miguel Corporation) as well as several middle and high-end residences, townhouses and condominiums (Mandaue City Comprehensive Land Use Plan 2014).

There are 16 major agricultural crops produced in Mandaue City. As of 2013, 407 metric tons of these major crops were produced for local sales and consumption. Among the 16 crops, four are staple crops (i.e. corn and fruit-bearing trees such as banana, mango and jackfruit). 150 metric tons were produced. The existing livestock activities in 2012 were piggery, cattle and goat-raising while the poultry products were broilers and eggs. Most of these livestock-raising are backyard activities except for the poultry farms. There are still some small areas for fishing grounds and aquaculture farming in Mandaue City. Fishing/Aquaculture products counted for approximately 807 tons in 2013. The number of local fishermen was approximately 167 out of which only 47 of them were registered. The catch is either sold at different satellite markets within the city, the public market and neighborhood or consumed locally (Mandaue City Comprehensive Land Use Plan 2014).

Lapu-Lapu City

Lapu-Lapu City makes a significant contribution to the overall development of Cebu Province and to Region VII as a whole. The Mactan-Cebu International Airport serves as the gateway in the region from the rest of the world by offering a transshipment point by air of cargoes and people flying to and from neighboring provinces in the Visayas and Mindanao. The historic significance of the city and its attractive coastline with world-class resort hotels make the area a prime destination to foreign and domestic tourist. Naturally, the service sector, dominated by hotel and restaurants, wholesale and retail, real estate renting, transportation and storage, play an important role in the City's employment and production.

Except for fishery, the development potential of agriculture for Lapu-Lapu City is limited due to land constraints. With only 6,424 hectares of land area, the geology of the Mactan Island is mostly coral-based, with little top soil for crop cultivation. Nevertheless, a relatively large number of its population is still dependent on fishery and livestock production as their livelihood. (CLUP 2014).

(2) Fishery

Mandaue City

According to Comprehensive Land Use Plan (CLUP) of Mandaue City, there are still some small areas for fishing grounds and aquaculture farming in Mandaue City. In the year 2012, about 91 tons of fishing/aquaculture products were produced: marine fishing ground 35 ton, inland fishing ground (i.e. river, lake, macrsh/swamp) 6 ton, and fispond/cages 50 ton. However, since this catch is sold for local consumption only as explained in CLUP and by a fisherman at the focus group discussion meeting (see 2.3.5), it is safe to say that this industry does not play a significant role in the local economy.

Table 4.4.8 shows the details of fishing activities in Mandaue City by fishing ground as of 2019. Within the project site, there are fishing grounds in Barangays Paknaan, Looc and Umapad. Number of fishermen within these 3 barangays is 60. Daily fish capture per fisherman is 1-5 kg that is equivalent to PhP 250-1,250.

Table 4.4.8 General Information on Fishery in Mandaue City

No.	Fishing Grounds	Barangays	No. of Fishermen	Fish Capture per fisherman (kg)	Kind of Fish Caught	Fishing Gear Used
1	Mandaue Municipal Water, Consolacion Municipal Water, Liloan, Lapu-Lapu.	<u>Paknaan</u>	28	2-5 kg a day PhP500- PhP 1,250	Mamsa, Dewet, Pot-pot, Obod, Kobal-Kobal, Oyap, Dduhaw	Hook & Line
4	Mandaue Municipal Water, Consolacion.	Labogon	22	2-3 kg a day PhP 500- PhP 750	Potpot, Dewet, Duhaw, Obod, Kobal-Kobal, Oyap, Mamsa	Gil Nets Hook & Line
2	Mandaue Municipal Water, Consolacion.	<u>Looc</u>	20	1-4 kg a day PhP 250- PhP 1,000	Danggit, Kitong, Dewet, Pot-Sot, Duhan, Solid, Hinok, Libgaw	Hook & Line
5	Mandaue Municipal Water, Consolacion & Liloan.	Jagobiao	19	2-8 kg a day PhP 375- PhP 2,000	Duhaw, Danggit, Bogaong, Pot-Pot, Hinok, Ambian, Oyap, Dewet, Solid	Gil Nets Hook & Line
3	Mandaue Municipal Water, Consolacion.	<u>Umapad</u>	12	2-4 kg a day PhP 500 - PhP 1,000	Danggit, Kitong, Dewet dewet, Pot-Pot, Duhan, Solid, Hinok, Libgaw	Hook & Line
6	Mandaue City Sea Water, Consolacion.	Basak	5	2-4 kg a day PhP 500 - PhP 1,000	Danggit, Kitong, Dewet, Pot-Pot, Duhan, Solid, Hinok, Libgaw	Hook & Line

Source: City Agriculture Office, Mandaue City, 2019

Table 4.4.9 shows the number of vessels registered at the City Agriculture Office of Mandaue City. Twenty eight (28) motorized vessels are registered at Barangay Paknaan, 7 at Umapad and 5 at Looc. Four (4) non-motorized vessels are registered at Barangay Paknaan, 5 at Umapad and 15 at Looc.

Table 4.4.9 Registered Fishing Vessels in Mandaue City

Barangay	Motorized	Non-Motorized
<u>Paknaan</u>	28	4
Labogon	18	4
Jagobiao	11	6
<u>Umapad</u>	7	5
<u>Looc</u>	5	15
Basak	2	3
<i>Total</i>	<i>71</i>	<i>37</i>

Source: City Agriculture Office, Mandaue City, 2019

Lapu-Lapu City

According to Comprehensive Land Use Plan (CLUP) of Lapu-Lapu City, the fishing grounds of the city are classified as off-shore and inland. The offshore fishing grounds are the sea waters of Olango Island, Pusok, and Punta Engano. The inland fishing grounds are the marshes of Barangay Babag, and Calawisan and the fishponds in Canjulao and fish cages in Caubian. No production data are currently available.

According to the City Fishery Aquatic Resource Management Council (CFARMC) in Lapu-Lapu, along mainland Mactan Island particularly in places that are already considered as highly urbanized, some marginal fisherfolks can be found along Barangay Pusok, Ibo, Buaya and Punta Engano, but in a minimal number as compared to Olango Island, where most of the fishing community and individual fisherfolks are found. Most of the fisherfolks found along the Mactan Island belong to the informal settlers and many engaged in hook and line fishing with their fishcatch averaging less than 3 kg a day. There are no fishpond in the aforementioned barangays, whereas fishpen can be found along barangay Ibo and Buaya. Most of these fisherfolks are conducting their fishing activities along the mouth of Mactan Channel towards Camotes Sea. The problem confronted by Lapu-Lapu City is the use of illegal fishing by some fisherfolks such as dynamite, cyanide and the use of fine mesh net.

Based on the statistics provided by the concerned institutions and the results of the FGDs, the major fishing grounds within and near the project site is described in Figure 4.4.3. The distance from the bridge construction site to the main coastal fishing grounds in the cities of Mandaue and Lapu-Lapu are approximately 550m and 1km, respectively.



Source: JICA Survey Team

Figure 4.4.3 Major Fishing Grounds in the Cities of Mandaue and Lapu-Lapu

As mentioned in Table 2.3.5.4, there is one operational aquaculture farm (i.e. Batiller Fish Pond) in Barangay Umapad, Mandaue City that is located within the ROW of the project whose land size is approximately 2.35 ha (23,500 m²) as shown in Figure 4.4.4. On the other hand, as mentioned in Table 2.3.5.7, there is no existing fishpond operation within the project and its adjacent areas in Lapu-Lapu City.



Figure 4.4.4 Location of an Operational Aquaculture Farm in Mandaue City

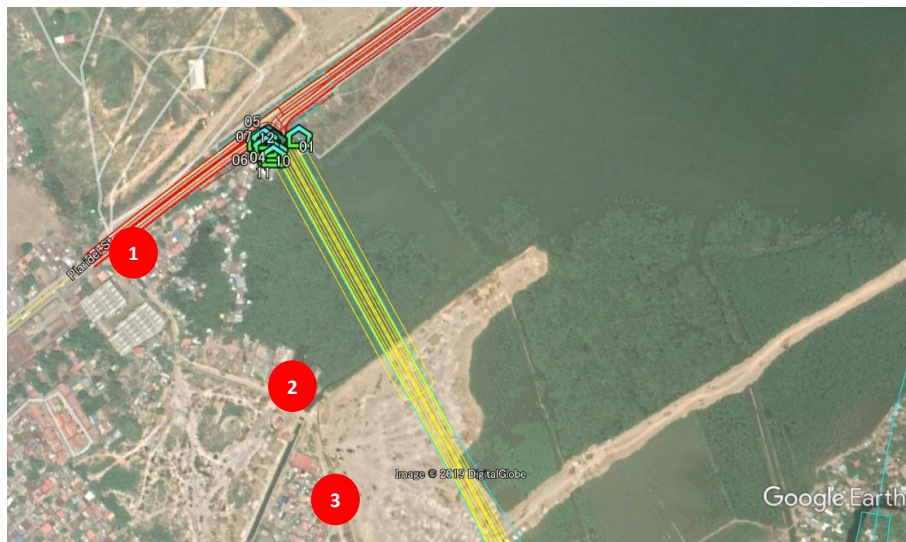
(3) Broom-Making

Broom-making using buri tree (palm tree) is known to be done in Barangay Paknaan, Mandaue City. One of the steps for making broom is to soak buri stem in pond until the fibers come loose, and this activity is said to be carried out in mangrove and abandoned fishponds in Barangay Paknaan (Figure 4.4.5). Based on the interviews to the Captain of the Barangay Paknaan, Mandaue City and the broom-making operators, it is found out that the soaking area for the broom-making activities is largely confined at a single location set-aside by the barangay with an area of approximately 5,000 m² as illustrated as the point 2 in Figure 4.4.6, and thus there are no soaking activities within the ROW of the 4th Cebu-Mactan Bridge and the Mandaue Coastal Road.

The pathways illustrated by arrows in Figure 4.4.6 provide access to some informal settlers living within the mangrove near to the Cansaga bay. The 1st (upper arrow) represents a dirt footpath along the edge of the reclamation development, while the 2nd (middle arrow) represents a footpath that is more developed and passable by lighter vehicles. This also provide access to the mangrove eco-park and the informal settlers along the Butuanon River/landfill site.



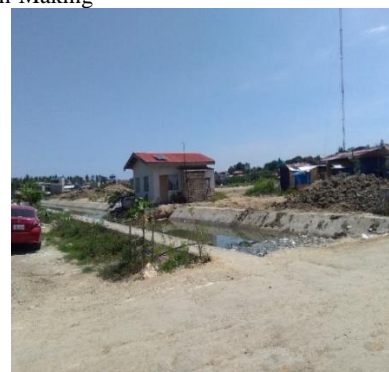
Figure 4.4.5 Soaking Areas for Broom-Making in Barangay Paknaan, Mandaue City



Entire Area Relevant to Broom-Making



Point 1: Road entrance, access to existing housing site, soaking area, mangroves, and the informal settlers along the Butuanon River and the Landfill.



Point 3: Drainage Canal/Waterway



Point 2. Access Road with the soaking area on the right side of the road.



Figure 4.4.6 Location of Broom-Making Activity Related Sites

4.4.1.5 Labor Force

Mandaue City

The population in Mandaue City was 323,400 in 2012. Among them, 144,660 were employed accounting for approximately 45% of the population. Among the 144,660 people employed, 71.7% were engaged in the service sector, 27.7% in the industrial sector and 0.7% in the agriculture sector including fisheries (Mandaue City Comprehensive Land Use Plan 2014).

Lapu-Lapu City

In Lapu-Lapu City, 184,232 people or approximately 63% of the total population of 292,530 were employed as of 2007 in the service (65.6%), industrial (29.8%) and agricultural and fisheries (4.5%) sectors (Mandaue City Comprehensive Land Use Plan 2014). According to CLUP (2014), 7,393 people were making a living in 2008 by working in the agricultural sector including fisheries and livestock industry. Among them, the fisheries and livestock industry take the lion's share.

4.4.1.6 Educational Opportunities and Standard

There are 27 publicly-run primary schools and 17 middle schools in Mandaue City. In addition, there are a number of private schools (i.e. primary schools, middle schools and higher educational institutions). One high school located approximately 1 km from the starting point of Mandaue Coastal Road in the west is situated close to the project site. The literacy rate was 96% as of 2014.

All barangays in Lapu-Lapu City, on the other hand, has a public primary school and most of the barangays have a public high school. The literacy rate in Lapu-Lapu City was 95% in 2000 (CLUP 2014).

Table 4.4.10 List of Schools in Affected Barangays of Mandaue City

School	Enrolment 2013-2014	No. of Classrooms	Area (has.)
Looc-CM Cabahug ES	1,667	27	0.48
Opao ES	3,375	62	0.47
Paknaan ES	4,104	52	0.17
Umapad ES	1,206	19	0.10
Paknaan NHS	1,996	18	0.28
Mandaue City College, Centro	1,225		0.1225
University of Cebu, Looc	15,065		2.3936
Datamex Institute of Computer, Looc	235		0.0323

Source: Mandaue City CLUP

Table 4.4.11 List of Schools in Affected Barangays of Lapu-lapu City

BARANGAY	SCHOOL	AREA OCCUPIED (IN SQ.M.)	PUBLIC/ PRIVATE	OFFERING
Ibo	Ibo ES	5,496.00	Public	
Pusok	Pusok ES	12,300.00	Public	
	Pusok NHS	7,143.00	Public	
	EMD Carmelite School Fndtn.		Private	PS/ES/HS
	Lapu-Lapu City Manpower Development Center			Vocational/ Technical

Source: Lapu-lapu City CLUP

4.4.1.7 Health and Sanitation

Table 4.4.12 shows the average birth rate, morbidity rate and mortality rate in 2009-2013 in Mandaue City and Lapu-Lapu City. Among the ten leading causes of morbidity in Mandaue City, upper respiratory tract infection, animal bites, wounds, tuberculosis and pneumonia were the top five causes in the recorded three years (2011–2013). Upper respiratory tract infection shared approximately 41% of all causes of morbidity.

Table 4.4.12 Annual Average Birth Rate, Morbidity Rate and Mortality Rate in Mandaue City and Lapu-Lapu City

City	Birth Rate	Morbidity Rate	Mortality Rate
Mandaue City*	23.8/1,000 people (crude birth rate) 3.3/1,000 people (total fertility rate)	40/1,000 people	3.5/1,000 people (crude death rate) 9.9/1,000 people (infant mortality rate)
Lapu-Lapu City**	30.9 /1,000 people (crude birth rate)	No data	4.6/1,000 people (crude death rate) 4.9/1,000 people (infant mortality rate)

*data of 2009-2013 average; **data in 2010; Source: Mandaue City Comprehensive Land Use Plan 2014

Table 4.4.13 Mandaue City Ten Leading Causes of Morbidity, 2013

MORBIDITY		MORTALITY	
1. Animal Bite	3,729	1. Myocardial Infarction	538
2. URTI	3,477	2. Carcinoma	171
3. Tuberculosis	1,145	3. Pneumonia	89
4. Wounds	1,047	4. Diabetes Mellitus	77
5. Pneumonia	773	5. COPD	53
6. Dengue	458	6. Cerebrovascular Accident	51
7. Hypertension	287	7. Hypovolemic Shock	50
8. Bronchitis	150	8. Acute Renal Failure	48
9. Fucunculosis	147	9. Liver Cirrhosis	31
10. UTI	129	10. Traumatic Injuries	21

Source: Mandaue City CLUP

Table 4.4.14 Lapu-lapu City Ten Leading Causes of Morbidity per 1000 pop.

DISEASES	2010		5 YEARS AVERAGE 2005 – 2009	
	NO.	RATE	NO.	RATE
1. Upper Respiratory Tract Infection	23,081	71.64	22,323	79.47
2. Skin Infection	6,521	20.24	4,464	15.75
3. Pneumonia	3,585	11.12	7,397	26.13
4. Bronchitis	2,596	8.05	8,205	27.36
5. Diarrhea	2,134	6.62	2,877	10.16
6. Animal Bite	2,029	6.29	1,130	3.93
7. Hypertensive Vascular Disease	1,859	5.77	2,841	9.63
8. Traumatic Injury	1,607	4.98	2,189	7.45
9. Pulmonary Tuberculosis	894	2.77	705	3.06
10. Parasitism	783	2.43	1,785	6.25

Source: Lapu-Lapu City CLUP

Table 4.4.15 Lapu-lapu City Ten Leading Causes of Mortality per 1000 pop.

DISEASES	2010		5 YEARS AVERAGE 2005 – 2009	
	NO.	RATE	NO.	RATE
1. Pneumonia	306	.94	325	1.12
2. Hypertensive Vascular Disease	288	.89	249	.86
3. Myocardial Infarction	175	.54	148	.50
4. Cancer (all types)	111	.34	120	.32
5. Diabetes Mellitus	109	.33	72	.25
6. Trauma/Gunshot/Stub wound	48	.14	65	.17
7. Congenital Heart Failure	43	.13	111	.37
8. Renal Failure	37	.13	34	.11
9. Pulmonary Tuberculosis	36	.11	43	.14
10. Bleeding Peptic Ulcer	24	.07	30	.10

Source: Lapu-Lapu City CLUP

4.4.1.8 Transportation and Traffic

(1) Current Road Network

According to the final report of “Project for Master Plan Study and Institutional Development on Urban Transport System in Metro Cebu”, the total length of the road network in Metro Cebu including the local roads (i.e. city, municipal, and barangay roads) is 1,398.2 km and the national roads account for 30% of the total network (Primary National Road: 121.0 km, Secondary National Road: 191.0 km and Tertiary National Road: 105.6 km). Most roads are generally narrow with two (2) lanes and a few of the roads are four (4) lanes in the urban core areas. Moreover, the traffic capacities of these roads are decreased by roadside and on-road activities such as jeepneys’ or taxis’ waiting for or loading/unloading passengers. 46% of roads are not paved, which are mostly barangay roads.

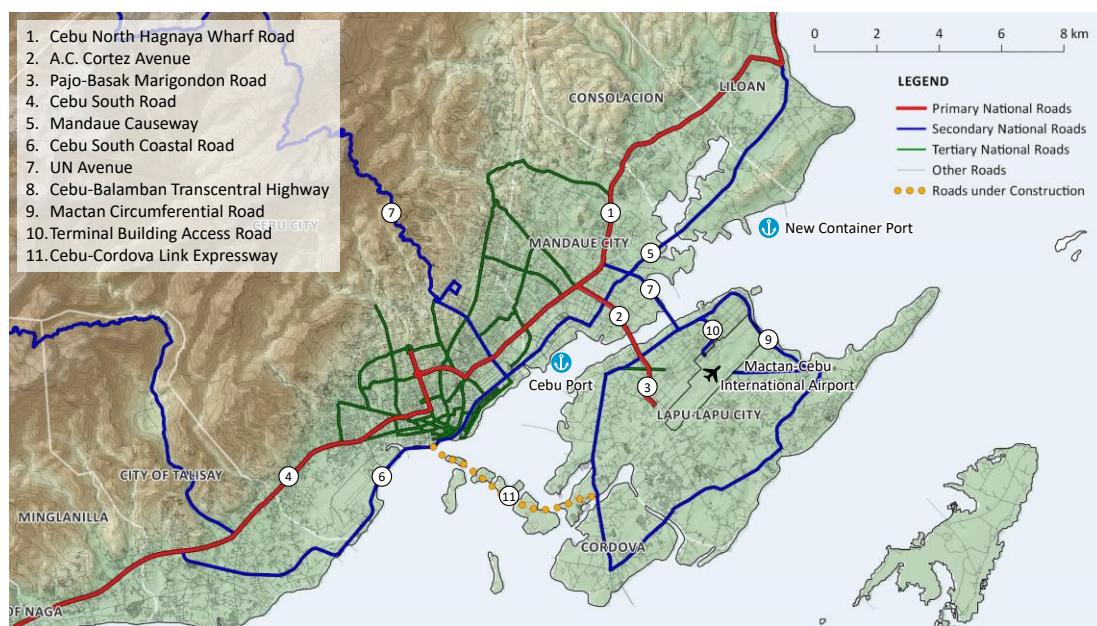


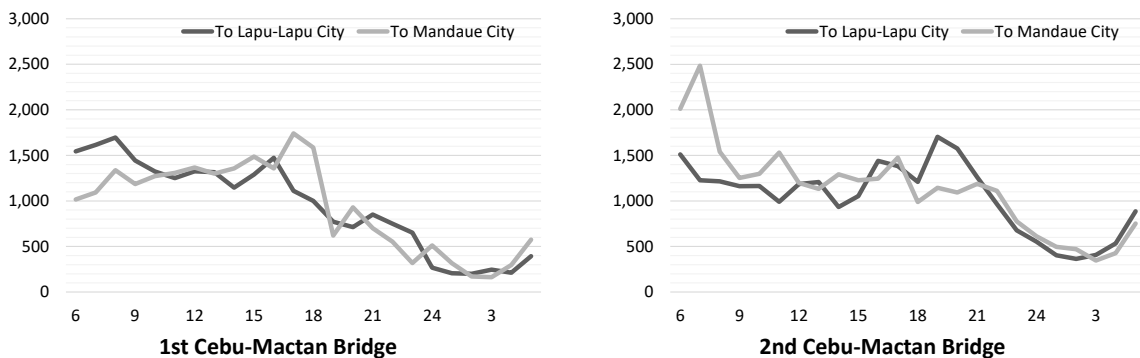
Figure 4.4.7 Current Road Network in Metro Cebu

(2) Current Traffic Situation

The traffic situation in Metro Cebu has deteriorated in recent years. Traffic congestion occurs on many roads and intersections not only during peak hours, but also off-peak hours, due to i) increase of traffic demand (population growth, economic development and motorization), ii) insufficient road network and public transport services, and iii) inadequate traffic management.

Cordon Line and Screen Line Surveys were conducted by MCUTMP in 2017 in order to determine the trip volume and to calibrate the distributed traffic volume obtained from the household interview survey. The 24-hour directional traffic volume at the 1st and 2nd Cebu-Mactan Bridges were obtained by the Screen Line Survey and the daily traffic volume at the two bridges including bicycles and motorcycles were 56,518 vehicle/day (or 45,350 PCU/day) and 59,139 vehicle/day (or 52,099 PCU/day) respectively.

As shown in Figure 4.4.8, the traffic pattern of the two bridges were different. On 1st Cebu-Mactan Bridge, the traffic in direction from Mandaue City to Lapu-Lapu City is higher than that in direction from Lap-Lap City to Mandaue City during morning peak hours (from 6:00am to 8:00am) and the traffic in direction from Lap-Lap City to Mandaue City is higher than that in direction from Mandaue City to Lapu-Lapu City during evening peak hours (from 5:00pm to 6:00pm). On the other hand, the directional traffic pattern in morning and evening peak hours on 2nd Cebu-Mactan Bridge are opposite.



Source: Based on the data obtained by MCUTMP, edited by JICA Survey Team

Figure 4.4.8 Hourly Traffic Volume across Mactan Channel in 2017

4.4.1.9 Solid Waste Disposal and Management¹⁵

Currently, the construction camp yards and the construction disposal site plant to be established near Mandaue Interchange area, located in Mandaue city (See Chapter 3.)

(1) Current Status of Solid Waste Generation in Mandaue City

The Mandaue City Solid Waste Management Plan (STMP) 2018-2028 noted that the Waste Analysis and Characterization Study (WACS) of Mandaue City was conducted in November 2016. WACS is a process of gathering information on the quantity and composition, weight and volume of solid wastes generated from various major sources which includes residential, commercial, industrial and institutional”.

¹⁵ Discussions on project construction and operations waste generation and management is tackled Section 4.1 Land.

Based on WACS in 2016, the total waste generation of the City is 240,364.20 kgs. /day and the per capita generation is 0.6270 kgs/day” from major sources such as residential, commercial and institutions. The total waste generated contains 27.17% biodegradable, 34.86% residual waste, 35.50% recyclable waste, and 2.48% special waste.

Table 4.4.16 Waste Generation of Mandaue City in 2016

Waste Type	Weight (kg/day)	Percentage
Biodegradable	65,295.90	27.17%
Residual	83,783.47	34.86%
Recyclable waste	85,318.1	35.50%
Special	5,966.73	2.48%
Total	240,364.20	100%

Source: The Mandaue City Solid Waste Management Plan (STMP) 2018-2028

(2) Current Solid Waste Management Condition

The Ecological Solid Waste Management Act of 2000 or RA 9003 is an act providing for an ecological solid waste management program, creating the necessary institutional mechanisms and incentives, declaring certain acts prohibited and providing penalties, appropriating funds thereof, and for other purposes.

In response to RA 9003, the City of Mandaue enacted City Ordinance No. 10-2005-343 issued on November 29, 2005, which requires the implementation of solid waste segregation at source and providing penalties for violation. The city government also instituted the Solid Waste Management Board and formulated its Ecological Solid Waste Management Plan.

The management system involves basically still the collections and disposal mindset of the entire citizenry, specifically those within the residential clusters or residential sources and generators, although the commercial and industrial sources and generators have at least the minimal compliance on the segregation of the generated solid waste, owing to the strict enforcement of the RA 9003 and the ECC conformance requirements set forth by the DENR-EMB 7.

Under the Executive Order No. 17, Series of 2016, “Convenning the Solid Waste Management Board of the City of Mandaue, providing for its function and for Other Purpose” and the Executive Order No. 37 “An Order Declaring the Permanent Closure of Umapad Controlled Dumpsite and Institutionalizing the Synchronized Waste Collection and Disposal System (SWCDS)”, rules & responsibilities are specified in the provisions to the different departments of the City of Mandaue.

The following three Organizations named Solid Waste Management Board (SWMB), City Environment & Natural Resource Office (C-ENRO) and Department of General Services (DGS), are key of the SWM of the City of Mandaue.

1) Solid Waste Management Board (SWMB)

SWMB serves as the LGU’s think tank on SWM. It conceptualizes, formulates and proposes plans to the Office of the Mayor such as the needed strategic policy guidelines, ordinances, measures, initiatives and /or funding requirements which has relevance to the effective implementation of the SWM Plans and Programs.

2) City Environment & Natural Resource Office (C-ENRO)

Functions of CENRO on SWM are shown bellows;

- a. The Mayor's designated focal office / entity that will oversee, coordinate, monitor, manage and /or supervise the SWM plan from its conceptualization, its approval by the EMB – NSWMC, its implementation and review;
- b. Crafting, formulating and facilitating the approval of the ten-year solid waste management plan based on annotated guidelines;
- c. Facilitating the implementation of the approved ten-year solid waste management plan;
- d. Facilitating the enactment of environmental laws, and proposed amendment of the existing one if deemed necessary;
- e. Facilitating the process of educating the public on the mandatory segregation of waste at source;
- f. MCENRO deputized eco-enforcers and barangay deputized eco-enforcers shall be authorized by the City Mayor to apprehend violators both public and private establishments and individuals;
- g. Promoting or facilitating the implementation of projects / programs related to waste diversion through reuse, reduce, recycling, composting and other resource recovery initiatives;
- h. Facilitating the establishment of Barangay and or Cluster of Barangays MRF;
- i. Facilitating the acquisition of the necessary environmental permit / clearances prior to the hauling of garbage from transfer station to the final depository site;
- j. MCENRO shall provide the inventory of licensed recycling facilities within the jurisdiction of the City of Mandaue; and
- k. In case of bombing incidents, MCENRO will do the hereunder matters, to wit:
 - Notify the barangay and advise to clean it up in three hours.
 - The Barangay Eco-Enforcers shall help stop and or prevent the bombing of waste in the area
 - After the lapse of time (three hours) from notice either verbal or written, if the bombed wastes were not attended the MCENRO will issue a notice of violation/citation to concerned Barangay Local Government Unit.
 - After the issuance of notice of violation/citation, MCENRO would ask help from DGS to pick up the unattended/uncollected segregated garbage dumped along the main roads of Mandaue City.

1) Department of General Services (DGS)

Functions of DGS on SWM are shown bellows;

- a. Manage, operate, maintain and /or oversee the SWM equipment's and vehicles necessary for the collection, transport and processes including the personnel supervision and the operations & management of the Umapad Sanitray Landfill;
- b. Crafting or formulating the "Safe Closure and Rehabilitation Plan" of the Umapad Controlled Dumpsite which must be in accordance with the standards set under DENR Administrative Order No. 2001 – 34, The Implementing Rules and Regulations of Republic Act No. 9003, and the DENR Administrative Order on the General Guidelines in the Closure and Rehabilitation of Open and Controlled Waste Disposal Facilities;
- c. Implementing the approved Safe Closure and Rehabilitation Plan in the preceding paragraph;
- d. Managing and operating the transfer station which must be in accordance with standard (Article 3, Section 25 of R.A 9003);
- e. Sustaining and intensifying the effective implementation of the garbage collection system and disposal of garbage in compliance with RA 9003 and in accordance with City's role on the synchronized collection and disposal system;
- f. Collecting and disposing all the wastes generated by the national and or city government offices / properties within Mandaue City;
- g. Disposing the residual waste stored in the designated transfer station to the final depository site;
- h. Establishing standard and licensed CITY STORAGE FACILITY exclusive for hazardous waste which must be in accordance with the standard of R.A 6969;

- i. Providing assistance to the barangay in collecting its garbage when the barangay garbage truck is not functional and shall formulate policies and systems for this assistance;
- j. Collecting the garbage that would be generated in areas that do not belong to any of the 27 barangays;
- k. Collecting the garbage that would be generated by schools within the City Core such Saint Joseph Academy, Mandaue City Central School, Mandaue Comprehensive National High School & Saint Louis School of Mandaue;
- l. Facilitate the construction of structure intended for MRF;
- m. Ensuring residual waste collected and disposed must be more or less dry;
- n. Creating a maintenance system for all delivery and disposal equipment;
- o. Facilitating the compliance of the health protection program set by City Health Office; and
- p. Ensuring the synchronized plan for waste collection.

(3) Current Status on Final Disposal in Mandaue City

The City has closed the controlled dumpsite located at Barangay Umamad, Mandaue City. The operation of the dumpsite in accepting mixed wastes ended on September 2017. It will be rehabilitated based on the guidelines on safe closure and rehabilitation of open dumpsites.

Presently, the segregated wastes are collected by the barangay garbage truck from the households and are brought/disposed directly to Guun Plastic Recycling Facility. The City has a newly constructed MRF for composting facility manage/supervise by the City Agriculture Office. The presence of scavengers in the umamad controlled dumpsite were organized as were trained in series of livelihood programs initiated by the Department of General Services.

Another facility that the City has a partner or with a joint agreement with is the Asian Energy Sanitary Landfill, a private sanitary landfill operator in Barangay Polog, Consolacion Cebu. The said facility accepts the unaccepted wastes and or not be processed by Guun Plastic Recycling Facility.

As described in Chapter 4.1.1.1 (4), the Umamad Dumpsite, having an approximate 5 hectares area, is recommended to be developed as the “Mandaue City Dumpsite Ecopark”.

4.4.1.10 Power

Mandaue City.

Visayan Electric Company (VECO), a privately-owned electric distribution utility company. VECO is the franchise-holder to supply and distribute power to the cities of Cebu, Mandaue, Talisay and Naga as well as the municipalities of Consolacion, Liloan, Minglanilla and San Fernando.

Based on Mandaue City CLUP, the total number of electricity consumers in Mandaue City served by VECO is 57,037. About 50,372 are residential households or 88% of the total. The total electricity consumed by the consumers located in Mandaue City for a typical month is 52 million kilowatt hours (based on June 2013 data).

Lapu-Lapu City.

Based on Lapu-lapu City CLUP, power in Lapu-Lapu City is supplied by Mactan Electric Company (MECO). Presently, power situation in the City remain stable. MECO has a power distribution capacity of 200 MW. Power demand in the city has steadily increased in 2008 to 2011. MECO projected that by year 2024 power demand in the City would rapidly be on an increasing trend. Records given by MECO showed that as of 2011, 57,233 households out of 58,904 Hh had been energized. 3,687 commercial, 437 industrial establishments are also served.

Table 4.4.17 Electricity Consumers/Connections in Mandaue & Lapu-lapu Cities

Sector	Mandaue (2013)	Lapu-lapu (2011)
Residential	50,372 (88%)	57,233 (97%)
Commercial	6,169	3,687
Industrial	482	437

Source: Mandaue City CLUP and Lapu-lapu City CLUP

4.4.1.11 Water Supply

Mandaue City.

The supply and distribution of water in Mandaue City is primarily provided by the Metropolitan Cebu Water District (MCWD). In 2012 there were 22,875 concessionaires with 22,499 household concessionaires. As of 2012 the estimated number of households is 82,298. MCWD supplied a total of 19,428 cubic meters of water in 2012. There are five barangays having their own local waterworks system serving an estimated 3,686 concessionaires (excluding those supplied by MCWD) as shown in Table 4.4.18. There are nine barangays that have communal faucet type of water supply system. There is a total of 34 communal faucets serving 6,800 households. As shown in Table 4.4.19, there are 170 households having their water sources either a hand pump or electric motor-driven pumps. There are two barangays having dug well as a source of water supply. A total of 33,155 households (based on available data) in 2012 have access to water supply system of various types or approximately 40.3 % of the number of households in 2012.

Table 4.4.18 Barangay Waterworks/Cooperative Water Sources and Households Served in Mandaue

Location	No. of Pumps		Est. No. of HHs Served
	Private	Barangay	
Canduman	3	4	-----
Tabok		4	1,611
Tingub		1	180
Casuntingan		4	115
Labogon		1	110

Source: Mandaue CLUP

Table 4.4.19 Number of Communal Faucets and Household Served

Location of Water Sources	No. of Communal Faucets	Est. No. of HHs Served
Umapad	2	6,800
Casuntingan	1	
Paknaan	3	
Alang-alang	3	
Labogon	1	
Maguikay	1	
Opao	1	
Subangdaku	9	
Looc	13	
Total	34	

Source: Mandaue CLUP

Lapu-Lapu City.

Only two-thirds (2/3) of the populace rely on Metropolitan Cebu Water District (MCWD) piped water connection. About 3-4 percent of total household population availed of rationed supply and has owned wells aside from their MCWD connection. (Please see Table 4.4.20.) While mainland Lapu-Lapu City is served by the water district especially on households located not far from MCWD lines, residents in

island barangays buy water from the mainland thru private peddlers. Some residents also rely on rainwater by installing water catchments at their own houses.

Table 4.4.20 Source of Water Supply, LAPU-LAPU CITY

BARANGAY	NUMBER OF HOUSEHOLD POPULATION							
	METRO CEBU WATER DISTRICT		RATIONED WATER SUPPLY/WATER PEDDLERS		WELLS		RAINWATER	
	NO.	%	NO.	%	NO.	%	No.	%
Lapu-Lapu City	218,781	75.00%	11,668	4.00%	11,668	4.00%	11,668%	4.00%

SOURCE: City Planning and Development Office, 2011

4.4.1.12 Cultural, Historic, Archaeologic and Aesthetics Value/ Landscape

There are no cultural, historical nor archaeologic structures/sites within the area that could be affected by the project that are officially registered at the NCCA. The nearest is the ‘Bantayan sa Hari’ in Barangay Looc, Mandaue City, located approximately 200 meters from the proposed Coastal Road alignment. A picture of Bantayan sa Hari and Mandaue City’s seal are shown in Figure 4.4.9 with its location indicated in Figure 4.4.10.



Source: Peanut Browas (available at: <http://www.peanutbrowas.com/blog/watching-history-unfold-at-the-bantayan-sa-hari>)

Figure 4.4.9 Bantayan sa Hari (left) and Seal of Mandaue City (right)



Source: JICA Survey Team

Figure 4.4.10 Location of Bantayan sa Hari

4.4.1.13 Indigenous People

The result of the initial investigation/inquiry suggest that there are no Indigenous Peoples (IPs) in the area that will be affected by the project, given the following:

- The Project Affected Households socio-economic survey results indicated that no project-affected persons belong to any IPs (none checked the known IPs in the ethnicity list)
- Verbal inquiry with resource persons (HUDO, local officials, etc) noted the absence of IPs in the affected barangays
- A list of identified IPs and their locations indicated that there are no IPs in Mandaue and affected barangays.

(https://en.wikipedia.org/wiki/Indigenous_Peoples%27_Rights_Act_of_1997#cite_ref-:0_2-4)

4.4.2 PROJECT AFFECTED FAMILIES AND ESTABLISHMENTS

4.4.2.1 Project Affected Families/ Households in Mandaue City

(1) Total Household and Establishments Affected

The survey revealed that there were 42 land owners, two lessees (companies), 33 structure and other improvement (e.g. fences) owners and 69 households (i.e. 243 persons) affected by the project. A bulk of the people and companies affected are located in Mandaue City including all affected households. On the other hand, 10 land owners and 10 improvement owners are located in Lapu-Lapu City.

All individuals that have their dwelling affected are informal settlers, or people that are living in the project-affected area without legal rights. Except for one consisting of five people located in Barangay Looc, all households have 20% or more of their structure affected and hence are expected to be subject to relocation.

Table 4.4.21 Number of Project Affected Families/Households & Companies

Location/ Entities	Mandaue City						Lapu-Lapu City		Total
	NRA/ CSSEAZ ¹⁶	Centro	Looc	Opao	Umapad	Paknaan	Pusok	Ibo	
Lot Owners	9 (8)	1	9 (8)	11	4	1 (0)	7 (5)	5 (4)	47 (42)* ¹
Impr. Owners	5	7	8	2	1	-	9	1	33
Households	-	-	5 (23)	11 (59)	12 (33)	41 (128)	-	-	69 (243)* ²

*1 Number in brackets are that when excluding duplicates.

*2 Number in brackets are that of PAPs.

Source : JICA Survey Team

(2) Basic Information of the PAFs

1) Household Composition

a. Household size

Among the 69 total PAFs, 37 of them have a size of household that range from one to four members. 24 PAFs have a household size of five to seven members while two PAFs have a household size of 8-10 members. The PAFs' household sizes in the affected barangays are shown in Table 4.4.22.

Table 4.4.22 Size of Project-affected Households

Household Size (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
1-4	2	2	8	25	37	53.62
5-7	3	8	3	10	24	34.78
8-10	0	1	0	1	2	2.90
11-15	0	0	0	0	0	0
No Response	0	0	1	5	6	8.70
TOTAL	5	11	12	41	69	100

Source: JICA Survey Team

b. Number of Children

The number of children of the project-affected households in Barangays Looc, Opao, Umapad and Paknaan, Mandaue City is summarized in Table 4.4.23.

¹⁶ City Special South Economic Administrative Zone

Table 4.4.23 Number of Children in the Project-affected Households

Number of Children (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
None	1	0	4	6	11	15.94
1	2	2	4	12	20	28.99
2	0	0	0	6	6	8.70
3	0	4	0	6	10	15.50
4	1	4	0	2	7	10.14
5	1	1	2	1	5	7.25
6	0	0	0	0	0	0
7	0	0	0	0	0	0
8	0	0	0	0	0	0
9	0	0	0	1	1	1.45
10	0	0	0	0	0	0
No Response	0	0	2	7	9	13.04
TOTAL	5	11	12	41	69	100

Source : JICA Survey Team

2) Marital Status

Among the 69 PAFs in total, 41 or 60.89% are married while 20 or 28.99% are single. One or 1.45% is a widower and the rest of the PAFs did not answer. The project-affected households by marital status in Barangay Looc, Opao, Umapad and Paknaan, Mandaue City respectively are summarized in Table 4.4.24.

Table 4.4.24 Project-affected Household Heads by Marital Status

Marital Status (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Single	3	2	6	9	20	28.99
Married	2	9	4	26	41	60.89
Widower	0	0	0	1	1	1.45
No Response	0	0	2	5	7	10.14
TOTAL	5	11	12	41	69	100

Source: JICA Survey Team

3) Gender

Of the 69 total PAFs, a majority (69.57%) of the household heads are male while 17.69% are female. The project-affected households' gender in Barangay Looc, Opao, Umapad and Paknaan, Mandaue City respectively are summarized in Table 4.4.25.

Table 4.4.25 Project-affected Household Heads by Gender

Gender (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Male	4	10	7	27	48	69.57
Female	1	1	3	7	12	17.39
No Response	0	0	2	7	9	8.70
TOTAL	5	11	12	41	69	100.00

Source: JICA Survey Team

4) Age Structure

Age distribution of the project-affected household heads is summarized in Table 4.4.26. 56.62% or 39 household heads belong to an age group of 30 to 60 years old. Approximately 17.39% or 12 household heads are 18-30 years old while 10.14% of the PAFs' household heads were over 60 years old.

Table 4.4.26 Project-Affected Household Head by Age Structure

Age (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
<18	0	0	0	0	0	0.00
18-30	0	3	2	7	12	17.39
30-60	4	8	5	22	39	56.52
>60	1	0	2	4	7	10.14
TOTAL	5	11	12	41	69	100.00

Source : JICA Survey Team

5) Educational Attainment

Out of the 69 PAFs, 17 or 24.64% are high school graduates, 14 or 20.29% are high school undergraduate, 11 or 15.94% are elementary undergraduates, nine or 13.04% are college graduate, six are elementary graduate, three are college undergraduate, and two PAFs were vocational graduate or had no educational attainment. The educational attainments of the PAFs' household heads in the barangays are shown in Table 4.4.27.

Table 4.4.27 Project-affected Household Head by Educational Attainment

Educational Attainment (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
None	0	1	1	0	2	2.90
Elementary Undergraduate	1	1	3	6	11	15.94
Elementary Graduate	0	1	4	1	6	8.70
High School Undergraduate	1	5	3	5	14	20.29
High School Graduate	1	3	1	12	17	24.64
Vocational Undergraduate	0	0	0	0	0	0
Vocational Graduate	1	0	0	1	2	2.90
College Undergraduate	0	0	0	3	3	4.35
College Graduate	1	0	0	8	9	13.04
Post Graduate	0	0	0	0	0	0
No Response	0	0	0	5	5	7.25
TOTAL	5	11	12	41	69	100

Source: JICA Survey Team

6) Primary Source of Income

Of the 69 total PAFs, household heads' main source of income in the barangays are presented in Table 4.4.28. The occupation with the largest group of respondents were skilled (i.e. 23.19%) and unskilled labor (i.e. 14.49%).

Table 4.4.28 Main Occupation of Project-affected Household Heads

Occupation (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
None	0	1	1	0	2	2.90
Farmer/Crop	0	0	0	0	0	0
Farmer/Livestock	0	0	0	0	0	0
Cottage Industry (Broom making, Mat weaving, etc.)	0	0	0	0	0	0
Hired Farm Worker	0	1	0	0	1	1.45
Aquaculture	0	0	0	0	0	0
Fisherman	0	0	0	2	2	2.90
Driver/Habal-Habal, Trike	0	1	0	3	4	5.82
Driver/Taxi, Rent-A-Car, etc	0	0	0	1	1	1.45
Waste Picker (Landfill)	0	0	5	0	5	7.25
Waste Recycler	0	0	3	3	6	8.70
Skilled Labor	0	5	0	11	16	23.19
Unskilled Labor	2	1	2	5	10	14.49
Government Employee	2	0	0	3	5	7.25
Private Firm	0	2	0	2	4	5.80
Business Operator	0	0	0	0	0	0
Housekeeper	0	0	0	0	0	0
Hunter/Gatherer	0	0	0	0	0	0
Gleaning	0	0	0	0	0	0
OFW	0	0	0	0	0	0
Student	0	0	0	3	3	4.65
Others	0	0	0	0	0	0
No Response	1	0	1	8	10	14.49
TOTAL	5	11	12	41	69	100

Source: JICA Survey Team

7) Linguistic Characteristics

Out of the 69 total project-affected households, 45 belong to the Binisaya ethno-linguistic, while 18 of the interviewed speaks Cebuano. Table 4.4.29 shows the distribution of PAFs' linguistic characteristics.

Table 4.4.29 Distribution of Project-affected Household Heads by Linguistic Characteristics

Ethno-Linguistic Affiliation (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Binisaya	4	9	8	24	45	65.22
Cebuano	1	2	3	12	18	26.09
Boholano	0	0	0	0	0	0
Hiligaynon/Ilonggo	0	0	0	0	0	0
Tagalog	0	0	0	0	0	0
Waray-waray	0	0	0	0	0	0
Ilocano	0	0	0	0	0	0
Others	0	0	0	0	0	0
No Response	0	0	1	5	6	8.70
TOTAL	5	11	12	41	69	100

Source: JICA Survey Team

8) Ethnicity

Out of the 69 total project-affected households, 36 or 52.17% of them, belong to the Bisaya Group, while 33 of them did not respond. The high rate of non-response is presumably because they considered them not to be affiliated with any of the ethnic (i.e. indigenous) groups mentioned in the questionnaire and hence decided to just not answer. Table 4.4.30 shows the distribution of PAFs' ethnic group affiliation in the barangays.

Table 4.4.30 Distribution of Project-affected Households by Ethnicity

Ethnic Affiliations (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Igorot	0	0	0	0	0	0
Mangayn	0	0	0	0	0	0
Tausug/Maranao	0	0	0	0	0	0
Manobo	0	0	0	0	0	0
Subanon	0	0	0	0	0	0
Aeta	0	0	0	0	0	0
Badjao	0	0	0	0	0	0
Others (Bisaya)	4	4	8	20	36	52.17
No Response	1	7	4	21	33	47.83
TOTAL	5	11	12	41	69	100

Source: JICA Survey Team

(3) Access to Basic Social Services

1) Source of Drinking Water

A total number of 31 or 44.93% of the PAFs has a water source from piped water provided by the Metropolitan Cebu Water District (MCWD) and five or 7.25% of them from the piped water (other source). 14 households or 20.29% use dug well, nine or 13.04% buy bottled water and one household or 1.45% rely on a spring. None of them collects rainwater or use cart with small tank/drum. Three households use other sources. The source of water supply of the PAFs in Barangays Looc, Opao, Umapad, and Paknaan are summarized in Table 4.4.31.

Table 4.4.31 Source of Drinking Water of the Project-affected Households

Source of Drinking Water (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Piped Water (MCWD)	5	4	10	12	31	44.93
Piped Water (Other Source)	0	0	0	5	5	7.25
Dug Well	0	0	1	13	14	20.29
Spring	0	1	0	0	1	1.45
Rainwater Collection	0	0	0	0	0	0
Bottled Water	0	4	0	5	9	13.04
Cart with small tank/drum	0	0	0	0	0	0
Others	0	2	0	1	3	4.35
No Response	0	0	1	5	6	8.70
TOTAL	5	11	12	41	69	100

Source: JICA Survey Team

2) Sanitation Facilities

A majority of the PAFs utilized flush/pour flush to septic tank type of toilet. A total number of 26 or 37.68% utilized flush/pour flush to pit latrine has a total number of three or 4.35%, those who utilized

pit latrine has a total number of six or 8.70%, four or 5.80% use composting toilet, 12 or 17.39% uses the public/common toilet while nine or 13.04% has no facilities and the remaining three or 4.35% uses other types of toilet facility. Table 4.4.32 shows the type of sanitation facilities of the PAFs in the project affected area.

Table 4.4.32 Sanitation Facilities of the Project-affected Households

Sanitation Facilities (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Flush/Pour Flush to Septic Tank	5	1	0	20	26	37.68
Flush/Pour Flush to Pit Latrine	0	3	0	0	3	4.35
Ventilated Improved Pit Latrine	0	0	0	0	0	0
Pit Latrine	0	6	0	0	6	8.70
Composting Toilet	0	0	0	4	4	5.80
Bucket	0	0	0	0	0	0
Public/Common Toilet	0	1	3	8	12	17.39
No facilities or elsewhere	0	0	7	2	9	13.04
Others	0	0	1	2	3	4.35
No Response	0	0	1	5	6	8.70
TOTAL	5	11	12	41	69	100

Source: JICA Survey Team

3) Electricity

Of the 69 PAFs, seven or 10.14% PAFs were affected uses kerosene, 14 or 20.29% have access to electricity, 37 or 53.62% PAFs utilized other lighting facilities such as solar. Table 4.4.33 summarizes the PAFs lighting facilities of barangays Looc, Opao, Umapad and Paknaan in Mandaue City.

Table 4.4.33 Lighting Facilities used by the Project-affected Households

Lighting Facilities (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Kerosene	0	0	4	3	7	10.14
Coleman	0	0	0	0	0	0
Oil	0	0	0	0	0	0
VECO	5	0	0	9	14	20.29
Own Generator	0	0	0	0	0	0
Others	0	11	7	19	37	53.62
No Response	0	0	1	10	11	15.94
TOTAL	5	11	12	41	69	100

Source: JICA Survey Team

4) Cooking Facilities

The sources of cooking fuels utilized by the PAFs are wood, LPG, kerosene, electricity and butane. 21 PAFs utilized wood, followed by 18 of them that utilized LPG. 13 households used butane and seven relied on charcoal. Three households used electricity and two PAFs utilized other cooking facilities. Table 4.4.34 shows the PAFs cooking facilities in Barangays Looc, Opao, Umapad, and Paknaan, Mandaue City.

Table 4.4.34 Cooking Facilities used by the Project-affected Households

Cooking Facilities (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Wood	0	2	7	12	21	30.43
Charcoal	0	0	0	0	0	0
LPG	0	5	0	13	18	26.09
Kerosene	0	1	0	1	2	2.90
Electricity	0	0	3	0	3	4.35
Butane	5	2	1	5	13	18.84
Others	0	0	0	2	2	2.90
No Response	0	1	1	8	10	14.49
TOTAL	5	11	12	41	69	100

Source: JICA Survey Team

(4) Household Income

A total of 21 or 30.43% of PAFs has a monthly income range of PhP 1,001-5,000 while 13 or 18.84% is on the range of PhP 5,001-10,000. 12 or 17.37% of PAFs have an income range of PhP 10,001-15,000, and four or 5.80% has a monthly income range of less than PhP 1,000. Three or 4.35% has PhP 30,001-50,000 and two households have an income range of PhP 15,001-20,000. As explained later, 38 households fall under the poverty threshold of PhP 10,481 per month set by NEDA. The monthly household income range of the PAFs in Barangay Looc, Opao, Umapad, and Paknaan, Mandaue City is summarized in Table 4.4.35.

Table 4.4.35 Monthly Household Income Range of the Project-affected Households

Monthly Household Income Range (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Below 1,000	0	0	1	3	4	5.80
1,001-5,000	2	3	7	9	21	30.43
5,001-10,000	1	0	2	10	13	18.84
10,001-15,000	2	3	0	7	12	17.37
15,001-20,000	0	1	0	1	2	2.90
20,001-30,000	0	2	0	0	2	2.90
30,001-50,000	0	1	0	2	3	4.35
Above 50,000	0	0	0	0	0	0
No Response	0	1	2	9	12	17.37
TOTAL	5	11	12	41	69	100

Source : JICA Survey Team

4.4.2.2 Project-affected Companies

While there are some companies that have their structures “severely affected” (as defined under LARRIPP), those companies that have their main building affected are considered to be limited to two companies both located in Lapu-Lapu City and possibly one more company located in Mandaue City¹⁷.

¹⁷ It is considered under this F/S that this company will not need to be dislocated given that there is enough space within their own property for necessary adjustments to be made, if any.

Table 4.4.36 exhibits the profile of the affected companies. It should be noted that some companies have not responded to the survey questionnaires and hence the table is not a complete list of all affected companies.

Table 4.4.36 Profile of the Project-affected Companies

Name of Companies	Type of Business	Main or Branch Office	Year Established	Years in Operation	Monthly Net Income	No. of Workers	Revenue
San Miguel Foods Incorporation	Warehouse, Manufacturing, Dry Goods & Feeds	Main	2016	Not yet operating	10,100,000 -20,000,000	221	No response (NR)
FMC-Dupont	Manufacturing	Main	1978	41	8,000,000	120	2,618,289,000
Tin Guan Trading Corp	Trading	Branch	NR	NR	NR	NR	NR
Petron Corp	Fuel, Terminal Depot	NR	NR	NR	5,100,000 - 10,000,000	NR	NR
Arctura Corp	Fuel, Terminal Depot	NR	2005	14	4,000,000	40	NR
Athecor Development Corp	Real Estate Devt	NR			NR	6	NR
General Milling Corp	Manufacturing, Leasing	NR	1961	58	NR	NR	NR
PJ's Videoke & BBQ	BBQ/Renting Space	NR	1999	20	30,000	2	NR
Muramoto Audio-Visuals Phils., Inc - Factory 1*	Manufacturing	Branch	1991	28	18,995,430	1,043	5,574,388,620
San Miguel Shipping & Lighterage Corp*	Warehousing, Transport/ Trucking	Main	1974	45	NR	312	NR
Petronas Marketing Group	LPG Distribution	NR	1997	22	NR	26	NR
BBQ House	Others (BBQ)	NR	NR	NR	NR	NR	NR
Miljun Bakeshop/ Key & Remote Duplicate	Bakeshop/ Renting space	NR	NR	NR	NR	NR	NR
Josh Internet Café	Internet Café/ Renting space	NR	NR	NR	NR	NR	NR

*Supplementary information was collected from their respective websites for these companies.

Source: JICA Survey Team

4.4.3 IMPACTS IDENTIFICATION AND ASSESSMENT

4.4.3.1 Displacement of Settlers and Properties

(1) Project Affected Families and Establishments

As indicated in Section 4.4.2.1(1) of this report, there will “42 land owners, two lessees (companies), 33 structure and other improvement (e.g. fences) owners and 69 households (i.e. 243 persons) affected by the project... [all] individuals that have their dwelling affected are informal settlers, or people that are living in the project-affected area without legal rights, except for one consisting of five people located in Barangay Looc, all households have 20% or more of their structure affected and hence are expected to be subject to relocation.”

(2) Impacts on Structures, Other Improvements and Trees

1) Project Affected Structures

a. Type of Structure

The PAHs affected housing/dwelling structures are predominantly shanties and wooden structures. In fact, this type of structures comprise of approximately 70% of the total number of structures affected. The type of materials used in the project affected Structures in Barangay Looc, Opao, Umapad and Paknaan, Mandaue City are summarized in Table 4.4.37.

Table 4.4.37 Type of Materials used in Project-affected Structures

Type of Structure Materials (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Shanty/Light-Nipa/Cogon/Bamboo	1	1	10	12	24	34.78
Predominantly Wooden	1	6	2	16	25	36.23
Semi-Permanent (Concrete and Wood)	3	4	0	8	15	21.74
Permanent (Concrete)	0	0	0	4	4	5.80
Others	0	0	0	0	0	0
No Response	0	0	0	1	1	1.45
TOTAL	5	11	12	41	69	100

Source : JICA Survey Team

b. Number of Storeys

The number of storeys of the buildings affected by the project in Barangays Looc, Opao, Umapad and Paknaan, Mandaue City are summarized in Table 4.4.38.

Table 4.4.38 Number of Stories of Project-affected Buildings

Number of Storeys (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
1-storey/flat	3	9	10	27	49	71.01
2-storeys	2	2	0	13	17	24.64
3-storeys	0	0	0	1	1	1.45
4-storeys	0	0	0	0	0	0
more storeys	0	0	0	0	0	0
No Response	0	0	2	0	2	2.90
TOTAL	5	11	12	41	69	100

Source : JICA Survey Team

2) Project-affected Crops and Trees

The type of trees and cultivated crops of the project-affected households in the Barangays Looc, Opao, Umapad and Paknaan, Mandaue City are summarized in Table 4.4.39.

Table 4.4.39 Type of Cultivated Crops and Trees in Project-affected Households

Types of Trees and Cultivated Crops (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Gmelina	0	0	0	1	1	1.41
Mahogany	0	0	0	0	0	0.00
Acacia	0	0	0	0	0	0.00
Talisay	0	4	1	5	10	14.08
Mango	0	0	0	4	4	5.63
Nangka	0	0	0	3	3	4.23
Caimito	0	0	0	0	0	0.00
Coconut	0	2	0	5	7	9.86
Banana	0	0	0	13	13	18.31
Papaya	0	2	0	10	12	16.90
Camanchiles	0	0	0	0	0	0.00
Boongon	0	0	0	0	0	0.00
Tomato	0	0	0	0	0	0.00
Leafy Legumes	0	3	0	2	5	7.04
Bil-at	0	1	0	0	1	1.41
Malunggay	0	2	2	2	6	8.45
San Francisco	0	1	0	0	1	1.41
Agbate	0	1	0	0	1	1.41
Tangad	0	1	0	0	1	1.41
Guava	0	0	0	0	0	0.00
Mangroves	0	0	2	0	2	2.82
Tambis	0	0	0	2	2	2.82
Others	0	0	0	2	2	2.82
TOTAL	0	17	5	50	71	100.00

Source : JICA Survey Team

(3) Project-affected Improvements

Other improvements on the land affected by the project in the Barangays Looc, Opao, Umapad and Paknaan, Mandaue City are summarized in Table 4.4.40.

Table 4.4.40 Project-affected Improvements

Other Improvements (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Fence	1	5	0	6	12	38.71
Pathway	0	4	0	1	5	16.13
Waiting Shed	0	0	0	0	0	0.00
Pigpen	0	0	0	2	2	6.45
Poultry	0	1	0	2	3	9.68
Storage Shed	0	0	0	0	0	0.00
Garage	0	0	0	0	0	0.00
Sari-sari store	0	1	0	2	3	9.68
Dog House	0	0	0	2	2	6.45
Compost	0	0	0	0	0	0.00
Materials Recovery Facility	0	1	0	1	2	6.45
Outside CR	0	1	0	0	1	3.23
Others	0	0	0	1	1	3.23
TOTAL	1	13	0	17	31	100.00

Source : JICA Survey Team

(4) Perception of the PAPs

1) Project Awareness

Among the 69 household heads, 60 or 86.96% of them are aware of the project, while only two or 2.90% PAFs, have no knowledge about the project. The project awareness of project affected household heads is summarized in **Table 4.4.41**.

Table 4.4.41 Project Awareness

Project Awareness	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Yes	5	11	11	33	60	86.96
No	0	0	0	2	2	2.90
No Response	0	0	1	6	7	10.14
TOTAL	5	11	12	41	69	

Source : JICA Survey Team

2) Source of Information on the Project

The source of information collected on the project in the Barangays Looc, Opao, Umapad and Paknaan, Mandaue City are summarized in **Table 4.4.42**. It has been revealed from the survey that most of the PAPs have heard about the project from either the government officials (i.e. 33.33%) or from neighbors and friends (i.e. 31.88%).

Table 4.4.42 Source of Information on the Project

Source of Information (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Government Officials	4	4	2	13	23	33.33
Flyers Handed Out	0	0	0	0	0	0
Neighbors/Friends	1	3	5	13	22	31.88
Posters in the Barangay Hall	0	0	0	0	0	0
Relatives	0	0	0	0	0	0

Radio	0	0	1	1	2	2.90
TV	0	0	2	5	7	10.14
NGOs	0	0	0	0	0	0
Newspaper	0	0	0	0	0	0
Public Meetings/Consultations	0	3	1	0	4	5.80
Enumerators/During Survey	0	1	0	3	1	1.45
Others	0	0	0	0	0	0
No Response	0	0	1	6	7	10.14
TOTAL	5	11	12	41	69	100

Source : JICA Survey Team

3) Attitude towards the Project

Of the 69 household, 58 or 84.06% of them are in favor of the project while one household or 1.45% was not in favor of the project. The PAFs stand on the project affected household heads is summarized in **Table 4.4.43**.

Table 4.4.43 PAFs' Attitude towards the Project

Attitude towards the Project (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Favorable	5	9	11	33	58	84.06
Unfavorable	0	0	0	1	1	1.45
Not Decided	0	1	0	0	1	1.45
No Comment	0	1	0	1	2	2.90
No Response	0	0	1	6	7	10.15
TOTAL	5	11	12	41	69	100

Source : JICA Survey Team

4) Preference of PAFs for Livelihood Restoration Programs

Preferences of the PAFs for livelihood restoration programs in Barangay Looc, Opao, Umapad and Paknaan, Mandaue City are summarized in **Table 4.4.44**.

Table 4.4.44 PAFs' Preference for Livelihood Restoration Programs

Preference of PAFs for Livelihood Restoration Programs (Number and Percentage Share)	Barangay				TOTAL	%
	Looc	Opao	Umapad	Paknaan		
Compensation	2	2	5	18	27	39.12
Vocational Training	0	0	0	0	0	0.00
Employment	0	3	1	3	7	10.14
Granting of Credit	0	0	0	0	0	0.00
Relocation	0	4	4	4	12	17.39
Others	0	0	0	0	0	0.00
No Response	3	2	2	16	23	23.33
TOTAL	5	11	12	41	69	100.00

Source : JICA Survey Team

5) Preference of PAFs for Compensation and Relocation

An additional survey was conducted in July, 2019 to confirm the PAFs' preference between being compensated in cash or being allowed to move into a resettlement site for replacement of loss of housing/abode. Among those that responded, 79% were in favor of the option of resettlement housing. Those that chose this option all preferred residential subdivision/house and lot package as opposed to

the condominium building units. Their preference for the location of the housing package was within five km radius from their existing residence. The table below shows the result of the questionnaire.

Table 4.4.45 PAFs Preference for Compensation/Replacement of Loss

Description	Looc	Opao	Umapad	Paknaan	TOTAL
Public Consultations/Meetings Attended on:					
-March 6		4			4
-April 12		10	1		11
-June 4		8	2	1	11
-None	3		1	25	29
Choice of Compensation/Replacement type to transfer residence					
Cash Compensation	1	2	2	4	9
Resettlement Housing	4	9	1	20	34
Choice of Type of Resettlement/Housing:					
Residential Subdivision/House and Lot	4	9	1	20	34
Low-Cost Condominium Unit/Medium Rise					
Amenable to either options Subdivision and Condominium					
Maximum Acceptable Distance of the Resettlement Site:					
Residential Subdivision/House and Lot:					
-Within 5km	3	1	1	20	25
-5-10 km	1	6			7
-10-15 km					
-15-30 km					
-Above 30 km					
Low-Cost Condominium Unit/Medium Rise Building					
-Within 5km		2			2
-5-10 km					
-10-15 km					
-15-30 km					
-Above 30 km					
Ranges of Monthly Amortization Fee acceptable or willing to Pay (PhP)					
-Below 500	4	9	1	13	27
-500-1000				7	7
-1001-5000					
-5001-10,000					
-Above 10,000					
-Undecided				7	7

Source : JICA Survey Team

4.4.3.2 Impacts to Households belonging to Vulnerable Groups

The vulnerable groups have been defined in this survey to be the following groups of people: poor people whose combined income falls within the poverty threshold set by NEDA except for professional squatters and members of the squatting syndicates; female-headed households; elderly people; and persons with Disabilities (PWD).

The Philippine Statistics Authority (PSA) reported that the poverty threshold per family per month rose by 10.9% in the Philippines to PhP 10,481 in 2018 from PhP 9,453 in 2015. The PSA explained that this is the level of income needed to meet both basic food and nonfood needs of a family of five in one month¹⁸. Based on the results of the survey, the number of households that fall under these categories are as follows:

Table 4.4.46 Number of Project-affected Households considered Vulnerable

Type of Vulnerability	Number of PAFs
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¹⁸ <https://businessmirror.com.ph/2019/04/11/poverty-rate-down-to-21-on-higher-income-neda/>

Poor	38
Female-headed	12
Elderly	7
PWDs	0

Source: JICA Survey Team

4.4.3.3 Right of Way Conflict

(1) Local Institutions and Decision Making

There are several stakeholders of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road Project including LGUs, Barangay, and Fisheres group, etc... Table 4.4.47 shows the stakeholders of the project. According to DAO 30-03 and JICA ESC Guideline, the project implementation must be coordinated with these stakeholders and reflect the comments and requests from the stakeholders to the project plan. Therefore, the project will not affect decision making of these stakeholders.

Table 4.4.47 List of Stakeholders of the Project

Tyep	Name of Organizations, Institute
Central Government	NEDA
LGUs	Mandaue City, Lapu-Lapu City, Consolacion City
	City Environment & Natural Resources Office (CENTRO)
	Metro Cebu Development and Coordinating Board (MCDCB)
	Regional Development Council-Economic Development Committee (RDC-EDC)
Other Public Authority	Cebu Port Authority (CPA)
	Coastal Guard
Local Community	Barangay Umapad, Paknaan, Pusok, Opao
FGDs	

Source : JICA Survey Team

(2) Misdistribution of benefits and damages/ Local conflicts of interest

1) Accessibility/Hindrance to Port/Docking Facilities and Operations

Offshore viaducts of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road may limit accessibility and hindrance to port/docking facilities along the Mactan Channel, particularly that of Ting Guan; Oil Depot/Terminal facilities of Petron, Arctura, and Total; and Shipyards of VM Cabahug.

The owners of these port/docking facilities requested that the Viaduct design shall consider a higher elevation (minimum of 40 meters high) to allow docking/manuevering of vessels.

The oil depot/fuel terminal operators also raised the risks/dangers of the Viaduct it poses to the highly inflammable and potentially explosive depot.

2) Fishery

As described in 4.4.1.4 (2), the major fishing grounds of fisher folks are relatively far from the bridge construction site. It is thus estimated that, during construction, the fisher folks would mainly use those fishing grounds if they remain accessible. On the other hand, as raised by fisher folks at the focus group discussion (see 2.3.5 (2)), construction work of bridge piers may limit the accessibility of fisher folks to their main fishing grounds by blocking the channel. (i.e. Cansaga bay area for Mandaue fisher folks and north east part of Mactan Island for Lapu-Lapu fisher folks). Hence, measures to secure the accessibility to the fishing grounds and the safety are necessary.

Deterioration of water quality, which may affect fish catch negatively, will be limited because no large-scale excavation or backfilling is planned. Possibility of water quality deterioration remains when foundation construction and pile driving are carried out. Therefore, mitigation measures to minimize the adverse impact on water quality shall be taken.

From the perspective of the impact on their income, as was confirmed in the focus group discussions and the information provided by the concerned LGUs, fishery is not a major income source, and the fish caught is mostly self-consumed and in some cases sold to neighbors, but not in public markets. It is thus considered that, even if there will be remaining minor impact despite of mitigation measures for accessibility/safety and water quality, no mitigation measure or compensation is required for the loss of income from fishery.

As mentioned in 4.4.1.4(2), there is an operational aquaculture farm in Barangay Umapad that is located within the ROW of the project. This aquaculture farm will be physically affected by the construction of viaduct. Hence, appropriate compensation shall be provided. The location of the aquaculture pond is shown in Figure 4.4.11.

3) Broom-Making

As described in 4.4.1.4(3), since there are no soaking activities within the ROW of the 4th Cebu-Mactan Bridge and the Mandaue Coastal Road, in general, the project will not affect the broom-making industry—particularly, the soaking area. However, construction works may prevent or limit inflow of seawater to the mangrove/fishpond area located at the south of the alignment, which will affect the soaking area. Furthermore, during construction, there will be a need for access of construction vehicles and equipment to the project site and the need for staging areas near or within the vicinity of the soaking areas.

On the other hand, operations of the 4th Cebu-Mactan Bridge may bring positive benefits through creation of opportunities of bringing clients/markets, in particular tourists, to the community.

4) Other Project-affected Improvements

The project will entail relocation of a jetty that belongs to a private company (i.e. Petron) and is used to transport oils from the ships to the oil tanks. In addition, a wharf that is located in Lapu-Lapu City is considered to be partially affected by the project and hence planned to be extended using the fund for the project. The location of these affected facilities are shown in Figure 4.4.11.

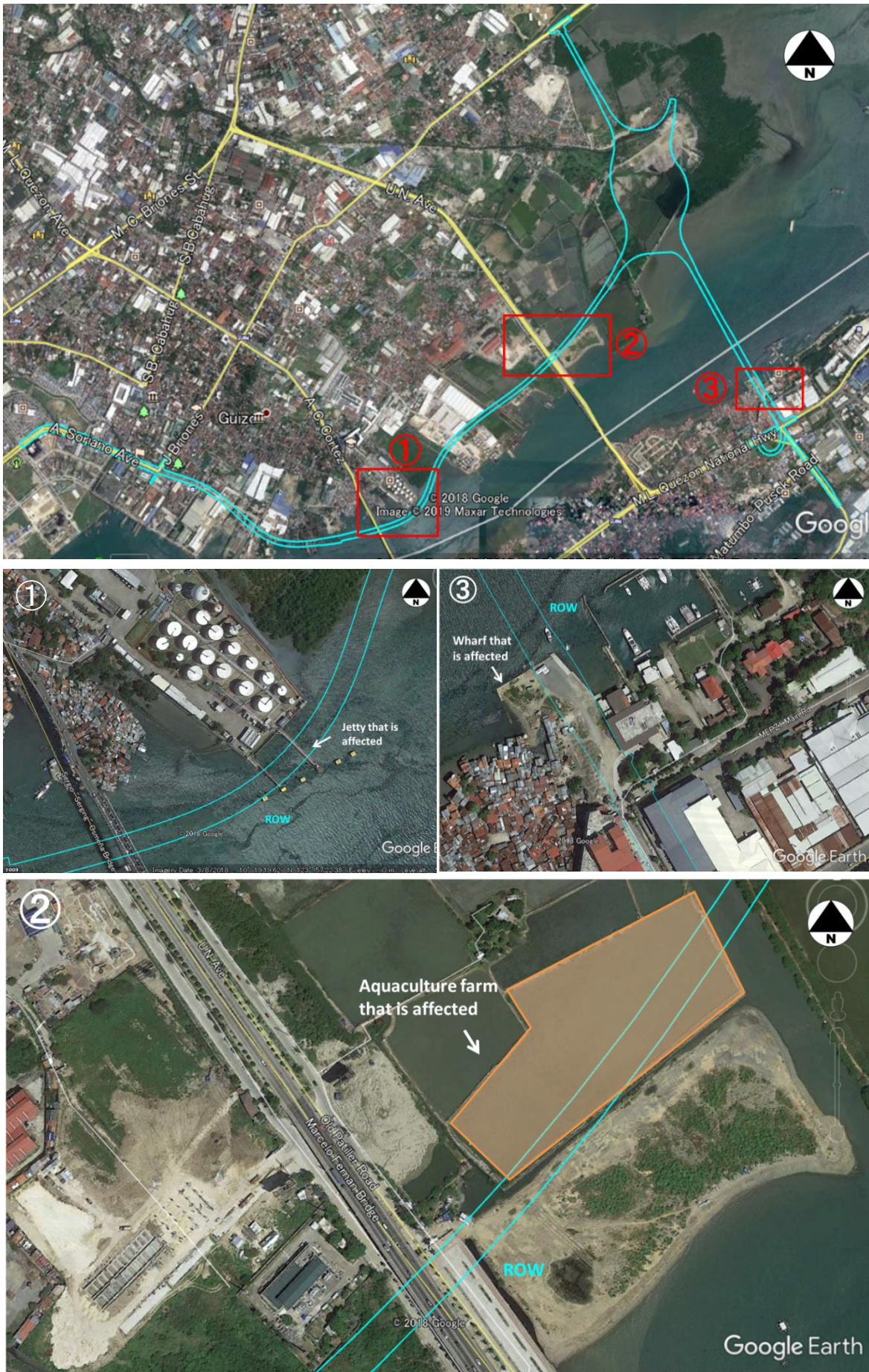


Figure 4.4.11 Location of Project-affected Jetty, Wharf and Aquaculture Farm

5) Other Projects

GlobalCity Mandaue Corporation and City Government of Mandaue (Joint Venture) plan to conduct “Mandaue Reclamation Project”. In addition, City Government of Mandaue also plan to redevelop Umapad landfill site as “Eco Park”. The alignment of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road will pass the site of these projects. It is thus necessary for the proponent to continue consultation with City Government of Mandaue, especially during the Detailed Engineering Design to avoid negative impact to surrounding area.

In addition, illegal reclamation ongoing in the Barangay Paknaan overlap the alignment of 4th Cebu-Mactan Bridge-Mandaue Coastal Road. This problem shall be resolved before the construction works of the project starts in a legal manner.

(3) Hazardous Facilities

As shown in 4.1.1.1(1), the alignment of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road will pass an industrial area, where hazardous facilities of private companies such as petrochemical factories and oil tanks of are located. If the clearance between these facilities and the coastal road is unsatisfactory and any physical barrier is not installed along the road, there may be a risk of casting flammable items into these hazardous facilities. Hence, appropriate mitigation measures are necessary to be taken.

4.4.3.4 In-migration, Proliferation of Informal Settlers

All PAPs are informal settlers, or people that are living in the project-affected area without legal rights. Based on Resettlement Plan (RAP), these PAPs will compensate accordingly, but there is a possibility that new informal settler will in-migrate to the project area after the construction and operation of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road, especially bottom of the elevated structures.

Construction workers and staff will require temporary housing in the vicinity of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road project. To the extent possible, local labor will be hired to minimize the need to provide housing for the construction crew.

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road – as it provides convenient access for people working in the Metro Cebu Cities to, and the northern part of the province, will influence the opening or enhancement of housing development in these areas.

4.4.3.5 Cultural, Historic, Archaeologic and Aesthetics Value/ Landscape

(1) Cultural, Historic, Archaeologic and Aesthetics Value

In accordance with the DPWH Department Order No. 12, Series of 2019 titled ‘Strict Preservation and Conservation of National Cultural Heritage’, the proponent together with the Study Team had a consultation/coordination meeting with the National Commission for Culture and Arts (NCCA) on May 22, 2019, where the project brief was presented. At the meeting, the NCCA indicated that in principle they have no objections with the project as the ROW/Alignment will not directly nor has significant impact on nearby identified historical/heritage sites/structures. The clearance for the project, or the Certification for Non-Coverage of National Cultural Treasure (NCT)/ Important Cultural Property (ICP) was issued on July 9, 2019 by the NCCA.

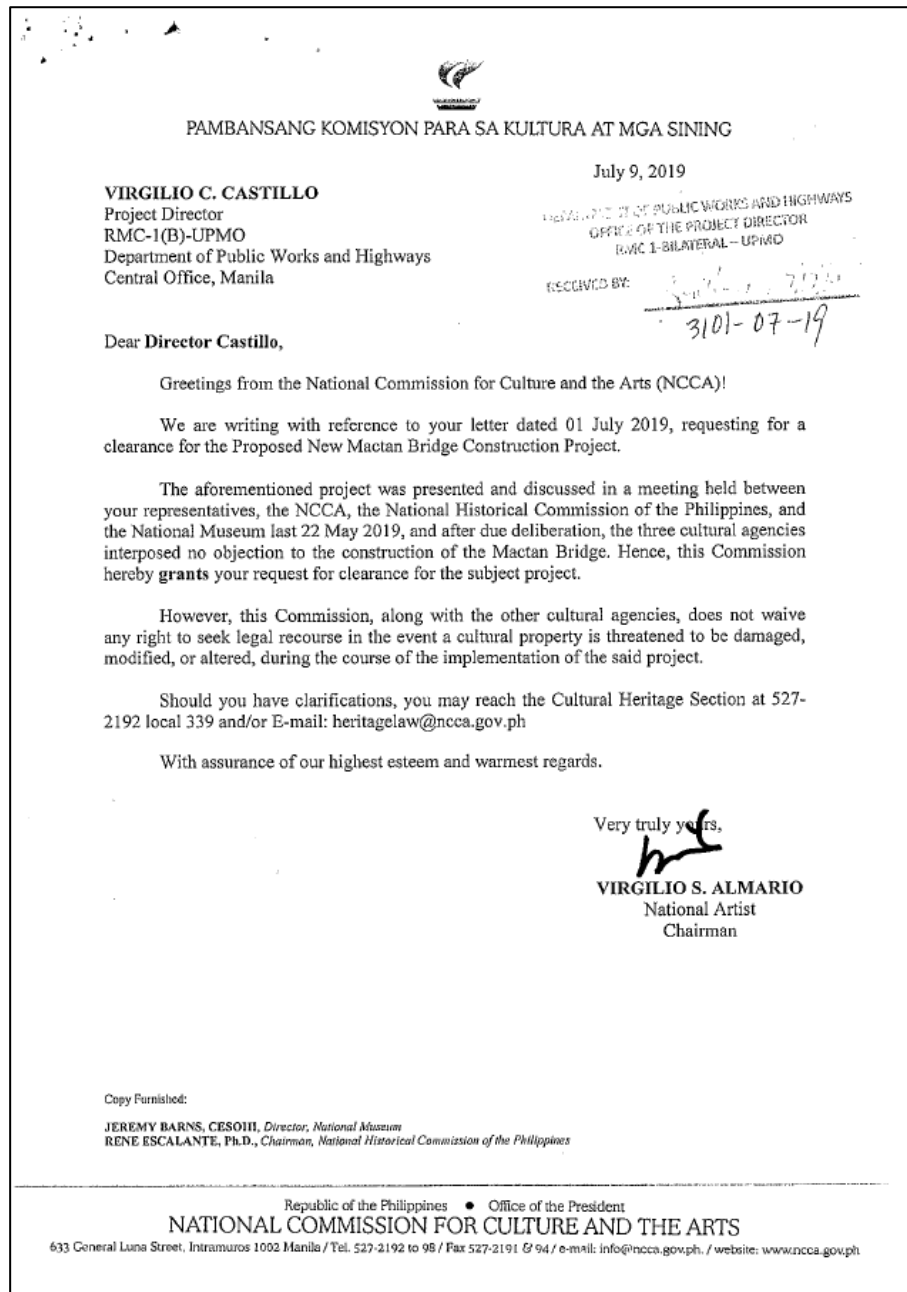


Figure 4.4.12 Certification for Non-Coverage of National Cultural Treasure/ Important Cultural Property issued by National Commission for Culture and the Arts

(2) Landscape

No serious impact on local landscape is expected because there is no legally-designated landscape to be protected around the project site. However, construction of a bridge and viaduct will change the landscape, which may be considered by some as a negative impact.

4.4.3.6 Occupational health hazards and threat to Public Health

The 4th Cebu-Mactan Bridge-Mandaue Coastal Road Project activities, if not carried out in a careful and safe manner, could result in risks to the public or workers. All forms of illness will have a probability of occurring among the workers and staff of the project, and might spread to the public. These will contribute to the increase in the morbidity rates of the barangay and the City.

The Project will comply with all requirements of the Occupational Health and Safety standards, thus the impacts on Public Health and Safety will not be significant from the perspective of worker safety and occupational exposure.

The proponent shall require the contractor to provide its own medical services to meet first-aid and emergency cases prior to referral to the advance medical facilities. The contractor shall ensure worker's safety.

4.4.3.7 Generation of Local Benefits from the Project

(1) Enhance the Employment/Livelihood Condition

The project's requirement for skilled and unskilled construction workers will cause generation of local employment. The salaries and wages of these local hires could circulate in the area and contribute to the consumption of local goods and services.

(2) Improve the transportation network

Overall, the Project will have a long term positive environmental effect as it will improve the provinces transportation network. It will help new area development and create new job opportunities.

4.4.3.8 Threat to Delivery of Basic Social Services/Resource Competition

(1) Power Consumption

During construction stage, there will be demand for power for utilization in the construction works (e.g. operation of the equipments, lighting etc). In addition, during the operations stage there will be demand for power for roadside lighting.

(2) Water Usage

During construction stage, there will be demand for water supply for utilization in the construction works (e.g. concrete mixing, etc). However, during the operations stage there will be very minimal usage of water.

4.4.3.9 Transportation Impacts/Generate the Traffic Disruption and Congestion

During the construction phase of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road , the following locations will result in temporary traffic disruptions or disturbances-especially works undertaken on existing routes that is within the 4th Cebu-Mactan Bridge-Mandaue Coastal Road alignment (both at grade and terrestrial viaduct).

- The beginning 1 km-long section of Mandaue Coastal Road where the widening of the existing road (Mandaue Causeway) from the corner of Bai Hotel up to the corner of Mandaue City Hospital is required;
- At-Grade Intersection of 4th Cebu-Mactan Bridge and Mandaue Causeway;
- Intersections of Lapu-Lapu Interchange; and
- Other intersecting roads crossings

During Operation, the long term environmental effects of the Project will be positive with an improved transportation network and an increase in public safety.

Environmental effects on Transportation resulting from the maintenance phases of the Project 4th Cebu-Mactan Bridge-Mandaue Coastal Road are anticipated to be localized, short term, and minimal in number. Construction and Maintenance activities may result in temporary traffic disruptions or disturbances. Where possible, these disruptions will be minimized and timed to avoid both daily and seasonal peak traffic periods.



Corner of Mandaue Causeway in front of Mandaue City Hospital



Intersections of Lapu-Lapu Interchange

Source: JICA Survey Team

Figure 4.4.13 Situations of Generate the Traffic Disruption and Congestion

4.4.3.10 Indigenous People

Following the request from the proponent/Survey Team, the National Commission on Indigenous Peoples (NCIP), Cebu Provincial Office issued, on July 29, 2019, a Certificate of Non-Overlap proving that the alignment of the proposed bridge and road and its vicinities has no presence of IPs living within the area, or does not overlap with any ancestral domain area of any Indigenous Cultural Communities or Indigenous Peoples (ICCs/IPs) as shown in Figure 4.4.14.

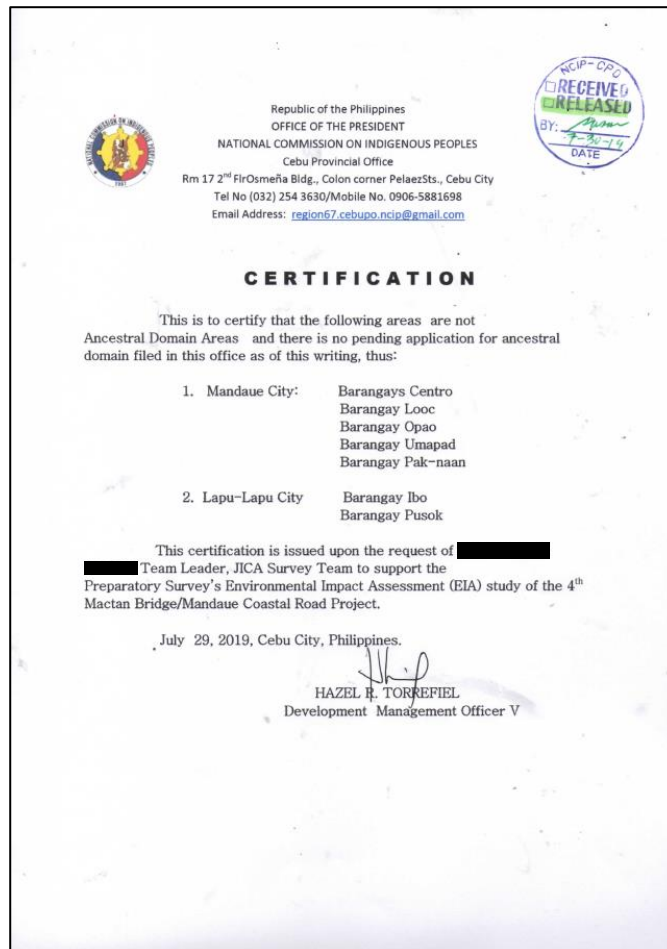


Figure 4.4.14 Certificate of Non-overlap issued by the National Commission on Indigenous Peoples, Cebu Provincial Office

4.4.3.11 Gender and Children's rights

Two (2) sessions of focus group discussions with women's associations were carried out, and their opinions, concerns, and recommendations in relation to the project were directly collected (see 2.3.5). Women constituted at least 30% of the total participants at every public consultations and focus group discussions held, and not a few female participants spoke out at the question and answer sessions (see 2.3.3, 2.3.4, and 2.3.5). Furthermore, twelve (12) female household heads out of 69 were identified and answered to the perception survey.

Based on the information collected through the aforementioned activities, there were no perceived impacts related to gender inequality or children's right abuse including the employment of children below 15 years old. It is thus important for the project proponents to follow acts and regulations on gender and human rights in order to prevent future problems in these aspects. Relevant acts and regulations are shown in Table 4.4.48.

Table 4.4.48 List of Laws and Regulation on Gender and Human Rights

Title	Contents
The Philippine Constitution of 1987	<ul style="list-style-type: none"> Article II recognizes the role that women play in the construction of the state, and claim the guarantee of gender equality based on the law.
Republic Act 9710 and Implementing Rules and Regulations (series of 2010) known as the “Magna Carta of Women”	<ul style="list-style-type: none"> The rights of women are defined as follows: gender equality in front of the law; protection from any violence; participation and representation; equal education opportunities and eradication of discrimination; scholarships and training; equal rights with marriage and family relations; comprehensive health services and information/education; and nondiscrimination in employment
Executive Order No.153 (2002)	<ul style="list-style-type: none"> It aims at curbing professional squatter activity and enhancing national momentum towards eradicating syndicates.
National Commission on Indigenous Peoples (NCIP) Administrative Order No. 1, Series of 2006	<ul style="list-style-type: none"> It stipulates the procedures for establishing Free, Prior and Informed Consent (FPIC) with affected communities
A Tool Kit for Making Road Infrastructure Projects Gender Responsive	<ul style="list-style-type: none"> It serves as a guideline showing the procedures that aim to carry out activities that contribute to gender mainstreaming at all stages of road improvement projects.
Republic Act 9231 known as Anti Child Labor Law	<ul style="list-style-type: none"> Specifically limits the employment of children below 15 years old, restricts the hours of work of working children, and expands working children's access to education, social, medical and legal assistance.
Republic Act 7658 known as the "Special Protection of Children Against Child Abuse, Exploitation and Discrimination Act"	<ul style="list-style-type: none"> An act prohibiting the employment of Children below 15 years of age in public and private undertakings.

Source : JICA Survey Team

4.4.4 IMPACT MITIGATION AND ENHANCEMENT

4.4.4.1 Project Affected Families and Establishments

(1) Compensation and Assistance

To mitigate the impacts to Project Affected Families and Establishments, the “Resettlement Action Plan” was presented the compensation and assistances need to be provided under the project to the PAPs. It is designed to enhance or at least restore the livelihoods of all PAPs in real terms relative to pre-project levels and to improve the living standards of the displaced poor and other people that are considered vulnerable. It should be noted that all compensation and support will be provided to the PAPs prior to resettlement. The following entitlement matrix exhibits the compensation and assistance package available to the PAPs:

Table 4.4.49 Entitlement Matrix

Type of Loss	Entitled Person	Compensation/Entitlements	Responsible Organization
Land (Classified as Agricultural, Residential, Commercial, or Institutional)	<ul style="list-style-type: none"> PAPs with Original Certificate of Title (OCT), Transfer Certificate of Title (TCT), emancipation patents (EP), or Certificates of Land Ownership Award (CLOA) granted under Comprehensive Agrarian Reform Act PAPs who are not original patent holders of lands granted through CA 141 (i.e. those who have bought the patent for land previously granted through CA 141 and where any previous acquisition is not through gratuitous title (e.g. donation or succession) For untitled land, PAPs with a) Tax Declaration showing 30 or more years of continuous possession; b) DENR certification showing that land is alienable and disposable; and c) other documents that show 	<ul style="list-style-type: none"> [Severely Affected] Cash compensation for the loss of entire land based on the current market value free of taxes including capital gain tax (CGT), documentary stamps tax (DST), transfer tax and registration fees AND Transaction costs (e.g. administrative charges and registration or title fees) *Payment of Real Property Tax (RPT) is a condition to be entitled. PAPs can request DPWH to: support the PAPs in preparing documents necessary to complete tax payment; and pay RPT in arrears to LGUs, which will be deducted from the amount of compensation except when the arrears are higher than the total amount of compensation. [Marginally Affected] Cash compensation for the affected portion of the 	DPWH-UPMO

Type of Loss	Entitled Person	Compensation/Entitlements	Responsible Organization
	<p>proof of ownership</p> <p>PAPs who were former ISFs but now hold title of land as a result of social government housing program</p>	<p>land based on the current market value free of taxes including CGT, DST, transfer tax and registration fees.</p> <p>*Payment of RPT is a condition to be entitled. PAPs can request DPWH to: support the PAPs in preparing documents necessary to complete tax payment; and pay RPT in arrears to LGUs, which will be deducted from the amount of compensation except when the arrears are higher than the total amount of compensation.</p>	
	<p>PAPs who were formerly informal settlers and government social housing program beneficiaries whose titles are still under the name of the organization</p>	<p>Same as PAPs with OCT with less any amount still owing to the title</p>	
	<p>PAPs whose properties are mortgaged</p>	<p>Same as PAPs with OCT with less any amount still owing to the title or the mortgage bank or other financial institutions</p>	
	<p>PAPs who are original patent holders of lands granted through CA 141 which has not been subject to previous government exercise of its lien</p>	<p>No compensation for land up to 20 m width if patent was granted prior to 1975 or up to 60 m width for patents granted thereafter. For area in excess of government lien, same as PAPs with OCT</p>	
<p>Structures (Residential, Commercial, Industrial/ Institutional)</p>	<p>PAPs that own affected structures including absentee owners</p>	<p>[Severely Affected]</p> <p>Cash compensation for entire structure at replacement cost including transaction costs without deduction for depreciation or salvaged materials</p> <p>AND</p> <p>In case affected structures are used as dwelling, permission to stay for one month or a longer time between delivery of compensation and other assistance, and demolition of the dwelling</p> <p>AND</p> <p>In case PAPs are informal settlers and affected structures are used as dwelling, option of living in a resettlement site</p> <p>[Marginally Affected]</p> <p>Cash compensation for affected portion of structure at replacement cost</p>	
	<p>Tenants of structures</p>	<p>[Severely Affected]</p> <p>Three months or longer prior notice to the tenants before evacuation</p> <p>*Not applicable to lease contracts that will expire at the time of taking</p> <p>[Marginally Affected]</p> <p>No compensation in principle</p> <p>YET</p> <p>In case tenants are forced to relocate for reasons reasonably attributable to the damages caused by the project, inconvenience allowance</p>	<p>DPWH-UPMO</p>
<p>Improvements</p>	<p>PAPs that own affected improvements</p>	<p>Cash compensation for affected improvements at replacement cost</p> <p>AND</p> <p>Transportation assistance if improvements need to be transferred and requires cost</p>	
	<p>PAPs that own land or are lessees directly involved in farming</p>	<p>Cash compensation for affected crops at replacement cost</p> <p>AND</p> <p>Disturbance compensation equivalent to five times the average of gross harvest over the last five years</p>	<p>DPWH-UPMO with support from MAO and DENR</p>
	<p>Displaced tenants and settlers on agricultural land</p>	<p>Cash compensation for affected crops at replacement cost</p> <p>AND</p> <p>Financial assistance equivalent to the average gross harvest over the last three years and not less</p>	

Type of Loss	Entitled Person	Compensation/Entitlements	Responsible Organization
		than PhP15,000/ha	
	PAPs growing crops, trees and perennials informally/illegally	<ul style="list-style-type: none"> • Cash compensation for affected crops, trees and perennials at replacement cost AND • Financial assistance equivalent to the average gross harvest over the last three years 	
Income Earning/Business Activities	PAPs who own affected fixed micro businesses (e.g. small shops)	<ul style="list-style-type: none"> • In case affected business entities move to new locations and continue with their business there, permission to continue with the business activities at the original location for a period that is sufficient to build, relocate and resume the business in the new site at a production level no less favorable than pre-project level OR • Income rehabilitation assistance not to exceed PhP15,000 per family AND • Cash compensation for relocation costs and transaction costs (e.g. payment of taxes due to the government) AND • Assistance in securing government soft loans that offer lower transaction costs and interest rates, and long-term and flexible payment schedule 	DPWH-UPMO with support from concerned government agencies
	PAPs who own affected small, medium or large businesses	<ul style="list-style-type: none"> • In case affected business entities move to new locations and continue with their business there, permission to continue with the business activities at the original location for a period that is sufficient to build, relocate and resume the business in the new site at a production level no less favorable than pre-project level AND • Cash compensation for relocation costs and transaction costs (e.g. payment of taxes due to the government) AND • Assistance in securing government soft loans that offer lower transaction costs and interest rates, and long-term and flexible payment schedule 	DPWH-UPMO with support from concerned government agencies
	PAPs who are employed in displaced establishments and lose job for reasons reasonably attributable to the damages caused by the project	<ul style="list-style-type: none"> • Cash compensation for net salary for two months based on minimum wage AND • Priority in employment during construction and operation stage of the project 	
Government Structure and Utilities	Government agencies that own affected structures	• Compensation to the government agencies based on mutual agreement between DPWH and the government agencies	
Vulnerable Groups	PAPs that are classified as any of the following groups: poor (whose combined income falls within the poverty threshold set by NEDA); female-headed households; elderly people, and persons with disability	<ul style="list-style-type: none"> • [Severely Affected] • Inconvenience allowance AND • Rehabilitation assistance in the form of skills training and other development activities equivalent to PhP15,000 per family AND • Participation in the Livelihood Restoration Program AND • For PAPs that need special assistance and/or medical care, respective LGUs to provide support before and during resettlement 	DPWH-UPMO with support from NHA and LGUs

Source: JICA Survey Team

(2) Resettlement of Project Affected Families (Informal Settlers)

As indicated in the survey results, 79% of the Project Affected Informal Settlers (in Mandaue City as there are none in Lapu-lapu City) were in favor of the option of resettlement housing. Those that chose

this option all preferred residential subdivision/house and lot package as opposed to the condominium building units. Their preference for the location of the housing package was within five km radius from their existing residence. However, the Mandaue City government has indicated the lack or non-availability of affordable lands in the City for resettlement sites. The Local Shelter Plan (2018-2026) has identified 8,760 displaced households needing relocation, which includes families living in the danger areas and doubled-up households. However, HUDO indicated that they received offers to sell from private individuals properties which the City is planning to develop into relocation sites, which could also accommodate the PAFs. These candidate sites include:

- A 1.8 hectares land in Brgy. Polog, Consolacion, approximately 8-10 kilometers from the PAFs current dwellings/abode
- A half-hectare land area in nearby Brgy. Labogon, Mandaue City, but is considered by the City Government as too expensive for the socialized housing/resettlement Site.

4.4.4.2 Right of Way Conflict

(1) Accessibility/Hindrance to Port/Docking Facilities and Operations

To mitigate the impacts on the accessibility/hindrance to port/docking facilities and operations, the following measures may be possible: i) the viaduct will be constructed over the towage facility or ii) the towage facility will be relocated to the outside of the ROW. Further consultations with the owners and management of the port/docking and fuel terminal facilities shall be conducted, especially during the Detailed Engineering Design so that the concerns of these facilities shall be addressed and considered in the final Engineering Details.

(2) Fishery

To mitigate the impacts on the accessibility of fisher folks to their main fishing grounds, access channel will be secured across the bridge construction site between bridge pier construction spots so that fisher folks can pass through the channel even during construction of the bridge. Safety for fisher folks is expected to be secured because the distance between bridge piers is as wide as 80m. Furthermore, the safety of fishing boats shall be more secured through organizing traffic by arranging patrol vessels to avoid collisions between construction vessels and fishing boats.

As mitigation measures for water quality deterioration, construction methods with less impact shall be taken. For bridge foundation, pile bent type will be adopted where possible, which minimize excavation. For cast-in-place pile, casing pipe will be set and excavation and casting concrete will be carried out within the pipe. In addition, silt fence shall be used during construction.

Compensation cost for the aquaculture farm in Barangay Looc, Mandaue City that are located within the ROW and thus physically affected will be provided. The area affected and the unit cost are 2.35ha and PHP170,107,000, respectively, so the total cost is estimated to be PHP 399,751,450. The details will be included in the Right of Way Action Plan/ Resettlement Action Plan (RAP).

(3) Broom-Making

To mitigate the blockage of footpaths during construction, access to cross the project road shall be secured by aggregating somewhere if the distant is short so that water can flow to the soaking areas and people can move crossing the construction sites.

(4) Other Project-affected Improvements

The jetty in Barangay Looc, Mandaue City and the wharf in Lapu-Lapu City that are located within the ROW and thus physically affected will be extended. Compensation cost for extending these improvements will be provided. For the jetty, the area affected and the unit cost are 1,600 m² and PHP54,500, respectively, so the total cost is estimated to be PHP87,200,000. For the wharf, the area affected and the unit cost are 1,200m² and PHP54,500, respectively, so the total cost is estimated to be PHP 65,400,000. The details will be included in the Right of Way Action Plan/ Resettlement Action Plan (RAP).

(5) Other Projects

To mitigate the impacts on other projects such as “Mandaue Reclamation Project” and “Umapad landfill Eco Park”, further consultations with City Government of Mandaue shall be conducted, especially during the Detailed Engineering Design to avoid negative impact to surrounding area.

The piers of the Cebu-Mactan Bridge is planned to be constructed on the land that will be reclaimed under the Mandaue Reclamation Project. Since a private developer’s undertaking and a public work do not always have common interests, a close coordination with the company is expected to be necessary, with the assistance of Mandaue City as a member of the joint venture.

With the 4th Cebu-Mactan Bridge/Mandaue Coastal Road interchange being planned right in the middle of the Umapad Landfill (open dumping site), a close coordination with Mandaue City may also be necessary for their Post-Closure Plan to be updated to accommodate this new development project.

As long as the City Government is involved in other projects, whether a member of joint venture in the Mandaue Reclamation Project or responsible organization in the Umapad Landfill Eco Park, consultation and coordination can be relatively smooth.

However, as mentioned in 4.4.3.3 (3), there is an ongoing illegal reclamation done by a private company. According to Mandaue City, they will try to solve this issue in a legal manner in July 2019.

(6) Hazardous Facilities

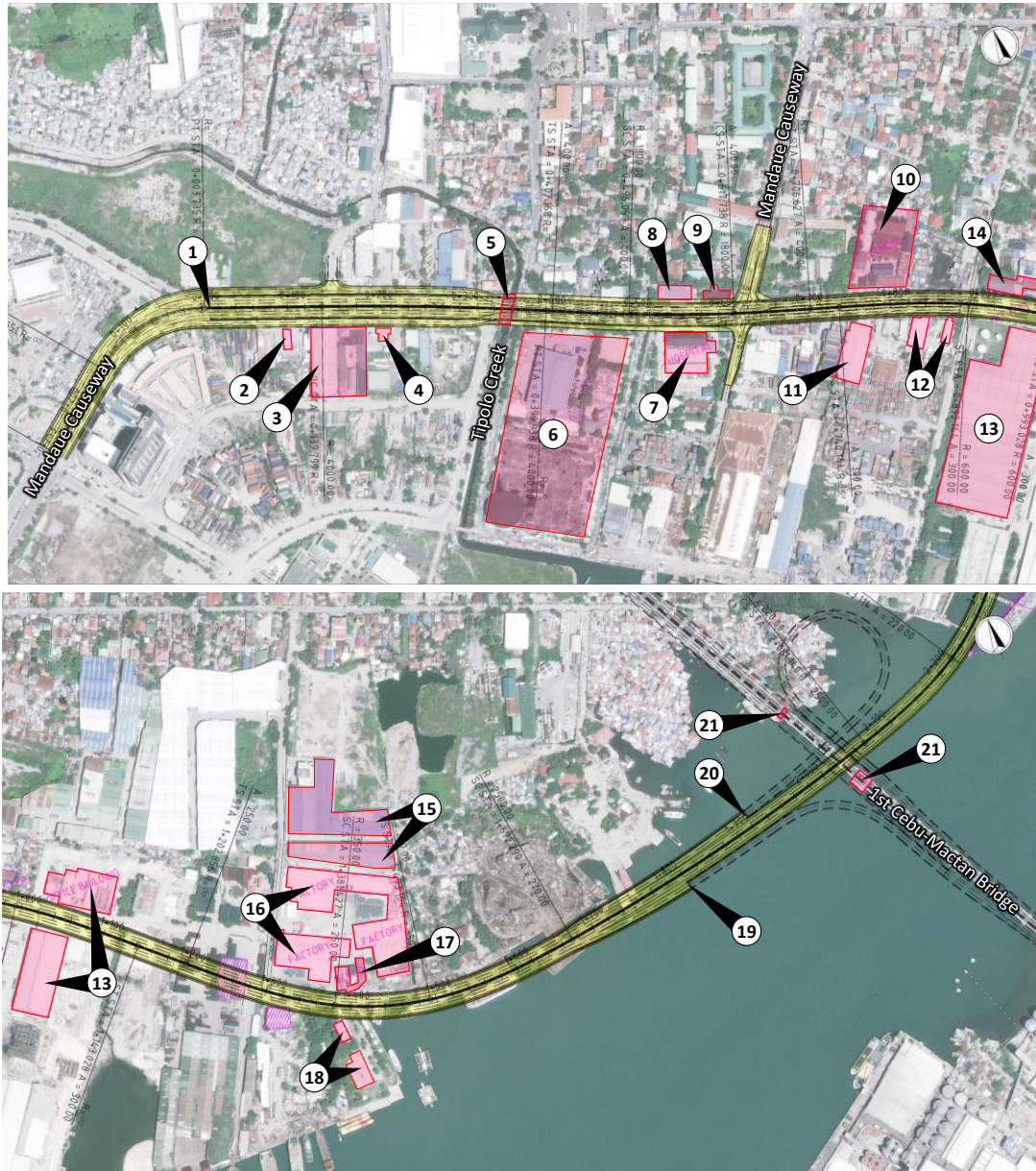
As shown in Table 4.4.50 and Figure 4.4.15, all the industrial facilities near the alignment of the Coastal Road including hazardous facilities such as oil tanks, LPG tanks and pipe lines were avoided or secured with satisfactory clearances from the road both horizontally and vertically, when determining the alignment. Furthermore, as mentioned in 4.3.3.3(1), noise barrier that will be installed along the alignment will cover the whole area where all the industrial facilities listed below are situated, and thus also serve as a ‘physical barrier’ to minimize the risk of casting flammable to the hazardous facilities.

Table 4.4.50 Industrial Facility Relevant Control Points for Alignment of Mandaue Coastal Road

No.	Control Point	Description
<i>Horizontal Alignment</i>		
2	Petron Petrol Station	Avoid building
3	Factory	Avoid building
11	Factory	Avoid building
12	Mabuhay Vinyl Corporation	Avoid buildings
13	San Miguel Food	Avoid buildings
15	Warehouse	Avoid buildings
16	DUPONT	Avoid building
22	Petron Corporation Mandaue Terminal	Avoid oil tanks (30 m clearance)
23	Arctura Tank Terminal	Avoid buildings, LPG tank

24	Warehouse	Avoid buildings
26	Tank farm	Avoid
<i>Vertical Alignment</i>		
22	Petron Corporation Mandaue Terminal	Provide 10 m clearance over the pipe line

Source: JICA Survey Team



				Families/ Housing Units	
1	Canduman	Canduman Haven	Joint Venture with NHA and the government	631	HUDO
2	Canduman	Kobe Canduman	Kobe Canduman	317	HUDO
3	Canduman	Sunflower	Co-ownership between government and private	100	HUDO
4	Subangdaku	Malibu, Matimco	Government	311	HUDO
5	Tipolo	Lower Tipolo	Government	237	HUDO
6	Tipolo	Sitio Maharlika	Government	215	HUDO
7	Guizo	Sta. Cruz Village	Government	317	HUDO
8	Guizo	Sta. Cruz II	Government	94	HUDO
9	Mantuyong	Mantuyong Urban Poor	Government	462	HUDO
10	Paknaan	6.5 Has. Resettlement Site	Private lot	1,200	HUDO
11	Jagobiao	JUPO/Sacred Heart Ville	Government	899	Project Inter-agency Committee
TOTAL				4,783	

*Organization that is formed by the PAPs to avail of the government housing program.

Source: Mandaue City CLUP 2014-2024

4.4.4.4 Cultural, Historic, Archaeologic and Aesthetics Value

(1) Cultural, Historic, Archaeologic and Aesthetics Value

As mentioned in 4.4.3.5(1), there is no adverse impact on cultural, historic and archaeological structures/sites during construction and operation phase, thus no mitigation is required.

(2) Change of the local landscape

The construction of a bridge and viaduct will change the landscape, which may be considered by some as a negative impact. To mitigate negative impact, the design of the 4th Mactan Bridge and viaduct of Coastal Road should be harmonize with local land scape. The lighting system should also be considered as new landscape of this area.

4.4.4.5 Occupational health hazards and threats to public safety

Construction and operations of any project is subject to occupational health and safety legislations, with standards implemented by the Department of Labor and Employment (DOLE) that is aimed at the protection of public and worker safety.

The proponent shall require the contractor to submit an Occupational Health and Safety Management Plan prior to commencement of work. The proponent shall also require the contractor to provide its own medical services to meet first-aid and emergency cases prior to referral to the advance medical facilities.

The contractor shall ensure worker's safety and provide-among others, the following:

- Personal Protective Equipments (PPE), e.g. helmets, masks, rubber boots, etc.
- Safety guidelines and signs,
- Appropriate sanitary facilities
- Safety equipments – e.g, fire extinguishers, first aid stations and emergency vehicles

To avoid the hazards of communicable and infectious diseases, the contractor shall also require the medical certificates to ensure workers to fit to work.

4.4.4.6 Enhancement of Livelihood/Employment Opportunities/Economic Contribution

The 4th Cebu-Mactan Bridge project will generate employment opportunities during construction and operation stage not only directly but indirectly (support facilities/amenities/livelihood) and will give priority to residents of the affected Barangays in Mandaue and Lapu-Lapu cities who are qualified. 4th Cebu-Mactan Bridge project will create jobs for a number of families and will boost local economies.

As a part of RAP, livelihood assistance and training program will be provided for PAPs by concerned governments such as Department of Social Welfare and Development (DSWD) Region VII, Technical Education and Skills Development Authority (TESDA) Region VII, Department of Labor and Employment (DOLE) Region VII, and Department of Trade and Industry (DTI) Region VII.

4.4.4.7 Delivery of Basic Social Services/Resource Competition

(1) Power Consumption

Construction phase / Operation phase

During construction stage, the construction works needs the power for operation of the equipment, lighting.

Basically, the electricity will be purchased by contractor from local electricity companies, named Visayan Electric Company (VECO) and Mactan Electric Company (MECO). Power generators will be prepared as a countermeasure for power failure and other construction works.

In addition, during the operations stage there will be demand for power for the lighting. LED lighting system can save power consumption, comparing with conventional lighting system.

(2) Water Usage

Construction phase / Operation phase

Water supply of the PAFs in Barangays Looc, Opao, Umapad, and Paknaan are shown in Table 4.4.31. Around 45% of the PAFs has a water source from piped water provided by the MCWD and around 20% of the PAFs use dug well. The location of these well is out of ROW, so the direct impact to these wells are not expected. However, if the constructions work such as excavation for viaduct will have indirect impact to ground water flow, the proponents should investigate and compensate for it.

During construction stage, there will be demand for water supply for utilization in the construction works (e.g. concrete mixing, etc). However, during the operations stage there will be very minimal usage of water.

The water will be supplied by the Metropolitan Cebu Water District (MCWD) both for construction stage and operation stage. Water saving/ conservation measures for construction and maintenance works/ activities should be implemented by contractors. As described in 4.2.3.1, recycled water, rain water or water from waterways shall be used for ground sprinkling or dust –suppression.

4.4.4.8 Transportation/Traffic Congestion and Safety of pedestrians, passersby and residents

Construction phase

Because of the mobilization of heavy vehicles, construction activities and staging of works, it will be unavoidable to restrict some roadway. This will lead to increased traffic congestion and changes in traffic patterns.

A Traffic Management Plan (TMP) that details the activities to adequately manage traffic flow will be developed in the detailed design phase and strictly implemented in the implementation phase. The preliminary conceptual TMP for the project is described below.

1. General for Temporary Traffic Control

Temporary traffic control is a major concern to be addressed by the Traffic Management Plan. The needs and control of all road users (motorists, bicyclists, tricyclists, and pedestrians within the construction site of 4th Cebu-Mactan Bridge and Mandaue Coastal Road through a temporary traffic control zone) are considered to be most critical during the construction works, utility relocation work, maintenance operations and management of traffic incidents under the Project.

Temporary traffic control plans and devices shall be the joint responsibility of DPWH, the Supervision Consultant and the Contractor, and the LGUs (particularly, the Traffic Enforcement Agency of Mandaue City (TEAM) and the City Traffic and Management System (CTMS) of Lapu-lapu City) who are having jurisdiction for guiding road users. There shall be adequate statutory authority for the implementation and enforcement of needed road user regulations, parking controls, speed zoning and the management of traffic incidents. Such statutes shall provide sufficient flexibility in the application of temporary traffic control to meet the needs of changing conditions in the temporary traffic control zone.

The Contractor will produce a final Traffic Management Plan for approval of DPWH and local authorities.



Figure 4.4.16 Images of Temporary Traffic Control

2. Principles of Temporary Traffic Control

Road user and worker safety and accessibility in temporary traffic control zones should be an integral and high-priority element of every project from planning through design and construction. Similarly, maintenance and utility work should be planned and conducted with the safety and accessibility of all motorists, bicyclists, tricyclists, pedestrians and workers being considered at all times.

3. Temporary Traffic Control Zones

A temporary traffic control zone is an area of the Project road with construction, maintenance or utility activities. The zone is typically marked by signs, channeling devices, barriers, pavement markings, and/or work vehicles. It extends from the first warning sign or high-intensity rotating, flashing,

oscillating or strobe lights on a vehicle to the END ROAD WORK sign or the last temporary traffic control device.

Most temporary traffic control zones are divided into following four areas:

- Advance warning area

The advance warning area is the section of the roadway where road users are informed about the approaching work area and what to expect ahead.

- Transition area

The transition area is the area where road users are redirected out of their normal path of travel.

- Activity area

The activity area is the area where works are physically being carried out and is set aside for works, machinery, equipment and storage of materials.

- Termination area

The termination area is the area where traffic resumes normal operations after passing the worksite.

4. Traffic Management Plans for Strategic Locations

For the construction works of 4th Cebu-Mactan Bridge and Mandaue Coastal Road, the following locations may be crucial in terms of traffic management plan because as a result of traffic analysis, they have high velocity, large volume traffic that require carefully planned detours and construction stagings during the construction. Details of traffic management plans for each location will be developed during the detailed design phase.

- The beginning 1 km-long section of Mandaue Coastal Road where the widening of the existing road (Mandaue Causeway) from the corner of Bai Hotel up to the corner of Mandaue City Hospital is required. For traffic flow and vehicular access to continue service roads will be established to divert traffic from the causeway construction yard (see Figure 4.4.17 and Figure 4.4.18);
- At-Grade Intersection of 4th Cebu-Mactan Bridge and Mandaue Causeway;
- Intersections of Lapu-Lapu Interchange; and
- Other intersecting roads crossings

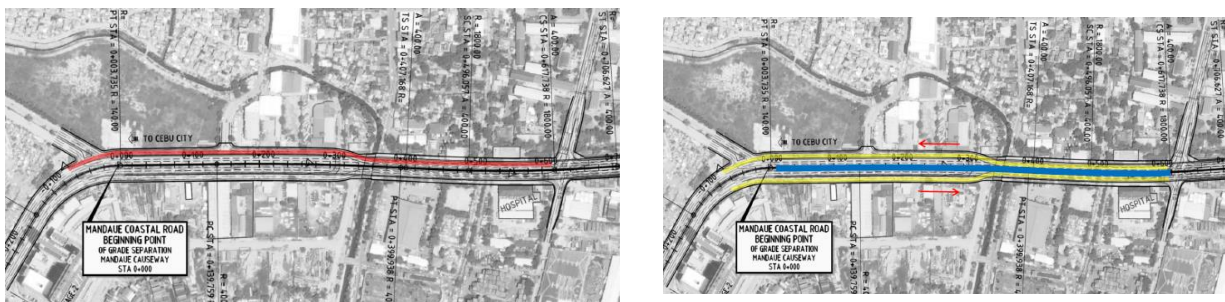


Figure 4.4.17 Service Road on the along the sides of the Causeway Construction Yard

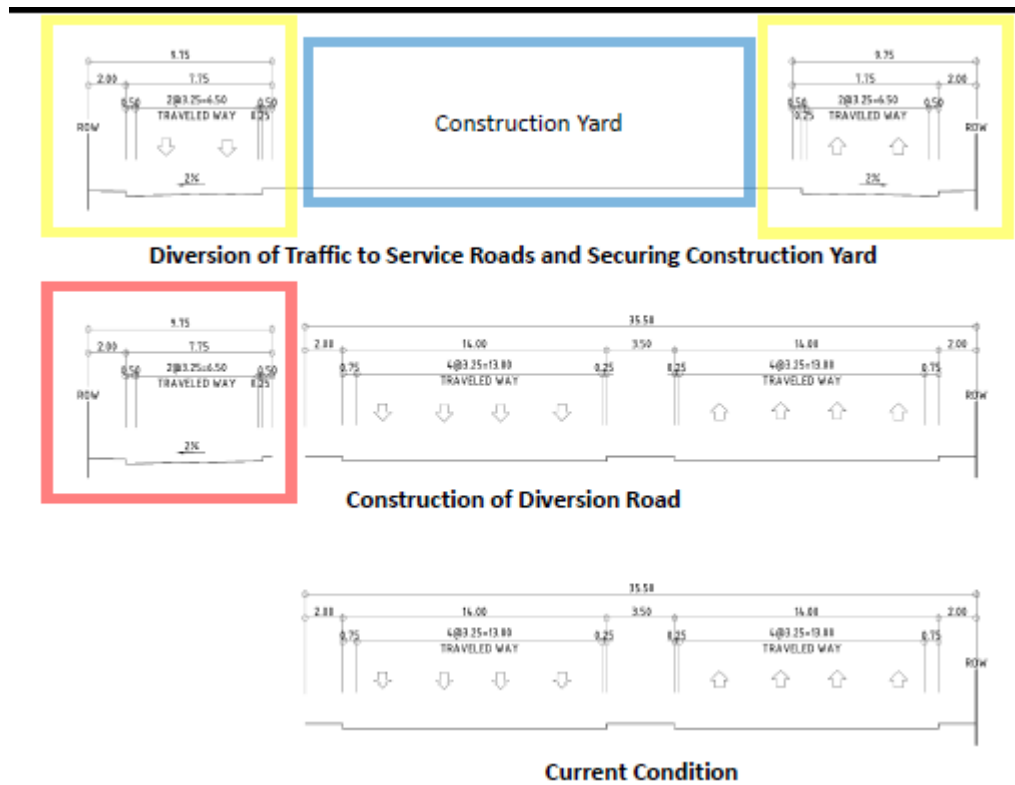


Figure 4.4.18 Elevation/profile of the Service Road and the Causeway Construction Yard

Operation Phase

The Local Government Code has explicitly indicated that the LGUs has traffic management jurisdiction within their respective political boundaries. However, Metropolitan Cebu’s traffic situation calls for close coordination between cities and municipalities to harmonize and jointly address the worsening traffic congestion of the metropolis. For this, the “Master Plan Study and Institutional Development on Urban Transport System in Metro Cebu (JICA Project Team) recommended for the establishment of the Metropolitan Cebu Traffic Management Board (MCTMB) to coordinate traffic and implement transport programs and projects in the Metro. Once the MCTMB (or any equivalent metropolitan-wide traffic body) will be realized and operational, the traffic management for the 4th Mactan Bridge and Coastal road will be under the jurisdiction of this body.

Table 4.4.52 Environmental Impact Assessment after EIA Study

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation		JICA Guide line	Evaluation				Reason for Evaluation
		Scoping	EIA		Scoping		EIA		
					Pre/During Construction	Operation	Pre/During Construction	Operation	
1.The Land									
1.1	Land use and Classification								
1.1.1	Change/Inconsistency in land use	LS	LS	Land use and utilization of local resources	C	C	B-	B-/B+	<p>Pre-/Construction Phase: Construction of bridge may affect negatively land use and utilization of local resources including fishery/ recreational activities, etc.</p> <p>Operation Phase: With improve transportation and mobility, the cities of Mandaue, Lapu-lapu will open-up to investment opportunities and sustain economic growth and development. But, uncontrolled development along roadside may hinder proper land use and make it difficult for the people to use local resources.</p>
1.1.2	Encroachment in Protected Area under NIPAS	LI	LI	Protected Area	D	D	D	D	Construction Phase / Operation Phase: There are no legally-designated protected areas in and around the project site.
1.1.3	Encroachment in other Environmentally Critical Areas (ECAs)	LS	LS	Ecosystem	B-	B-	B-	B-	Construction Phase / Operation Phase: As the whole project area is included in the important bird area (IBA) and key biodiversity area (KBA), there is concern about the negative impact on mangrove forests, tidal flats, and the organisms that use them (especially birds).
1.2	Geology/Geomorphology			Geographical Features	C	D	B-	D	
1.2.1	Change in surface landform/ topography/ terrain/slope	LS	LI						<p>Construction Phase: Modification of topography, soil disturbance and loss of top soil due to excavation (mostly of viaduct columns) will have negative and irreversible impacts, however the magnitude is considered as minor to moderate. Because the proposed structure is viaduct mainly, so that modification of topography due to cut-and-fill work will be limited and the Project area and its vicinities have low susceptibility to earthquake and rainfall induced landslides because the area is generally flat. The area along existing road is already developed and opening of new road areas are limited usage for cultivation.</p> <p>Operation Phase: There will be no change in topography and soils in the project site.</p>

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation		JICA Guide line	Evaluation				Reason for Evaluation
		Scoping	EIA		Scoping		EIA		
					Pre/During Construction	Operation	Pre/During Construction	Operation	
1.2.2	Change in sub-surface/ underground geomorphology	LS	LI					<p>Construction Phase: In addition to“1.2.1”, construction plan of viaduct columns will be optimized to prevent subsidence, the impact on sub-surface/ underground will be limited.</p> <p>Operation Phase: There will be no change in topography and soils in the project site.</p>	
1.2.3	Inducement of landslides or other natural hazards	LI	LI					<p>Construction Phase / Operation Phase: Historical seismic data from PHIVOLCS show that only small magnitude earthquakes occur in Cebu Island and the project area. Even though, the design of the structure will be considered the probability of occurrence of earthquakes.</p>	
1.2.4	Inducement of subsidence	LI	LI	Ground subsidence	D	D	D	D	<p>Construction Phase / Operation Phase: No serious impact is expected because there is no activity planned that may lead to ground subsidence such as large scale embankment and pumping.</p>
1.3	Pedology								
1.3.1	Soil erosion	LS	LI						<p>Construction Phase: Impacts is limited as the structure of the project will be viaduct mainly, so that modification of topography due to cut-and-fill work will be limited and the design and the construction plan of viaduct columns will be optimized in the detail design stage.</p> <p>Operation Phase: There will be no change in topography and soils in the project site.</p>
1.3.2	Change in soil quality	LI	LS	Soil pollution	B-	D	B-	D	<p>Construction Phase: There is a possibility that excavated soil at the landfill site is contaminated; this may lead to contamination of other soils. The landfill site has been permanently shut down and started rehabilitation by the City of Mandaue, so excavation soil at landfill site will be separated and followed the instruction by the City of Mandaue.</p> <p>Operation Phase: There is a possibility that soil contamination from accidental releases of chemicals, fuel, oil, lubricants will occur due to the maintenance work, but it will be managed by the contractor, so that serious impact is not expected.</p>
				Bottom sediment	B-	D	D	D	<p>Construction Phase: No serious impact is expected because the bottom sediment near the construction site of the new Mactan Bridge is not polluted and thus there is no possibility of the bottom sediment stirred up by the installation of piers pollute the surrounding bottom sediment.</p>

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation		JICA Guide line	Evaluation				Reason for Evaluation
		Scoping	EIA		Scoping		EIA		
					Pre/During Construction	Operation	Pre/During Construction	Operation	
									<p>Operation Phase: No serious impact is expected because there is no plan that may affect bottom sediment.</p>
				Waste	B-	D	B-	B-	<p>Construction Phase: Construction waste such as construction residual and cut trees may be generated by civil engineering work and excavation. General waste and manure is expected to be generated from the base camp.</p> <p>Operation Phase: There is a possibility that solid waste will be disposed at roadside.</p>
1.4	Terrestrial Ecology			Ecosystem	B-	B-	B-	B-	<p>Construction Phase/: Construction of interchanges that occupy a relatively large area may bring negative impacts to the surrounding ecosystem including mangrove forests.</p>
1.4.1	Vegetation removal and loss of habitat	LS	LS						<p>Construction of bridges and approach roads is expected to cause tree cuttings. Approximately 700 mangrove trees and 1,400 terrestrial trees along the project alignment will be affected.</p> <p>As the whole project area is included in the important bird area (IBA) and key biodiversity area (KBA), there is concern about the negative impact on mangrove forests, tidal flats, and the organisms that use them (especially birds).</p> <p>Terrestrial trees to be possibly removed includes Molave (<i>Vitex parviflora</i>) classified under endangered category of the DAO No.1-2004, to which a particular consideration should be taken.</p> <p>Operation Phase: Land use changes of the surrounding areas into commercial-residential development will impact on the environment. The presence of bridges and traffic flow and noise generated from them may affect the ecology of the main species that feed on tidal flats located around the bridge construction area.</p>
1.4.2	Threat to existence and/or loss of important local species	LS	LS						
1.4.3	Threat to abundance, frequency and distribution	LS	LS						
1.4.4	Hindrance to wildlife access	LS	LS						
2.The Water									
2.1	Hydrology/Hydrogeology			Hydrology	B-	B-	B-	D	<p>Construction Phase: Changes in the flow conditions of seawater due to bridge construction may affect the distribution of the tidal flats.</p> <p>Operation Phase: There is no activity in operation of road and bridge to impact for Hydrology</p>
2.1.1	Change in drainage morphology	LS	LS						<p>The modifications of topography/terrain will be limited, but there is a possibility that it will disrupt drainage pattern, causes erosion/transport of sediments to surface waters.</p>

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation		JICA Guide line	Evaluation				Reason for Evaluation
		Scoping	EIA		Scoping		EIA		
					Pre/During Construction	Operation	Pre/During Construction	Operation	
2.1.2	Change in stream, lake water depth	NR	NR						
2.1.3	Reduction in stream volumetric flow	NR	NR						
2.1.4	Inducement of flooding	LS	LS						<p>Construction Phase: Increase in run-off due to exposed soils, disturbance of soils which may result to localized flooding, sedimentation, etc.;</p> <p>Operation Phase: No serious impact is expected because there is no land acquisition in the operation phase.</p>
2.1.5	Water resources competition	LI	LI	Water usage	B-	D	B-	D	<p>Construction Phase: There is a possibility that are construction activities which may affect groundwater flows such as excavation for viaduct.</p>
2.1.6	Reduction/Depletion of ground water flow	LI	LI						<p>Operation Phase: No serious impact is expected because there is no land acquisition in the operation phase.</p>
2.2	Oceanography			Hydrology	B-	B-	B-	D	<p>Construction Phase / Operation Phase: Changes in the flow conditions of seawater due to bridge construction may affect the distribution of the tidal flats.</p>
2.2.1	Change/disruption in circulation pattern	LS	LI						<p>The modifications of topography/terrain will be limited, but there is a possibility that it will disrupt drainage pattern, causes erosion/transport of sediments to surface waters which are considered adverse impacts to coastal processes and change of the characteristics of beach.</p>
2.2.2	Change in bathymetry	LS	LI						Same as 2.2.1
2.3	Water Quality			Water Quality	B-	B-	B-	B-	<p>Construction Phase: Turbid water may be generated in the channel and river as a result of piling for installation of piers and other earth works for constructing a new road. In case the construction period of the reclamation project planned on the southern coast of Cebu Island overlaps with that of the subject project, water in Mactan Channel may be polluted.</p>
2.3.1	Groundwater pollution	LI	LI						<p>Operation Phase: Wastewater from the bridge may cause seawater pollution.</p>
2.3.2	Stream water pollution	NR	LS						
2.3.3	Lake water pollution	NR	NR						
2.3.4	Marine water pollution	LS	LS						

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation		JICA Guide line	Evaluation				Reason for Evaluation
		Scoping	EIA		Scoping		EIA		
					Pre/During Construction	Operation	Pre/During Construction	Operation	
2.4	Freshwater Ecology			Ecosystem	B-	B-	B-	B-	<p>Construction Phase: Release of contaminants, such as fuel and hydraulic fluid from equipment/vehicles for construction, chemicals, liquid wastes, and sediment-laden run-off from uncleaned/dirty area of construction work sites will affect the habitat condition.</p> <p>Operation Phase: The presence of bridges and traffic flow and noise generated from them may affect the ecology of the main species that feed on tidal flats located around the bridge construction area.</p>
2.4.1	Threat to abundance, frequency and distribution of species	LS	LS						
2.4.2	Loss of important species	LS	LS						
2.5	Marine Ecology			Ecosystem	B-	B-	B-	B-	<p>Construction Phase: Removal of or direct physical injury to aquatic flora and fauna (e.g. seagrasses and sea weeds in Cansaga Bay and Mactan channel) through activities associated with construction of offshore viaduct and bridge.</p> <p>Turbidity, siltation/sedimentation of Mactan Channel due to movement of loose underwater sediments, soil from construction of viaduct footings/columns will occur.</p> <p>Vibration/disturbance from pile-driving will occur.</p> <p>Operation Phase: The presence of bridges and traffic flow and noise generated from them may affect the ecology of the main species that feed on tidal flats located around the bridge construction area.</p> <p>Construction Phase / Operation Phase: Release of contaminants, such as fuel and hydraulic fluid from equipment/vehicles for construction, chemicals, liquid wastes, and sediment-laden run-off from uncleaned/dirty area of construction work sites will affect the habitat condition.</p>
2.5.1	Threat to abundance, frequency and distribution of species	LS	LS						
2.5.2	Loss of important species	LS	LS						
2.5.3	Loss of habitat	LS	LS						
3. The Air									
3.1	Meteorology/Climatology								
3.1.1	Change in the local climate, e.g., local temperature	LS	LS						<p>Construction Phase / Operation Phase: Construction of bridges and roads is expected to cause tree cuttings, and the pavement of road will disturb the natural drainage. It will cause the change in the local climate, in particular, local temperature.</p>

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation		JICA Guide line	Evaluation				Reason for Evaluation
		Scoping	EIA		Scoping		EIA		
					Pre/During Construction	Operation	Pre/During Construction	Operation	
3.1.2	Contribution to Global greenhouse gas	LS	LS	The impacts to transboundary or global issues	B-	C	B-	B+	<p>Construction Phase: Construction of bridges and roads is expected to cause tree cuttings. It is expected to decrease greenhouse gas absorption. Operation of construction machines and construction of structures are expected to lead to emission of greenhouse gases.</p> <p>Operation Phase: Greenhouse gas emissions are expected to increase in the new bridge and road area, while reduction in greenhouse gas emissions are expected in the whole area by reducing traffic congestion.</p>
3.2	Air Quality (and Noise)								
3.2.1	Air Pollution	LS	LI	Air Quality	B-	B-/B+	B-	D	<p>Construction Phase: Temporary negative impacts are expected on air quality due to exhaust gas (NOx and PM) resulted from operation of construction machines and equipment, and traffic congestion by traffic regulations.</p> <p>Operation Phase: No serious impact is expected because the baseline and forecast results are almost equal.</p>
3.2.2	Increase in noise	LS		Noise and vibrations	B-	B-/B+	B-	B-/B+	<p>Construction Phase: Noise and vibration levels are expected to heighten temporarily due to the operation of construction vehicles and machineries, concrete placement work and the traffic congestion resulted from traffic regulations.</p> <p>Operation Phase: Noise and vibration levels are expected to heighten around newly constructed bridge and road, whereas they are expected to be reduced due to a decrease in traffic volume around existing highways and bridges.</p>
				Offensive odors	B-	D	B-	D	<p>Construction Phase: General wastes from the base camp may generate offensive odors.</p> <p>Operation Phase: No serious impact is expected because there is no activity planned that may generate offensive odor.</p>
4. The People									
4.1.1	Displacement of settler/s	LS	LS	Resettlement	A-	D	A-	D	<p>Pre-/Construction Phase: Resettlement of 69 households and 23 companies are expected within the affected area.</p> <p>Operation Phase: No serious impact is expected because there is no land acquisition in the operation phase.</p>
4.1.2	Change in land ownership	LS	LS						
4.1.3	Displacement of properties	LS	LS						

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation		JICA Guide line	Evaluation				Reason for Evaluation
		Scoping	EIA		Scoping		EIA		
					Pre/During Construction	Operation	Pre/During Construction	Operation	
4.1.4	Right of way conflict	LS	LS	Local Institutions, decision making	B-	D	D	D	<p>Construction Phase / Operation Phase: According to the system of public involvement, the social structure and decision making will not be affected by the project.</p> <p>No serious impact is expected because there is no activity planned that may affect the social structure.</p>
				Misdistribution of benefits and damages	D	D	D	D	<p>Construction Phase / Operation Phase: Misdistribution of benefits and damages is expected to be minor because the benefit of improved convenience by the bridge and road construction will be equally distributed. In addition, the damage by the construction will be compensated properly.</p>
				Local conflicts of interest	B-	D	B-	D	<p>Construction Phase: Impacts on the accessibility/hindrance to port/docking facilities and operations will occur due to the bridge and road construction. In addition, there are several projects to be coordinated with the construction of bridge and road.</p> <p>Operation Phase: No serious impact is expected as explained in "Misdistribution of benefits and damages".</p>
				Existing social infrastructures and services	B-	B-	B-	B-	<p>Construction Phase / Operation Phase: A school located along the road about 1 km from the starting point of the coastal road as well as factories, power plants and oil tanks (e.g. casting flammable items into the tanks) located along the coastal road may be affected.</p>
4.1.5	In-migration(Proliferation of informal Settlers)	LS	LS					<p>Construction Phase/ Operation Phase: Inter-regional disputes may arise as local inhabitants and local authorities may request for their own preferential treatment (e.g. provision of employment opportunities).</p>	
				Poor	B-	D	B-	D	<p>Pre-/Construction Phase: There are 38 PAFs whose monthly income is less than the poverty threshold set by the Philippine Statistics Authority (PSA).</p> <p>Operation Phase: No serious impact is expected because there is no land acquisition in the operation phase.</p>
4.1.6	Presence of Indigenous Peoples	LI	NR	Indigenous, or ethnic people	C	C	D	D	<p>Construction Phase / Operation Phase: Neither the existence of ethnic minorities and indigenous people, nor impacts to them have been identified.</p>
4.1.7	Cultural change	LI	NR	Cultural heritage	B-	B-	D	D	<p>Construction Phase / Operation Phase: There are no existing materials of cultural, historical nor archaeological significance present in the area that could be impacted by the project.</p>

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation		JICA Guide line	Evaluation				Reason for Evaluation
		Scoping	EIA		Scoping		EIA		
					Pre/During Construction	Operation	Pre/During Construction	Operation	
				Landscape	C	C	D	D	<p>Construction Phase / Operation Phase: No serious impact is expected because there is no legally-designated landscape to be protected around the project site.</p> <p>Operation Phase: Presence of a bridge and viaduct may change the landscape, so the design and lightning system should be considered to harmonize with local landscape. .</p>
4.1.8	Threat to public health	LS	LS	Infectious diseases such as HIV/AIDS	B-	B-	B-	B-	<p>Construction Phase: Infectious diseases such as STD may possibly spread due to an inflow of construction work</p> <p>Operation Phase: The improved access from the airport to the urban area due to the newly constructed bridge and road may increase the number of travelers and spread infectious diseases such as STD.</p>
4.1.9	Local benefits from the project	LS	LS	Local economies, such as employment, livelihood, etc.	C	C	B-/B+	B-/B+	<p>Pre-/Construction Phase: Local economy is expected to be developed through creation of employment opportunities in construction work and business for construction workers. Livelihood of residents may be affected by land acquisition and resettlement. New construction of bridge and road may affect the livelihoods of fishery/aquaculture/broom-making workers.</p> <p>Operation Phase: Land acquisition does not occur in the operation phase, whereas the presence of newly constructed bridge and road that narrows the fishing ground/aquaculture ponds may negatively affect the livelihoods of fishery/aquaculture/broom-making workers. Positive impacts on the local economy such as alleviation of traffic congestion are expected in Cebu City.</p>
				Working conditions (Health)	B-	D	B-	D	<p>Construction Phase: If the contractor fails to take appropriate safety measures, the worker's health and safety are expected to deteriorate.</p> <p>Operation Phase: No serious impact is expected because construction of bridge and road is considered to bring no significant change to the working environment of the surrounding local inhabitants.</p>
4.1.10	Threat to delivery of basic services	LS	LS	Water usage	B-	D	B-	D	<p>Construction Phase: Land acquisition and construction work may affect the accessibility to drinking water resources such as wells.</p>

Philippine Environmental Impact Statement (EIS) System (DAO 03-30)		Evaluation		JICA Guide line	Evaluation				Reason for Evaluation
		Scoping	EIA		Scoping		EIA		
					Pre/During Construction	Operation	Pre/During Construction	Operation	
									<p>Operation Phase: No serious impact is expected because there is no land acquisition in the operation phase.</p>
4.1.11	Traffic congestion	LS	LS	Accidents (Safety)	B-	B-	B-	B-	<p>Construction Phase: Operation of construction machines and equipment may cause accidents in the project site.</p> <p>Operation Phase: Traffic accidents may occur on the newly-constructed bridge and road.</p>
				Gender	B-	D	D	D	<p>Construction Phase: There may be differences between men and women in terms of wages and treatment as construction workers.</p> <p>Operation Phase: No serious impact is expected because no activity that may affect gender is planned in the operation stage.</p>
				Children's rights	C	D	D	D	<p>Construction Phase: If child labor in construction work is customary, children's right to compulsory education may be hampered. The presence and extent of the impact will be clarified through the survey.</p> <p>Operation Phase: No serious impact is expected because operation of bridge and road is considered not to affect children's rights.</p>
5. Other									
				Waste	B-	D	B-	B-	<p>Construction Phase: Construction waste such as construction residual soil and cut trees may be generated by civil engineering work and excavation. General waste and manure is expected to be generated from the base camp.</p> <p>Operation Phase: There is a possibility that solid waste will be disposed at roadside.</p>
<p>Note1: Relevance based on PD and Project Location LS: Likely Significant LI: Likely Insignificant NR: Not Relevant</p>				<p>Note 2: Rating based on JICA ES Guideline A±: Significant positive/ negative impact is expected. B±: Some positive/ negative impact is expected. C: Extent of positive/ negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses.) D: No impact is expected. IEE/ EIA is not necessary.</p>					

5. ENVIRONMENTAL MANAGEMENT PLAN

5.1 Impacts Management Plan

The Environmental Management Plan (EMP) covers the construction and operations of 4th Cebu-Mactan Bridge-Mandaue Coastal Road Project. The EMP is inclusive of the enhancement/mitigation measures as exhibited in the IMP/EMP matrix shown in Table 5.1.1.

Table 5.1.1 Impact Management Plan Matrix

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
PRE-CONSTRUCTION : Preparation of sub-studies, archt & Eng Design, procurement of permits/ clearances, consultations etc./ Clearing along ROW					
LAND					
Geology	<ul style="list-style-type: none"> • Damage to components of the construction work (Ground shaking, ground rupture) 	<ul style="list-style-type: none"> • Undertake site-specific seismic risk characterization and estimates of how the ground beneath the structure will move; and Design and construct structures that will address seismic hazards 	DPWH, DED Consultant	Design & consultancy fees:	ECC, SOP
Soil pollution (near Umapad Dumpsite)	<ul style="list-style-type: none"> • Soil contamination due to excavation work near Umapad Dumpsite 	<ul style="list-style-type: none"> • Conduct a comprehensive soil quality survey in the DED and provide the results to the Mandaue City as a contribution to the rehabilitation of the dump site 	DPWH, DED Consultant	Design & consultancy fees:	ECC, SOP
Terrestrial Flora and Fauna	<ul style="list-style-type: none"> • Removal of up to 1,700 trees (approx. 370 terrestrial trees possibly relocatable and approx. 700 mangrove trees and 1,000 terrestrial trees inevitably cut) • Possible relocation and removal of Molave (<i>Vitex parviflora</i>) classified under endangered category of the DAO No.1-2004 	<ul style="list-style-type: none"> • Compliance with the conditions stipulated in the permits / clearances (e.g. ECC, Tree Cutting Permit, etc.) issued for the Project • Providing a temporary fencing to vegetation for their protection to minimize clearing of vegetation as much as possible • Replantation of approx. 370 terrestrial trees, less than 1.5m height, including a threatened species 'Molave' • Compensatory plantation of mangrove and terrestrial trees in accordance with DENR relevant regulation(s) (Plant approx. 70,000 seedlings of mangrove and approx. 100,000 seedlings of other terrestrial tree species) 	DPWH, Contractor supervised by Consultant, DENR-FMB and concerned LGUs	Temporary fencing cost: PhP 500,000 Tree replanting cost: PhP 1,500,000 Tree seedling planting cost: PhP 7,664,400	ECC, SOP
Protected Area/Terrestrial Flora and Fauna	<ul style="list-style-type: none"> • Disturbance to KBA 	<ul style="list-style-type: none"> • Conduct the Biodiversity Survey (detailed bird survey) at the early stage of Detailed Engineering Design as an input to the design of coastal road, interchange and bridge and for consideration of further measures to minimize the disturbance to IBA/KBA (i.e. development of wetland park and installment of bird-car collision prevention poles/fences) 	DPWH, DENR, LGU	Design & consultancy fees:	ECC
PEOPLE					
Public Involvement	<ul style="list-style-type: none"> • Informed/empower the public to participate in the decision-making process 	<ul style="list-style-type: none"> • Transparent and participatory approaches and methodologies, Consideration of community needs/aspirations (Conduct of IEC, public consultations) 	DPWH	Conduct of IEC and public consultations: PhP 617,400	Standard procedures & guidelines (JICA, EMB, DOLE)

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
Loss of property & resettlement	<ul style="list-style-type: none"> Loss of land, property and establishments along/within the ROW of Bypass road alignment 	<ul style="list-style-type: none"> Resettlement, compensation, assistance and rehabilitation of affected residents (PAFs) & establishments; implementation of RAP 	DPWH, LGU, PAFs	RAP Budget (can be adjusted to accommodate changes after DED): PhP 13,825 million	RAP, ECC
Living conditions	<ul style="list-style-type: none"> Improvement of living conditions 	<ul style="list-style-type: none"> Livelihood rehabilitation assistance in the form of skills training and other development activities shall be provided in coordination with other concerned government agencies if the present means of livelihood is no longer viable and the PAP will have to engage in a new income activity; and Financial assistance to augment loss of income during initial months of relocation 	DPWH DSWD, DOST NGOs, etc..	RAP Budget:	RAP, ECC
Basic Service Utilities/Infrastructure	<ul style="list-style-type: none"> Relocation of utilities (e.g. electric poles, water lines, communication lines, etc.) along right of ways 	<ul style="list-style-type: none"> Necessary planning and coordination with concerned authority and local body; Prior notice to and consultation with concerned authority, local body and public to be affected so as to ensure that work does disrupt services 	DPWH, VECO, MCWD, Telcos, LGU, etc.		Agreement with Utilities-services providers
CONSTRUCTION :Site Preparation, Roadbed Preparation ,Installation of Structures, Temporary ancillary elements					
LAND					
Land Use Pattern, Zoning	<ul style="list-style-type: none"> Change/Disturbance in land use pattern due to road construction & ancillary facilities 	<ul style="list-style-type: none"> Scheduling heavy construction works during the daytime; Construction activities that necessitate utilizing portion of the road/street should be undertaken upon permission by the City Traffic MGT and outside of traffic rush-hours; Construction activities should not be a hindrance to the operations in neighboring area. 	DPWH., Contractor, Site Manager and LGUs of Mandaue, and Lapu-lapu	To be included in the contractor's cost:	ECC, Zoning
Change in Land Use -Cumulative Impacts from Mandaue Reclamation Project	<ul style="list-style-type: none"> Increased land use change, noise, water pollution, dust and emissions Increased traffic by construction vehicles Increased restriction of access to sea water by local fisher folks 	<ul style="list-style-type: none"> Mitigation measures on air quality, noise level and water quality described in this EMP. Implementation of the Traffic Management Plan (TMP) and rerouting plans in coordination with Mandaue Reclamation Project Securing a route for small vessels of fisher folks during the bridge pier construction 	DPWH., Contractor, Site Manager and LGUs	To be included in the contractor's cost:	ECC, SOP

ENVIRONMENTAL IMPACT ASSESSMENT

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
Topo., Geology	<ul style="list-style-type: none"> • Alteration in topography due to site development (inland areas): clearing, backfilling, grading, foundation works, etc.: • Soil disturbance and loss of top soil due to excavation 	<ul style="list-style-type: none"> • Limiting land clearing and excavation within the affected areas of the primary impact area and excavating within the desired level only • Proper and appropriate excavation and embankment protection techniques, such as sand guards"Yaita" 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
Soil erosion	<ul style="list-style-type: none"> • Slope failure • Soil runoff due to cut and fill areas, and waste soil disposal sites • Movement of excavated soil to waterways 	<ul style="list-style-type: none"> • Take appropriate soil protection measures when doing excavation for foundation works • Ensure slope protection such as stone pitching or vegetation to prevent soil runoff • Keep excavated soil (road sub-base, base, foundation works for viaduct columns, etc) away from waterways • Provide drainage sump pits and silt traps 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
Soil pollution	<ul style="list-style-type: none"> • Soil contamination due to excavation work near Umapad dumpsite • Soil contamination due to leaks and spills of fuels, lubricants, solvents • Endangerment of health and safety of worker and community by exposure to hazards 	<ul style="list-style-type: none"> • Establish and implement health and safety management plan and emergency and contingency plan in case of spills; • Excavation soil near Umapad Dumpsite will be separated from other excavation materials and followed the instruction of DENR-EMB, DGS and CENRO. • Store bulk hazardous chemicals in an impermeable area and with appropriate secondary containment; • Comply with environmental requirements for the storage, transport, treatment and handling of hazardous substances and wastes • Conduct a semi-annual soil quality monitoring 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
Construction Waste Disposal/ Mgt.	<ul style="list-style-type: none"> • Wastes generation, consisting of the following types: <ul style="list-style-type: none"> • Surplus and const. wastes: scrap metals, concrete rubble etc. (estimated volume: around 18,500 m3) • Domestic wastes (Biodegradable): food and kitchen wastes from temp. canteen • Sanitary wastes from office and workers toilets, bathrooms • Others (Packaging wastes such as plastics, wood pallets, crates, metal wires, cardboard, sacks, containers, etc.) 	<ul style="list-style-type: none"> • Detailed waste management program will be prepared by contractor including the following: <ul style="list-style-type: none"> • Solid wastes to be moved/transported to materials recycling facility (MRF) for sorting and diversion of wastes to recycles and re-utilization • Concrete rubbles and other excess materials to be reused for backfilling of the project sites/areas • Secure hauling permits and dispose excess earth materials to approved-suitable disposal sites • Residuals to be segregated into biodegradable, recyclable, residual, and special waste and disposed through the City garbage collectors • Temporary stockpiles of excavated materials from foundation works must be properly covered and regularly hauled to DENR-approved disposal sites; • No stockpiling of construction debris as these will not be utilized anyway; • Litters and other types of domestic garbage from construction sites and camps must be properly kept in trash bins and regularly disposed through the City garbage collectors 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
Terrestrial Flora and Fauna	<ul style="list-style-type: none"> • Small-scale loss of bird habitat such as mangrove, fishpond and tidal flat • Noise from construction work frightening migratory birds away from the IBA/KBA. 	<ul style="list-style-type: none"> • Conduct awareness campaign to all relevant construction workers about the careful consideration for IBA/KBA • Adoption of lower noise and vibration construction method and machines • Adoption of temporary jetty construction road to minimize adverse impacts on mangrove and tidal flat • Conduct semi-annual bird monitoring 	DPWH, DENR, LGUs	To be included in the contractor's cost:	ECC
WATER					

ENVIRONMENTAL IMPACT ASSESSMENT

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
Hydrology / Oceanographical Conditions	<ul style="list-style-type: none"> • Disruption of natural drainage pattern • Increase in run-off due to alteration of topography and reduction of infiltration resulting to localized flooding, 	<ul style="list-style-type: none"> • Setting the adequate drainage system such as the crossing drainage pipe; • Limiting the area of exposed soil, • Building of bund/dikes effectively enclosing water-areas prior to landfilling for coastal road • Implementation of erosion control measures including temporary diversion berms/sandbagging, drainage swales and siltation basins • Loose earth materials stockpile be kept away from banks and near waters (waterways, sea) 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
Water Quality & Marine Envi.	<ul style="list-style-type: none"> • Increase turbidity and sediment load due to transport of wastes and sediments to surface water, Mactan Channel, Cansaga Bay and Silot Bay, waters 	<ul style="list-style-type: none"> • Prepare temporary drainage plan with sump pits/sedimentation pond to trap sediments and wastes; • Use of silt fences and sediment traps, cover exposed earth especially before heavy rains are expected. • Conduct a quarterly Total Suspended Solids (TSS) level monitoring 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
	<ul style="list-style-type: none"> • Pollution of receiving water bodies due to fuel and oil leaks from vehicles and other equipment 	<ul style="list-style-type: none"> • Proper handling of oil and lubricants to prevent spillage and contamination of surface and ground waters; (Storage of oil and lubricants in secure areas/places) • Heavy equipment's and machineries shall be well-maintained to prevent discharges from engines and regularly checked for fuel and oil leaks. • During repair/maintenance of equipment and machinery, containers/drip trays shall be used to collect leakage • Paint residues and paint containers shall be handled & disposed properly and arrangement will be made with the suppliers to be return for their proper disposal • Conduct quarterly oil & grease content monitoring 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
	<ul style="list-style-type: none"> • Further bacteriological contamination of the esteros due to improper management of domestic and solid wastes 	<ul style="list-style-type: none"> • Contractor/Project Management provides toilet/washroom facility for construction workers and require proper sanitation practices; • Provision of garbage bins at the construction areas; • Regular disposal of wastes generated by the personnel to city approved disposal sites; • Conduct weekly inspection of the construction areas to ensure proper management of the wastes generated by the construction personnel and • Conduct quarterly total coliform monitoring 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
Water Supply	<ul style="list-style-type: none"> • Wastage of water resource through improper usage during construction • Competing use with the community 	<ul style="list-style-type: none"> • Sourcing of water from outside of the communities within the project area • Implement water saving/conservation measures of water use for construction works/activities • Recycled water or water from waterways and marine waters shall be used for ground sprinkling or dust-suppression measures 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
Aquatic Flora and Fauna	<ul style="list-style-type: none"> • Removal of or direct physical injury to aquatic flora and fauna (e.g. seagrasses and sea weeds) through the construction of offshore viaduct and bridge • Vibration/disturbance from pile-driving 	<ul style="list-style-type: none"> • Monitor the distribution and health of surrounding intertidal habitats along or near the vicinity of the 4th Cebu-Mactan Bridge-Mандаue Coastal Road alignment. • Offsets to be implemented such as development of marine sanctuary, planting of mangroves in nearby available coastal areas (if applicable) • Position the water borne equipment in a manner that will minimize damage to identified fish habitat (mangrove, seagrasses, and coral reefs) • Avoid pile-driving methodology with sound & vibration impacts destructive to marine env/ habitats & disruptive to fish spawning • Coordinate with Bureau of Fisheries and Aquatic Resources (BFAR) on pile-driving schedule • Monitoring of sound and vibration level during driving any type of piles with in mind its impacts on fish and their habitat. 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
AIR					

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
Air quality	<ul style="list-style-type: none"> • Movement of construction vehicles and equipment's will generate fugitive dusts • Exhaust emissions from construction machineries and equipment 	<ul style="list-style-type: none"> • Regular sprinkling of water of areas considered as dust generators • Use only new or properly maintained vehicles, equipment and conduct regularly check to regulate emissions within standard levels • Transport of excess materials should be undertaken during off-peak traffic periods • Hauling trucks should be covered with tarpaulin or canvass • Conduct quarterly TSP, PM10, NO2, SO2 level monitoring 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
Noise and Vibration level	<ul style="list-style-type: none"> • Noise from movement of vehicles (trucks, cars) coming-in and out of the facility—disturbance to residents along Access St. • Noise from Pile driving activities 	<ul style="list-style-type: none"> • Provision of temporary noise barriers such galvanized iron sheets, particularly in noise-sensitive receptor areas • Schedule heavy noise generating activities from 7am-7pm. • Use only new or properly maintained vehicles, equipment • Minimize the use of impact devices • Installation of noise abatement devices such as mufflers and suppressors to all construction vehicles, machineries, and heavy equipment • Locate stationary equipment, such as compressors as far as possible from noise sensitive areas. • Avoid impact-type pile driving and employ appropriate pile-driving technology in noise-sensitive receptor areas and bird habitats • Conduct quarterly noise level monitoring at sensitive receptor areas 	DPWH., Contractor, Site Manager	To be included in the contractor's cost: Temporary noise barriers cost: PhP 8,665,845	ECC, SOP
PEOPLE					
RoW Conflict on Fishery and its related industry	<ul style="list-style-type: none"> • Loss/limitations and hindrance of access by vessels to establishments with port/docking facilities 	<ul style="list-style-type: none"> • Bridge design to accommodate/consider higher clearance to allow vessels to access and dock to establishments, such as shipyards, oil depot/fuel terminals and other establishments with docking facilities 	DPWH, LGU, port/docking facilities owners and operators		DED, ECC

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
In-migration	<ul style="list-style-type: none"> • Construction workers and staff will require temporary housing 	<ul style="list-style-type: none"> • To the extent possible, local labor will be hired to minimize the need to provide housing for the construction crew. 	DPWH., Contractor	To be included in the contractor's cost:	Contractors Contract
Occupational Health and Safety	<ul style="list-style-type: none"> • Increased risk of accidents due to improper work ethics, which may threat health and safety of workers and local residents 	<ul style="list-style-type: none"> • Contractors shall submit an Occupational Health and Safety Management Plan prior to commencement of work • Appropriate personal protective equipment (PPE) must be provided to all construction workers • Safety guideline and signs will be prepared for workers • First aid stations supervised by the Environment and Safety Health Officer (ESHO) of the Contractor will be located within the construction site; and • Emergency vehicles will be on stand-by within the construction area at all times 	DPWH., Contractor, Site Manager	PPE cost:	ECC, SOP
	<ul style="list-style-type: none"> • Hazards of communicable and infectious diseases 	<ul style="list-style-type: none"> • Contractors shall submit an Occupational Health and Safety Management Plan. • Medical certificates will be requested to ensure workers are fit to work; • Appropriate sanitary facilities shall be provided at all construction sites. 	DPWH., Contractor, Site Manager	To be included in the contractor's cost	ECC, SOP
Local economy (Employment and livelihood)	<ul style="list-style-type: none"> • Enhancement of employment and /or livelihood opportunity that will lead to economic growth. 	<ul style="list-style-type: none"> • Provide the priority for local hiring • Encourage patronage for local goods & services 	DPWH., Contractor,	To be included in the contractor's cost	ECC, Contractors Contract

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
Public Safety/ Transportation & Traffic	<ul style="list-style-type: none"> • Increase traffic density due to movement of vehicles/trucks hauling construction materials to site, causing traffic congestion along access roads • Safety of pedestrians, passersby, as well as residents 	<ul style="list-style-type: none"> • Strict implementation of the Traffic Management Plan (TMP) and rerouting plans; • Traffic flow restrictions will be minimized during daytime hours; • Schedule equipment move-in to blend with regular non-peak hour day-time vehicular traffic; • Placement of traffic decking will be done in stages; • Work will be performed during night time to the extent possible; • The minimum width of lanes will be maintained in accordance with the requirements of City Traffic MGT; • Parking time of idle dump trucks and the other construction vehicles along constricted areas will be limited; and • Well-trained traffic aides and flagmen duly deputized by City Traffic MGT will be designated at critical construction areas to direct traffic • All excavation sites and the storage site of hazardous substances will be enclosed with corrugated metal sheet barriers to limit access to public, especially children; • Installation of adequate lighting and reflectorized warning signs along the entire stretch of the construction site 	DPWH, Contractor LGUs Traffic Management Office	To be included in the contractor's cost	ECC, TMP/TIA SOP

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
CONSTRUCTION : Demobilization/Clean up					
LAND					
Solid waste generation	<ul style="list-style-type: none"> Excess soil generation from earthwork activities such as excavation, backfilling and embankment Disposal of a total of around 18,500 m³ of construction debris 	<ul style="list-style-type: none"> Detailed waste management program and Demobilization plan for the construction yards will be prepared which including the following; Reuse excavated excess soil to backfill depressed areas within or nearby the area; Recycle construction debris through sorting and stockpiling; Take appropriate measures, such as covering hauling trucks with tarpaulin or canvass, in transporting excess/excavated earth materials to disposal site; and Take proper and diligent management of solid waste, such as covering temporary stockpiles of excavated materials and hauling regularly to DENR-approved disposal sites. 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
WATER					
Water quality	<ul style="list-style-type: none"> Further contamination of the waterways crossed by the alignments due to abandoned wastes and construction spoils 	<ul style="list-style-type: none"> All temporary sanitation facilities, especially the portable toilets are properly dismantled and no domestic wastes are abandoned; and Conduct a site inspection at the work sites to ensure that construction spoils/debris, solid, and domestic wastes are properly disposed to approved disposal sites and not abandoned in the construction areas 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
AIR					
Air quality	<ul style="list-style-type: none"> Dust re-suspension due to abandoned construction spoils/debris 	<ul style="list-style-type: none"> Conduct a site inspection at the work sites to ensure that construction spoils/debris are properly disposed to approved disposal sites and not abandoned in the construction areas 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
PEOPLE					
Social Service Utilities	<ul style="list-style-type: none"> Possible long-term interruption of basic social service utilities such as power and water supplies 	<ul style="list-style-type: none"> Contractors/Sub-Contractors must ensure that all affected service utilities are immediately and properly restored to their normal operation; and Conduct a joint site inspection involving the ESHO of the Contractors, leaders of affected barangays, and representatives of concerned utility companies to ensure immediate restoration of affected service utilities 	DPWH., Contractor, Site Manager		ECC, SOP

ENVIRONMENTAL IMPACT ASSESSMENT

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
Public Health	<ul style="list-style-type: none"> • Possible spread of communicable diseases due to abandoned wastes 	<ul style="list-style-type: none"> • Ensure that all temporary sanitation facilities, particularly portable toilets, are properly dismantled and all residual wastes are properly disposed to the disposal sites duly-approved by the DPS; and • Conduct a joint site inspection at the work sites involving the ESHO of the Contractors, community leaders, and representatives of Health and Sanitation Office, DPS to validate compliance of the Contractor 	DPWH., Contractor, Site Manager	To be included in the contractor's cost:	ECC, SOP
OPERATION PHASE : Project presence, Infrastructure Maintenance, Vegetation Management					
LAND					
Soil pollution	<ul style="list-style-type: none"> • Soil contamination from accidental releases of chemicals, fuel, oil, lubricants will occur due to the maintenance work 	<ul style="list-style-type: none"> • Immediately collect and contain spilled oil, lubricants and other chemicals • Proper management of wastes • Secure storage of oil, lubricants • Proper handling and maintenance of equipment, machineries, vehicles 	DPWH., facilities manager, LGU	Part of Maintenance Cost of the Facilities:	ECC, operations manual for Bypass road
Terrestrial Flora and Fauna	<ul style="list-style-type: none"> • Road kill of birds caused by car-bird collision especially at the interchange section in the vicinity of fishpond and mangrove forest • Lighting in the interchange area may give adverse impacts on the mangrove forest facing the Cansaga Bay, which is considered a potential birds roosting area 	<ul style="list-style-type: none"> • Install road sign warning with birds and KBA • Install recessed lighting system at the interchange area near the mangrove forest • Consider the installment of bird-car collision prevention poles/fences based on the results of the Biodiversity Survey (detailed bird survey) planned at the early stage of DD • Consider the development of wetland park based on the results of the Biodiversity Survey (detailed bird survey) planned at the early stage of DD • Conduct a semi-annual bird monitoring 	DPWH., Contractor, Site Manager		ECC, SOP
Waste disposal (Roadside)	<ul style="list-style-type: none"> • Pollution from littered uncollected garbage 	<ul style="list-style-type: none"> • Improvement/enhancement of current wastes disposal practices and implementation of the Solid Waste Management (SWM) plan 	DPWH., facilities Manager, LGU		ECC, policy, operational guidelines
WATER					
Water Quality	<ul style="list-style-type: none"> • Accidental releases of fuel, oil, lubricant and other chemicals due to maintenance work finding its way to waterways • Wastewater from maintenance works 	<ul style="list-style-type: none"> • Proper handling of oil and lubricants to prevent spillage and contamination of surface and ground waters; (Storage of oil and lubricants in secure areas/places) • Paint cans, containers of oil, lubricants should be clean and chips, residues should be properly disposed 	DPWH., facilities Manager, LGU	Part of Maintenance Cost of the Facilities:	ECC, policy, operational guidelines

Env. Component likely Affected	Pollution/Impact Source & Potential Impact	Prevention or Enhancement/ Mitigation Measures	Responsible Party	Est. Cost/	Guarantee
	<ul style="list-style-type: none"> Contamination/degradation of water quality due to drainage outfall 	<ul style="list-style-type: none"> Adequate maintenance of drainage line/canal (e.g. desilting) and putting-up of catch basins (silt trap) at regular interval. 	DPWH., facilities Manager, LGU		ECC, policy, operational guidelines
	<ul style="list-style-type: none"> Contamination/degradation of water quality due to storm water run-off/discharge 	<ul style="list-style-type: none"> Care and maintenance of greeneries, ground cover – specifically, those along the riverbanks and shorelines that would retard storm water run-off and screen discharge of pollutants to surface waters Set up filters and catch basins for storm drains, to prevent possible pollutants from being flushed into the sea Conduct a semi-annual water quality monitoring 			
Oceanography & Marine water quality	<ul style="list-style-type: none"> Sedimentation of marine water Contamination of marine water by pollutants 	<ul style="list-style-type: none"> Regular maintenance of drainage system (e.g. desilting) Care & maintenance of greeneries, ground cover – specifically, those along the shorelines that would retard run-off from flowing into open waters 	DPWH	Operational budget (TBD)	ECC, Admin policy, operational guidelines
Aquatic Flora and Fauna	<ul style="list-style-type: none"> Lighting along the bridge may give adverse impacts on fish in the ocean Deterioration of habitat due to release of contaminants, chemicals, liquid wastes, and sediment-laden run-off from uncleaned/dirty area of maintenance work sites 	<ul style="list-style-type: none"> Set up a type of light which does not irradiate the sea surface and outside of the bridge Proper handling of oil and lubricants to prevent spillage and contamination of sea water (i.e. storage of oil and lubricants in secure areas/places) 			
AIR					
Noise	<ul style="list-style-type: none"> Traffic Noise 	<ul style="list-style-type: none"> Installment of 2m-height noise barriers on the 1m height handrails 	DPWH	Operational budget (TBD) Cost of Noise barriers PhP 176,880,000	ECC, Admin policy, operational guidelines
PEOPLE					
Public Health	<ul style="list-style-type: none"> Health/Accident 	<ul style="list-style-type: none"> Submission of medical certificate of workers to the contractors 	DPWH, Contractor	Operational budget (TBD)	ECC, Admin policy, operational guidelines
Socio-Economics	<ul style="list-style-type: none"> Enhance income-generation, livelihood opportunities for local residents 	<ul style="list-style-type: none"> Continued employment of local people Provision of livelihood assistance and training program for PAPs 	DPWH	Operational budget (TBD)	ECC, Admin policy, operational guidelines

6. ENVIRONMENTAL COMPLIANCE MONITORING

Section 9 of the DAO 2003-30 Implementing Rules and Regulations prescribed the monitoring of projects with ECCs through the following: Self-monitoring and Third Party Audit, and the Multi-Partite Monitoring Team. It also prescribed the establishment of an Environmental Guarantee Fund (EGF).

6.1 Self-Monitoring Plan

An Environmental Unit (with the Pollution Control Officer) – specifically established for the 4th Cebu-Mactan Bridge -Mandaue Coastal Road Project shall undertake self-monitoring a during the construction and operation phases of the project to determine the project's impacts on the receiving environment. The EU/PCO will be tasked to regularly submit its Compliance Monitoring Report (CMR) and Self-Monitoring Reports (SMR) that will serve as reference/indication that the project has complied with its environmental requirements.

Monitoring activities, basically, focused on the compliance to the ECC conditions and the project's Environmental (Impact) Management Plan, and monitor the effectiveness of environmental measure on prevention of actual project impact.

For social impacts – the Right of way Action Plan/Resettlement Action Plan (RAP) will be prescribing an institutional arrangement/ mechanism that will implement the RAP recommendations- such as, livelihood programs and projects and social services.

The Proponent may commission third party experts to undertake monitoring on its behalf. The third party monitoring agent (TPMA) shall be tasked to perform all environmental compliance and monitoring activities in behalf of the project proponent (DPWH). It shall closely coordinate with the stakeholders, organize and undertake IEC meetings prepare and submit CMRs and SMRs, compile monitoring reports, and regularly update the DPWH on the progress of such activities.

The stakeholders consist of the following:

- (i) Affected Barangay Local Government Units (BLGU);
- (ii) DENR-EMB7;
- (iii) City Engineering Office of City of Mandaue and Lapu-lapu City;
- (iv) City Health and Sanitation Office of City of Mandaue and Lapu-lapu City;
- (v) City Waste Management and Disposal Department of City of Mandaue and Lapu-lapu City;
- (vi) Cebu Police District
- (vii) Traffic Management Group of City of Mandaue and Lapu-lapu City
- (viii) Fisheries-related offices (i.e. MAO, MFARMC, BFARMCs, etc.)
- (ix) Mactan-Cebu Bridge Management Board (MCBMB)
- (x) Utility companies
- (xi) Locally accredited NGOs (e.g. Haribon Foundation) and POs in the affected communities
- (xii) Ecosystem experts from University of Philippines, Cebu; and
- (xiii) Other sectors that may be identified prior to implementation of the Project

Significant environmental impacts stated in the EMP are not expected to persist after the construction phase, and could be addressed through the mandates of concerned LGUs. The engagement of the TPMA may be terminated upon project completion and upon compliance with the decommissioning plan.

6.2 Multi-Sectoral Monitoring Framework

MMTs are organized to encourage public participation, to promote greater stakeholder vigilance and to provide appropriate check and balance mechanisms in the monitoring of project implementation. The MMT is recommendatory to EMB.

According to DAO 2017-15, section 16.1, MMTs shall only be for Environmentally Critical Projects (ECP). Given that the 4th Cebu-Mactan Bridge-Mandaue Coastal Road project is Category B: Non-ECP project, so that the formation of an MMT will not be required.

The Environmental Management Bureau-7, through its Monitoring Section, will continue to monitor the project's compliance to its ECC conditions and Environmental Management Plan

Provided in Table 6.2.1 is the Third Party Monitoring Agent (TPMA) framework for the proposed Project. It presents the envisioned list of stakeholders who would play a role in the monitoring activities, the basis for selecting them, and their proposed role and responsibilities.

Table 6.2.1 Third Party Monitoring Framework

	Members	Basis of Selection	Role and Scope of Monitoring Activity
1	DENR EMB-7	DENR Representative	<ul style="list-style-type: none"> • Ensures strict adherence with the policies and implementing rules and regulations governing the preparation and submittal of the CMRs and SMRs; • Initiates transmittal to the EMB Central Office for resolution, regional or project specific issues where consensus or decisions cannot be made at the regional level; and • Concurs with and sign the CMRs and SMRs
2	DPWH	Implementing Agency	<ul style="list-style-type: none"> • Provides necessary budget/funds for the monitoring activities; • Makes available to the third party monitoring agent all project information, such as the EMP necessary to determine compliance with the environmental requirements and commitments to the extent that such information is not subject to any restrictions and confidentiality; • Coordinates with, and allows the TPMA to inspect and observe construction and operation activities of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road Project; and • Reviews and signs the TPMA monitoring reports
3	DENR-FMB	Responsible for the greening program	<ul style="list-style-type: none"> • Designates a representative who shall participate in actual monitoring work of DENR-designated reforestation area; • Concurs with and signs the TPMA monitoring reports
4	Barangay Chairpersons	As representative of the communities affected by the Project	<ul style="list-style-type: none"> • Advises the TPMA of any complaints, information or reports from LGUs concerning the Project; • Concurs with and signs the TPMA monitoring reports; and • Participates in meetings provided for in the IEC Framework so that they can provide feedback to affected communities
5	Ecosystem experts from University or NGOs		<ul style="list-style-type: none"> • Advises the TPMA on ECO Systems concerning the Project; • Concurs with and signs the TPMA monitoring reports; and • Participates in meetings provided for in the IEC Framework so that they can provide feedback to affected communities

6.3 Environmental Guarantee Fund

The EMB7 shall determine if an Environmental Guarantee Fund (EGF) will put-up for the 4th Cebu-Mactan Bridge-Mandaue Coastal Road Project, if the project pose a significant public risk or where the project requires rehabilitation or restoration (see Table 6.3.1). The EGF shall be used to implement damage prevention measures, environmental education, scientific or research studies, IEC, training on environmental risk or response to environmental accidents. In the case of the 4th Cebu-Mactan Bridge-Mandaue Coastal Road Project, public risk is presumed through the presence of activities and/or structures that could endanger life, property and the environment in case of failure.

Table 6.3.1 Environmental Monitoring Plan (EMoP)

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPL) MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
I. PRE-CONSTRUCTION PHASE													
LAND													
Geology	Ground shaking, ground rupture	Situation of ground	Site-specific seismic risk characterization	Once during the DD	All the project affected area (at the buildings along the ROW)	DPWH	To be included in engineering cost						
Soil Pollution	Soil pollution near the dump site	Aldrin, Chlordane, Total DDT (DDT+DDE+DDD), Dieldrin, Endrin, Heptachlor, HCB, Mirex, Toxaphene, PCBs Total, Dioxins (I-TEQ)	Soil Sampling and Analyses in accordance with the prescribed procedures described in DMC 2017-03	Semi-Annual during the DD	At one (1) sampling location: Umapad dumpsite	Mandaue CENRO, Pollution Control Officer (PCO) of the Contractor	Total sampling cost shall be determined during implementation of the project	Landfill Post-Closure Action plan to address soil contamination at the Umapad landfill site.	Screening values for soil described in DMC 2017-03	Landfill Post-Closure Action plan to address soil contamination at the Umapad landfill site.			
Terrestrial Flora	Cutting of trees along the alignment	Volume of trees cut	Ocular inspection	Daily during site clearing along the ROW	All the project affected area (along the ROW)	DPWH-ESSD, PCO of the Contractor	Part of the operational funds of the Project Management Office for monitoring/management	-	-	-			
Terrestrial Flora	Replacement of cut trees along alignment (incl. relocation and compensatory plantation)	Survival rate of the seedlings planted	Ocular inspection	Quarterly (until the 3-year maintenance period is completed)	Designated tree planting site and/or reforestation area designated by the DENR	DPWH-ESSD, PCO of the Contractor	Monitoring cost part of Tree Plantation Management & Maintenance budget TBD	Agreement with DPWH, CENRO & City/Brgy Govt for trees planted within the vicinity of the alignment. Agreement with govt or NGO parties for trees planted outside of Mandaue/ Lapulapu	85-90% survival rate of the seedlings planted as prescribed by the DENR Central Office	Agreement with DPWH, CENRO & City/Brgy Govt for trees planted within the vicinity of the alignment. Agreement with govt or NGO parties for trees planted outside of Mandaue/ Lapulapu			

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPL) MANAGEMENT SCHEME						
								EQPL RANGE			MANAGEMENT MEASURE			
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit	
Protected Area/Terrestrial Flora and Fauna	Disturbance to KBA	Population Count, Flying Route & Altitude, Roosting Area , , etc	Ocular inspection	Quarterly (until the 3-year maintenance period is completed)	KBA/IBA	DPWH-ESSD, PCO of the Contractor, Local expert	To be determined							
PEOPLE														
Public Involvement	Informed/empower the public to participate in the decision-making process	Number of participants, attributes (sex, age, occupation, etc.)	Information. Education, and Communication (IEC)	Monthly during Construction Phase or as needed	All the project affected area	DPWH-ESSD, RIC	To be determined							
Involuntary Resettlement for PAPs	Displacement of commercial establishments along the proposed alignment	Compensation for affected land, structures and improvements	Consultation Meeting and Survey with PAPs	Monthly until resettlement is fully completed	Affected families	DPWH-ESSD, RIC	To be determined and finalized during the RAP updating in the Detailed Engineering Design Phase							
	Improvement of living conditions	Resettlement of Informal Settlers Families (ISFs) to the relocation sites	Consultation Meeting and/or Survey with the PAPs	Semi-annually until the end of livelihood restoration program	Affected barangays	DPWH-ESSD, RIC	To be determined and finalized during the RAP updating in the Detailed Engineering Design Phase							

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPL) MANAGEMENT SCHEME						
								EQPL RANGE			MANAGEMENT MEASURE			
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit	
Basic Service Utilities/Infrastructure	Relocation of utilities along right of ways	Relocation of electric poles, water lines, communication lines, etc.	Ocular inspection	Annual	Affected utilities along right of ways	DPWH-ESSD, RIC	To be determined							
II. CONSTRUCTION PHASE														
LAND														
Land Use Pattern, Zoning	Change/Disturbance in land use pattern	Change of land use	IEC	Monthly during Construction Phase or as needed	All the project affected area	DPWH,LGU	To be determined							
Cumulative Impacts from Mandaue Reclamation Project	Cumulative impacts including increased land use change, noise, water pollution, dust and emissions, traffic by construction vehicles, restriction of access to sea water by local fisher folks	According to monitoring data of land use change, noise, water pollution, dust and emissions, traffic	IEC	According to each monitoring data	All the project affected area	Mandaue City CENRO, PCO of Contractor	To be determined							
Topo., Geology	Alteration in topography, soil disturbance and loss of top soil	Rate of land modification	Ocular inspection	Quarterly (until the 3-year maintenance period is completed)	All the project affected area	ESHO of the Contractor	To be determined							
Soil erosion	Slope failure, soil runoff and movement of excavated soil to waterways	Situation of soil runoff and movement on slopes	Ocular inspection	Quarterly (until the 3-year maintenance period is completed)	All the project affected area (Slopes and waterways)	ESHO/PCO of the Contractor	To be determined							

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPL) MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
Soil Pollution	Soil pollution	Cu Other parameters to be decided in consultation with DENR-EMB	Soil Sampling and Analyses in accordance with the prescribed procedures described in DMC 2017-03	Semi-Annual (dry and wet season)	At three (3) sampling locations: 1. Northern side of fishpond 2. Southern side of fishpond 3. C-St1 Landfill	PCO of the Contractor	Total sampling cost shall be determined during implementation of the project	-		Screening values for soil described in DMC 2017-03	DPWH, LGU, DENR & contractor agreement on strategies-actions to address exceedance of standard limits		
Soil contamination	Soil contamination due to oil on lubricant spill	Oil spill	Ocular inspection	Weekly Immediately after the spills	All construction sites	PCO of the Contractor and DPWH	To be included in engineering cost						
Solid waste Management	Generation of solid waste; Land and water contamination; aesthetic impacts; spread of diseases	Proper waste management and disposal	Checking compliance to RA 9003 – Ecological Solid Waste Management Act and RA 6969 – Toxic and Hazardous Substances	Weekly	All construction sites	PCO of the Contractor and DPWH	To be included in engineering cost						
Terrestrial Fauna	Continued use of wetland area as feeding ground by migratory birds	Species and number of migratory birds	Ocular inspection	Every two months (Joint monitoring with DENR-CENRO to complement their quarterly monitoring)	Wetland areas near the interchange section	DENR-CENRO	To be determined during DED						

WATER

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPL) MANAGEMENT SCHEME						
								EQPL RANGE			MANAGEMENT MEASURE			
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit	
Hydrology / Oceanographical Conditions	Disruption of natural drainage pattern and increase in run-off	Situation of soil runoff and movement on slopes	Ocular inspection	Quarterly (until the 3-year maintenance period is completed)	All the project affected area (Slopes and waterways)	ESHO/PCO of the Contractor	To be determined							
Water Quality	Water contamination	pH, Oil & Grease, BOD, Total and Coliform Fecal, COD, and TSS	Water Sampling and Analyses in accordance with the prescribed procedures described in DAO 2016-08	Quarterly	At four (4) sampling locations: B-St1 Upstream Mactan Channel B-St2 Downstream Mactan Channel B-St3 Near Coastal Road Mactan Channel B-St4 Downstream Butuanon River	PCO of the Contractor	Total sampling cost (approx. PhP43,000) shall be determined during implementation of the project	-		For Class "D" freshwater and "SC" marine water	DPWH, LGU, DENR & contractor agreement on strategies-actions to address exceedance of standard limits			
Water Supply	Competing use with the community	Usage situation of water supply	IEC	Monthly during Construction Phase or as needed	All the project affected area	DPWH, LGU	To be determined							
Aquatic Flora and Fauna	Removal of direct physical injury to aquatic flora and fauna	Result of monitoring for aquatic flora and fauna	Ocular inspection	Monthly during Construction Phase or as needed	All the project affected area	ESHO/PCO of the Contractor	To be determined							
	Vibration/disturbance from pile-driving	Vibration during construction	Ocular inspection	Monthly during Construction Phase or as needed	All the project affected area	ESHO/PCO of the Contractor	To be determined							

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPL) MANAGEMENT SCHEME					
								EQPL RANGE			MANAGEMENT MEASURE		
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit
II. CONSTRUCTION PHASE													
AIR (Air Quality and Noise Level)													
Air Quality	Increase in particulate matter and gaseous air contaminants	TSP, PM10, NO ₂ , and SO ₂	Air quality sampling and analyses using the following methodologies: 1. TSP, PM10 High Volume-Gravimetric Method; 2. SO ₂ Impinger-Pararosaniline Colorimetric Method; 3. NO ₂ Impinger-Griess Saltzman Reaction Method <i>Note: 24-hour sampling at each stations</i>	Quarterly	At three (3) sampling locations: A-St1 National High School A-St2 Village Social Housing Area A-St3 Commercial/Mall	PCO of the Contractor	Total sampling cost (approx. PhP433,000) shall be determined during implementation of the project	–	TSP				
Noise level	Increase in noise level	Noise level (dBA)	<i>Note: 24-hour sampling at each stations</i>	Quarterly	At three (3) sampling locations: A-St1: National High School A-St2: Village Social Housing Area A-St3: Commercial/Mall	PCO of the Contractor	Including the air quality sampling		Standard for areas directly facing four-lane roads for Class AA Class A and Class B	DPWH, LGU, DENR & contractor agreement on strategies-actions to address exceedance of standard limits			
PEOPLE													
ROW Conflict on Fishery and	Loss/limitations and hindrance of access by vessels to	Content of the complaint	IEC	Monthly during Construction	All the project affected area	ESHO/PCO of the Contractor	To be determined						

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPL) MANAGEMENT SCHEME						
								EQPL RANGE			MANAGEMENT MEASURE			
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit	
its related industry	establishments with port/docking facilities			Phase or as needed										
In-migration	Construction workers and staff will require temporary housing	Situation of temporary housing	Ocular inspection	Monthly during Construction Phase or as needed	All the project affected area	ESHO/PC O of the Contractor	To be determined							
Occupational Health and Safety	Increased risk of accidents due to improper work ethics	Number of accidents	IEC	Monthly during Construction Phase or as needed	All the project affected area	ESHO/PC O of the Contractor	To be determined							
Local economy (Employment and livelihood)	Enhancement of employment and /or livelihood opportunity that will lead to economic growth.	Number of workers and means of livelihood	IEC	Monthly during Construction Phase or as needed	All the project affected area	DPWH	To be determined							
Traffic Congestion	Aggravation of existing traffic problem	<ul style="list-style-type: none"> • Implementation of TMP approved by City Traffic Management; • Implementation of minimized restriction of traffic flow during day time hours; • Implementation of equipment move-in at non-peak day-time; • Implementation of placement of traffic decking in stages; • Limitation of parking of idle dump trucks 	Ocular inspection	Weekly	At critical traffic areas	ESHO/PC O of the Contractor	Included in the construction cost	–		–		–		

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPL) MANAGEMENT SCHEME						
								EQPL RANGE			MANAGEMENT MEASURE			
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit	
		and other construction vehicles along the constructed area; • Designation of well-trained traffic aide/flagman at critical construction areas.												
Social Service Utilities	Possible long-term interruption of basic social service utilities	Power and water supplies	IEC	Monthly during Construction Phase or as needed	All the project affected area	ESHO/PCO of the Contractor	To be determined							
Public Health	Possible spread of communicable diseases due to abandoned wastes	Number of patients with communicable diseases	IEC	Monthly during Construction Phase or as needed	All the project affected area	ESHO/PCO of the Contractor	To be determined							
III. OPERATION PHASE														
LAND														
Soil pollution	Soil contamination from accidental releases of chemicals, fuel, oil, lubricants	Situation of soil contamination	Ocular inspection	Semi-annual	All the project affected area	PCO of the DPWH	To be determined							
Terrestrial Flora	Replacement of cut trees	Survival rate of the seedlings planted	Ocular inspection	Quarterly (until the 3-year maintenance period is completed)	Designated tree planting site and/or reforestation area designated by the DENR Central Office	ESHO/PCO of DPWH	To be determined and finalized during implementation of the project based on current	-						

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPL) MANAGEMENT SCHEME						
								EQPL RANGE			MANAGEMENT MEASURE			
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit	
							prices of seedlings							
Terrestrial Fauna	Continued use of wetland area as feeding ground by migratory birds	Species and number of migratory birds	Ocular inspection	Semi-annual (northward migration and southward migration periods)	All the project affected area	DENR-CENRO	To be determined during DED							
Waste disposal (Roadside)	Pollution from littered uncollected garbage	Situation of uncollected garbage on roadside	Ocular inspection	Semi-annual or as needed	All the project affected area	ESHO/PCO of DPWH	To be determined during DED							
WATER														
Water Quality	Accidental releases of fuel, oil, lubricant and other chemicals, contamination/degradation of water quality	Accidental releases record	Ocular inspection	Semi-annual or as needed	All the project affected area	PCO of the DPWH	To be determined during DED							
Oceanography	Sedimentation of marine water	Water quality	Ocular inspection	Semi-annual or as needed	All the project affected area	ESHO/PCO of DPWH	To be determined during DED							
Aquatic Flora and Fauna	Deterioration of habitat due to lighting along the bridge and release of contaminants, chemicals, liquid wastes, etc.	lighting system and water quality management	Ocular inspection	Semi-annual or as needed	All the project affected area	DENR-CENRO	To be determined during DED							
AIR														
Noise	Traffic Noise	Noise level (dBA)	<i>Note: 24-hour sampling at each stations</i>	Semi-annual or as needed	At three (3) sampling locations: A-St1: National High School	PCO of the DPWH	To be determined during DED					Standard for areas directly facing		

Key Environmental Aspects per Project Phase	Potential Impacts per Environmental Sector	Parameter to be Monitored	Sampling Methodology and Measurement Plan			Lead Person	Annual Estimated Cost	ENVIRONMENTAL QUALITY PERFORMANCE LEVELS (EQPL) MANAGEMENT SCHEME						
								EQPL RANGE			MANAGEMENT MEASURE			
			Method	Frequency	Location			Alert	Action	Limit	Alert	Action	Limit	
					A-St2: Village Social Housing Area A-St3: Commercial/Mall					four-lane roads for Class AA Class A and Class B				
PEOPLE														
Public Health	Health/Accident	Situation of health and accident	IEC	Annual	All the project affected area	ESHO/PCO of DPWH	To be determined during DED							
Socio-Economics	Enhance income-generation, livelihood opportunities for local residents	Number of workers and means of livelihood	IEC	Annual	All the project affected area	ESHO/PCO of DPWH	To be determined during DED							
<p><i>Note:</i> ESHO – Environment Safety and Health Officer TMP – Traffic Management Plan PCO – Pollution Control Officer DPWH – Department of Public Works and Highways DENR-EMB – Department of Environment and Natural Resources-Environmental Management Bureau LGU – Local Government Unit; DAO – DENR Administrative Order BOD – Biochemical Oxygen Demand TSP – Total Suspended Particulates TSS – Total Suspended Solids IEC – Information, Education, and Communication ESSD-Environmental Social Safeguards Division RIC-Resettlement Implementation Committee CENRO-Community Environment and Natural Resources Office</p>														

7. SOCIAL DEVELOPMENT PLAN (SPD) AND INFORMATION, EDUCATION AND COMMUNICATION (IEC) FRAMEWORKS

7.1 Social Development Plan

The 4th Cebu-Mactan Bridge -Mandaue Coastal Road Project Right of way Action Plan /Resettlement Action Plan (RAP) have provisions for compensation and entitlements for Project Affected Families-including livelihood assistance programs and social services.

The Social Development Plan basically adopts and implements the 4th Cebu-Mactan Bridge -Mandaue Coastal Road Project's RAP, which provides the mechanism for compensation and entitlements for Project Affected Families-including livelihood assistance programs and social services.

Consistent with the goal of the SDP, the preparation of the RAP is to ensure that the views and voices of the PAPs both individuals and organizations affected by the project are adequately heard and that they are compensated and provided necessary support and assistances that enable them to enjoy a standard of living that is equivalent or higher than that prior to the project.

The project's compensation policy and package were developed in consultation with DPWH and other concerned government bodies such as Mandaue City and Lapu-Lapu City reflecting also the views of other stakeholders, PAPs and project-affected companies in particular, that had been collected through different means of consultations.

The RAP noted the following has the following components:

Livelihood Restoration Program

The objective of the Livelihood Restoration Program (LRP) is to assist PAPs whose livelihoods are directly adversely affected by the Project for restoring their income generating capacity to at least pre-project levels.

Livelihood Restoration of Business Entities and Employees

The following measures will be taken with an aim to restore and improve the livelihood of business entities and their employees affected by the project. One of the constraints surrounding the project is the fact that available land is limited in or around the project site. This constraint is of particular concern to the business entities operating on the economic zone (i.e. PEZA). It is therefore considered important and helpful to provide assistance to those business entities willing to continue operating on PEZA in searching for a land suitable for such business operators in collaboration with PEZA.

Livelihood Restoration of Displaced Persons and Vulnerable Groups

The LRP for individuals including displaced employees is designed based on the existing relevant programs at the national, regional, provincial and LGU levels. While DPWH carries the ultimate responsibility for the program, LGUs are expected to play an equally, if not more, important role in ensuring that the PAPs' livelihood is restored and/or improved in a long run and that the LRP is in line with the existing programs and institutions which will include: Vocational Trainings, mainstream employment information and referral, project employment opportunities, financial management and entrepreneurial training, and other additional support for vulnerable persons.

7.2 Information, Education and Communication

There are two types of IEC activities for this project: 1) IEC during the undertaking of the EIA study, review and approval process (see Section 2.3) and, 2) After the issuance of the ECC-where the project's ECC conditions and the Project's Environmental Management Plan (EMP) will be communicated to the stakeholders and the surrounding communities.

Table 7.2.1 Information, Education, and Communication (IEC) Framework

Target Sector	Major Topics	IEC Scheme/Strategy Methods	Information Medium	Indicative Timelines and Frequency	Indicative Cost
Mandaue and Lapu-lapu Cities: local Officials:- Mayor, Councilors, Dept. Heads (esp. Planning and Engineering), and Barangay Captains of the affected Barangays	<ul style="list-style-type: none"> • Project Description • EIA findings • Project (EIA) ECC/EMP • Envi. Monitoring plan 	<ul style="list-style-type: none"> • Kick-off Meeting 	<ul style="list-style-type: none"> • Slide Presentation • Minutes of meetings 	<ul style="list-style-type: none"> • After issuance of project's ECC (amendment), prior to start of project construction 	<ul style="list-style-type: none"> • TBD
Affected BLGUs	<ul style="list-style-type: none"> • Presentation of Project Status • Role of BLGUs in SDP • Issues, concerns, of BLGUs 	<ul style="list-style-type: none"> • Kick-off Meeting • Coordination Meeting 	<ul style="list-style-type: none"> • Slide Presentation • Minutes of meetings 	<ul style="list-style-type: none"> • Monthly during Construction Phase or as needed 	<ul style="list-style-type: none"> • P20,000/month
Affected Families and SMEs	<ul style="list-style-type: none"> • Presentation of Project Status • Explanation of the grievance redress process in the vernacular, making sure that each process is well understood by the project-affected persons • Presentation of the livelihood restoration plan (LRP) 	<ul style="list-style-type: none"> • Consultation Meetings 	<ul style="list-style-type: none"> • Slide Presentation • Minutes of meetings 	<ul style="list-style-type: none"> • Monthly during Construction Phase or as needed • During updating of LRP and every month thereafter until completion of relocation • LRP monitoring during operation stage 	<ul style="list-style-type: none"> • P80,000/yr
Affected Utility companies, if any	<ul style="list-style-type: none"> • Presentation of Project Status • Issues, concerns of utility companies 	<ul style="list-style-type: none"> • Coordination Meeting 	<ul style="list-style-type: none"> • Slide Presentation • Minutes of meetings 	<ul style="list-style-type: none"> • Weekly during Construction Phase or as needed 	<ul style="list-style-type: none"> • P10,000/month
Indirectly affected residential and commercial establishments	<ul style="list-style-type: none"> • Presentation of Project Status • Issues, concerns of residential sector • Issues, concerns of commercial sector 	<ul style="list-style-type: none"> • Consultation Meeting 	<ul style="list-style-type: none"> • Slide Presentation • Handouts 	<ul style="list-style-type: none"> • Monthly during Construction Phase or as needed 	<ul style="list-style-type: none"> • P20,000/month
Community stakeholders & Private sector representatives	<ul style="list-style-type: none"> • Project (EIA) ECC/EMP compliance • Envi. Monitoring plan 	<ul style="list-style-type: none"> • Consultation Meeting 	<ul style="list-style-type: none"> • Slide Presentation • Focus Group Discussion 	<ul style="list-style-type: none"> • Annually, after issuance of project's ECC 	<ul style="list-style-type: none"> • TBD

8. EMERGENCY RESPONSE POLICY AND GENERIC GUIDELINES

The emergency response policy and generic guidelines for the 4th Cebu-Mactan Bridge Project should focus on the following:

- Assessment of hazards in the workplace
- Identification of health, safety and environment (HSE) needs of project staff
- Training on emergency first response
- Establishment of first aid stations and other emergency facilities and procedures
- Provision of personal protective equipment (PPE)
- Formulation of regular HSE programs for project staff and workers, including conduct of regular drills on emergency response, rescue drills, fire and earthquake emergencies, etc.

The Proponent should also implement a policy on keeping all construction areas clean and free from unnecessary debris at all times to prevent accidents and emergencies in the workplace. Common accidents in construction areas include falling debris and workers stepping on pointed objects. Workers should also be required to wear PPE while in the work place. This should include helmets, facemasks, gloves, safety shoes, ear muffers, and harness particularly for workers who will be involved in construction activities in the open sea.

The Proponent and Contractor should also institute a policy on working during extreme weather conditions particularly in the offshore areas. As much as possible, activities should be confined to the land or near the land during inclement weather.

The Proponent and Contractor should also designate a full time first aider who will attend to medical emergencies. An emergency medical kit should also be stocked with adequate quantity of medicines and supplies as required in the Occupational Safety and Health Standards (OSHS).

9. ABANDONMENT/DECOMMISSIONING/REHABILITATION POLICIES

If the project will be abandoned at any time during any of the project phases, the Proponent will prepare an abandonment plan with the objective of rehabilitating the site to its pre-construction state as much as possible. The abandonment will commence with the securing of necessary permits from DENR and the LGU. Materials removed from the site will be managed according to use, type and waste category. Recyclable and reusable materials will be collected and sold or transferred to other areas while non-recyclable and residual materials will be brought to a government-approved final disposal site.

10. INSTITUTIONAL PLAN FOR EMP IMPLEMENTATION

The institutional plan shall ensure the judicious implementation of sound environmental management within the 4th Cebu-Mactan Bridge/Mandaue Coastal road areas of operation. Specifically, it aims to ensure the following (as indicated in the DAO 2003-30 Revised Procedural Manual (RPM) for the PEISS IRR):

- a) Project compliance with the conditions set in the ECC;
- b) Project compliance with the Environmental Management Plan (EMP);
- c) Effectiveness of environmental measures on prevention or mitigation of actual project impacts vis a vis the predicted impacts used as basis for the EMP design; and
- d) Continual updating of the EMP for sustained responsiveness to project operations and project impacts.

The DAO 2003-30 RPM has indicated primary actors/key players that will made-up the institutional set-up for monitoring projects issued with ECC, namely: project proponent, MMT, and the EMB. The RPM defined the roles and responsibilities of these players:

Project Proponent/DPWH:

Proponents issued ECCs are primarily responsible for monitoring their projects. The Proponent, through its Environmental Unit or Environmental Officer, is required to submit a standardized semi-annual ECC CMR to the designated monitoring EMB office on a semiannual frequency. The CMR requirement is to report performance at three (3) levels, at the minimum, as follows: a) performance against the ECC conditions; b) performance against the EMP; and c) performance against the monitoring of actual impacts (including residual impacts) as against predicted impacts in the EIA Report and as related to current project operations. The detailed report on compliance to environmental standards specific to environmental laws shall be submitted through the Self-Monitoring Report (SMR) as required by DAO No. 2003-27 on a quarterly basis to the concerned EMB RO.

The DPWH has an Environmental and Social Safeguards Division (ESSD) under the Office of the Undersecretary for Planning that is tasked to ensure the integration and implementation of environment and social safeguards.

The general function of the ESSD shall be to

- i. Prepare/reviews environment impact statement (EIS), initial environmental examination (IEE), project description (PD), environmental management plan (EMP), and Right of way action plan/resettlement action plan (RAP);
- ii. Conduct environmental assessment/screening, scoping;
- iii. Conduct monitoring of impacts and compliance of projects;
- iv. Identify and manage climate change issues and concerns (e.g. rainwater collection system, cleaning/clearing of waterways, non-structural measures, etc.);
- v. Assist in the conduct of public consultation;
- vi. Assist in the conduct of environmental sampling and monitoring;
- vii. Develop Gender and Development (GAD) plans and programs, among others.

The ESSD is divided into three (3) units, namely: (i) Environmental Safeguards Section (ESS), (ii) Social Safeguards and Right-of-Way Section (SSROW); and (iii) National Sewerage and Septage Management Program Section (NSSMP)

The ESSD is mainly responsible for monitoring the overall operation and effectiveness of the IMP during the construction and operational phases.

Based on the monitoring result, DPWH as project proponent has to update the IMP as the need arises.

An Environment Safety and Health (ESH) Officer shall be assigned by the main Contractor during the construction phase. In coordination with the Senior Environmental Specialist of Construction Supervision Consultant, he shall be responsible for implementing the Impacts Management Plan (IMP) and the Environmental Monitoring Plan (EMP)

Aside from the above-mentioned tasks, the main duties of the ESH Officer shall be to:

- i. Ensure that all other concerned supervisors and staff understand and properly undertake their responsibilities;
- ii. Ensure that environmental monitoring activities are being done promptly and in an accurate manner;
- iii. Implement an effective preventive and corrective control system, particularly in terms of environmental emergency preparedness and response procedures;
- iv. Conduct or initiate training of contractors (and sub-contractors, if any) on environmental awareness; and
- v. Collate performance data and prepare reports, which include an assessment of performance in comparison with the IMP objectives and targets, for submittal to the Construction Supervision Consultant's Senior Environmental Specialist. To ensure effectiveness of the IEC, he shall also act as a liaison between PMO-UPMO, and the primary stakeholders, particularly the LGUs concerned, other government agencies, and more importantly, the affected barangays. This task is particularly important in terms of receiving comments, views, complaints (if any), and other concerns from the stakeholders mentioned.

The main Contractor shall also engage a Safety Officer to review and recommend amendments and updates to DPWH's and authorized company circulars and bulletins pertaining to environmental safety, with special attention to the protection of human lives and properties against fire, and natural disasters such as typhoons, earthquake, and other calamities. In coordination with the ESH Officer, he shall also be in charge of posting environmental information and internal/external communications that pertain to environmental quality and safety.

Aside from these two (2) key staff, each Sub-Contractor shall be required to assign Environmental Coordinators to undertake site supervision and inspection, during the implementation of the Environmental Monitoring Plan, as well as in maintaining cleanliness and aesthetic appeal, at construction areas. Each shall be responsible for liaising with other government agencies with regards to licensing and securing permits, as required.

Pollution Control Officer (PCO). The accredited Pollution Control Officer shall have the following duties and responsibilities (DAO 21):

- (1) Attend to the requirements of the establishment or agency prior to the construction or installation of pollution control facilities including the application and securing of necessary pollution permits and renewal thereof;
- (2) Monitor activities pertaining to the installation or construction of pollution source and control facilities with the end in view of ensuring their compliance with the air, noise and water quality standards; the PCO and the head of establishment shall be held responsible for any violations of PD 984 and its implementing rules and regulations committed by establishment where the officer is employed;

- (3) Supervise the proper operation and maintenance of pollution control facilities of the establishment or agency;
- (4) Report within reasonable time to the Facility Manager the breakdown of any pollution control facility, and the estimated and actual date of completion/repair and operation;
- (5) Promptly submit validated/certified as correct by the General Manager periodic reports as stipulated in Section 7 hereof or as required by the Department (otherwise, said reports shall not be accepted as evidence in a pollution case);
- (6) As the Environmental liaison officer he shall keep himself abreast with the requirements of the DENR-EMB and the latest available technology on the prevention, control and abatement of pollution;
- (7) Maintain liaison with the city/provincial/municipal or local pollution control officers;
- (8) Attend the meetings for Pollution Control Officers which may from time to time be called by the Department;
- (9) Facilitate compliance of the establishment he represents with the requirements that may from time to time be prescribed by the DENR-EMB;
- (10) Recommend to the management the installation and operation of additional equipment for the pollution abatement facilities; and
- (11) Handle other matters of environmental concern as required by his employer.

The main Contractor shall also engage a Safety Officer to review and recommend amendments and updates to DPWH's and authorized company circulars and bulletins pertaining to environmental safety, with special attention to the protection of human lives and properties against fire, and natural disasters such as typhoons, earthquake, and other calamities. In coordination with the ESH Officer, he shall also be in charge of posting environmental information and internal/external communications that pertain to environmental quality and safety.

Aside from these two (2) key staff, each Sub-Contractor shall be required to assign Environmental Coordinators to undertake site supervision and inspection, during the implementation of the Environmental Monitoring Plan, as well as in maintaining cleanliness and aesthetic appeal, at construction areas. Each shall be responsible for liaising with other government agencies with regards to licensing and securing permits, as required.

EMB:

The EMB shall be primarily responsible for the over-all *evaluation/audit* of the Proponent's monitoring activities.

Other Parties/Stakeholders:

While the formalized multi-partite monitoring team is not anymore mandatory, other parties such as the City and Barangay local government units, National and other Government Agencies, and community/people's organization have their respective roles and responsibilities in the monitoring of project implementation and the proponent's environmental performance.

The City and Barangay government units is in the forefront in making sure that the project complies with local laws and environmental requirements including compliance to the ECC and its corresponding Environmental Management Plan (EMP) during construction and operation stage. The City's Environment and Natural Resources Office (CENRO) of both Mandaue and Lapu-lapu Cities are specifically tasked to ensure environmental protection and conservation in their jurisdictions.

The Barangay governments are usually the first to received complaints from the residents on the project's adverse impacts on the communities, thus, it has to be proactive in monitoring the project's environmental performance to avoid any untoward incidents that will negatively affect the community.

Government Agencies-aside from the EMB, such as the DENR-CENRO has specific functions to monitor project's impacts to mangroves and other environmental resources within the timberland and foreshore areas.

Resettlement Implementation Committee (RIC)

In order to ensure that the project's impacts on the affected families/households will be addressed a Resettlement Action Plan (RAP) is being prepared, with its recommendations integrated in this project's Environmental Impact Management Plan. The RAP establishes the Resettlement Implementation Committee (RIC) which is a local coordinating and consultative body organized for the implementation of RAP and set up by UPMO by entering into an MOA with concerned parties, prior to the commencement of the detail design. RIC is composed of and functions as follows.

Composition:

- City Mayor or representative
- UPMO/Field Office
- City Government Officers
- Barangay Chairperson of each affected barangay
- Representative of PAPs of each affected barangay
- Representative of non-governmental organizations operating within the jurisdiction of the city
- Representatives of assisting regional government offices such as NHA, Department of Labor and Employment (DOLE), Technical Education and Skills Development Authority (TESDA), Department of Social Welfare and Development (DSWD), Department of Trade and Industry (DTI) and others if necessary.
- Functions:
- Assist UPMO in preparing and validating the list of PAFs and affected assets
- Assist UPMO and ESSD in the conduct of consultation meetings and information dissemination of PAPs and other relevant stakeholders during RAP process
- Assist UPMO and ESSD in monitoring the implementation of RAP during the process
- Assist the City Government in the enforcement of laws and ordinances regarding encroachment into the ROW of the Project in coordination with concerned government agencies.
- Receive complaints and grievances of PAPs and other stakeholders and act accordingly
- Maintain record of all public meetings, complaints and actions taken to address complaints and grievances

With the above serving as reference/guidelines, the institutional set-up/arrangements during construction and operation phases of the project are exhibited in Figure 10-1 and Figure 10-2.

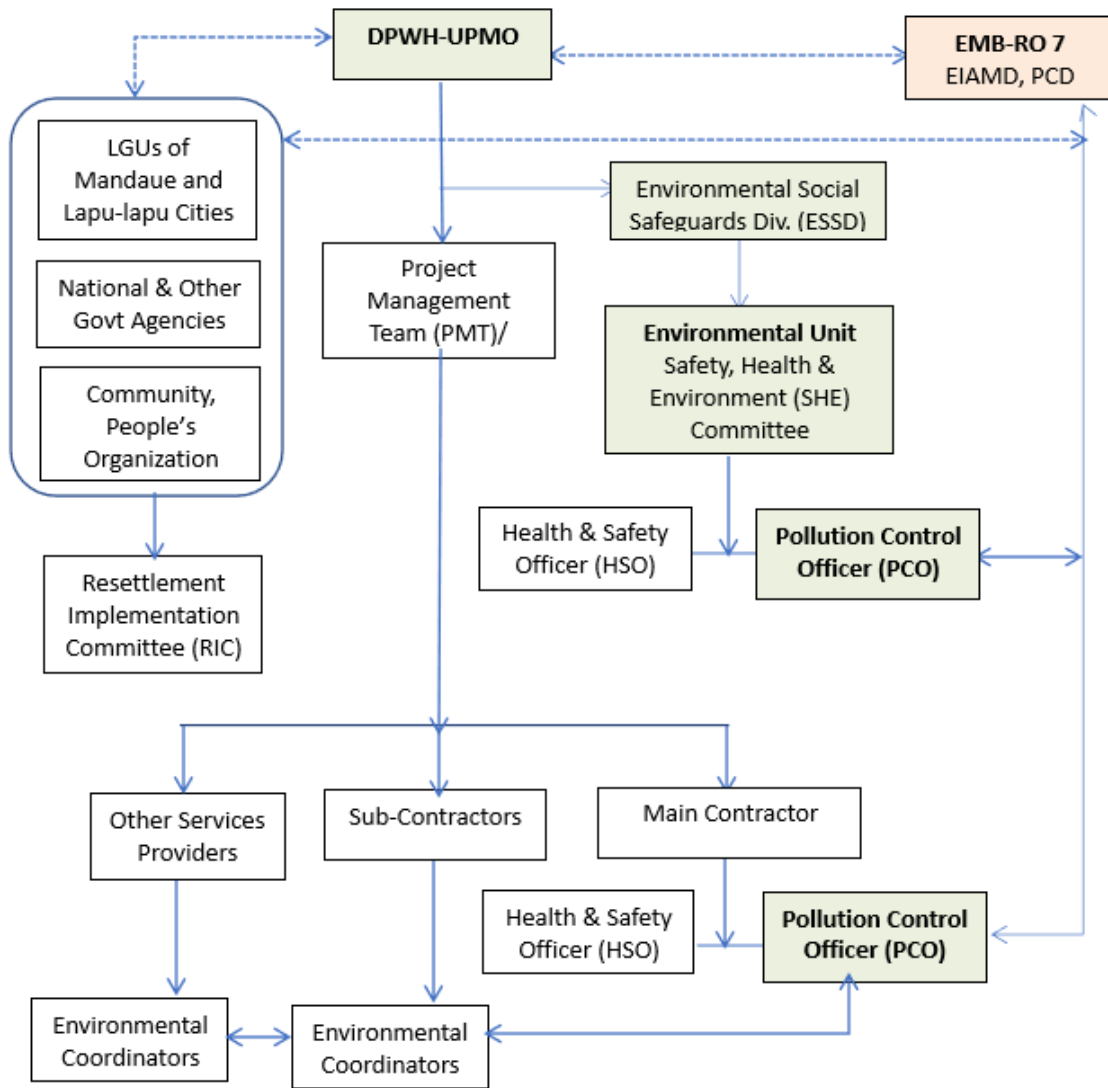
During construction and operation stages of the New Mactan Bridge and Coastal Road project, the DPWH-UPMO being the designated project proponent has the primary responsibility in ensuring compliance to the ECC provisions and its Environmental Impact Management Plan. In both stages, it will be the ESSD and its Environmental Unit that will be directly in-charge to handle the management and technical works necessary to comply with the environmental requirements of the project. It will also coordinate and provide the necessary information and assistance to the other parties in fulfilling their respective monitoring responsibilities, such as the EMB, LGUs, other government agencies, people's organization and the stakeholders. The ESSD is also a member of the RIC, thus, it also has the primary responsibility for the RAPs implementation.

During the construction stage, the main project contractor will have its own environmental unit and PCO to ensure compliance to the Construction Environmental Management Plan. The sub-contractors, will have at least an environmental coordinator to monitor their activities and environmental performance.

A Project Management Team or Project Management Office (PMO) will be establish on-site to directly manage the construction activities, including environmental compliance monitoring.

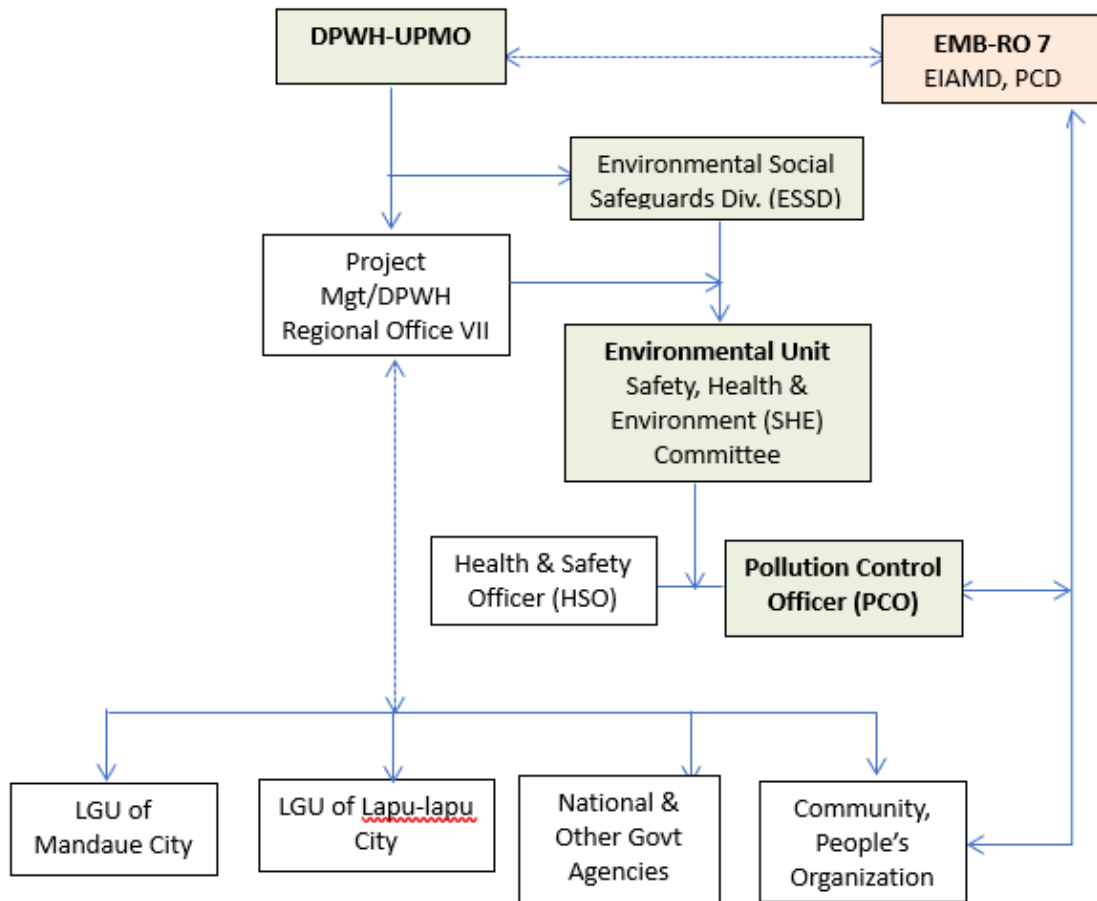
During the Operation stage of the project -as this is in the long-term, the DPWH Regional Office maybe designated by the DPWH-UPMO to monitor and comply with the environmental requirements. However, it will have an Environmental Unit/PCO solely designated for the New Mactan Bridge and Coastal Road -which, aside from complying documentary requirements for the facility's environmental performance, also include attending to and monitoring the bridge/coastal road infrastructure pollution source and control facilities with the end in view of ensuring their compliance with the air, noise and water quality standards and to handle other matters of environmental concerns.

The other parties such as the LGUs, other government agencies, people's organization and stakeholders will continuously monitor and vigilant on the facility's environmental performance during its operational life.



Source: JICA Study Team

Figure 10-1 Institutional Arrangement Schema during Construction Stage



Source: JICA Study Team

Figure 10-2 Institutional Arrangement Schema during Operation Stage

Annex-1 Zoning Certificate

Annex-1.1 Zoning Certificate from Lapu-Lapu City



*Republic of the Philippines
City of Lapu-Lapu 6015
Tel. No: 340-0020 | Telefax: 340-7323
Office of the City Planning and Development*

CERTIFICATION

TO WHOM IT MAY CONCERN:

This is to certify that as per City Ordinance No. 13-200-2016 (Comprehensive Zoning Ordinance of the City of Lapu-Lapu) the areas covered by the route alignment of the New (4th) Mactan Bridge Construction within Lapu-Lapu City had been zoned as Commercial and Industrial.

This certification is issued as a requirement by the Environmental Management Bureau-Regional Office VII relative to the application for Environmental Impact Assessment/Environmental Compliance Certificate (EIA/ECC) of the above-stated project.

Done this 7th day of May, 2019, at Lapu-Lapu City.


PERLA T. AMAR, C.E., EnP
City Planning & Devt. Coordinator



Annex-1.2 Zoning Certificate from Mandaue City

Republic of the Philippines
Province of Cebu
City of Mandaue
CITY PLANNING & DEVELOPMENT OFFICE



G/F City Hall Building, P. Zamora St.
Centro, Mandaue City
Cebu, 6014, Philippines
Tel. No. 230-4500 loc. 1058, 1059
www.mandauecpdo.com

CERTIFICATION


TO WHOM IT MAY CONCERN:

This is to certify that the land use classification of the areas covered by the route alignment and adjacent zones of the **Mandaue Coastal Road and the New (4th) Mactan Bridge Construction** based on their submitted alignment are identified as **PLANNED UNIT OF DEVELOPMENT ZONE I (Civic and Trade Center Development), INSTITUTIONAL ZONE, LOW DENSITY COMMERCIAL ZONE, MEDIUM DENSITY COMMERCIAL ZONE, MEDIUM DENSITY INDUSTRIAL ZONE, AQUACULTURE ZONE, PARKS/OPEN SPACE ZONE AND PLANNED UNIT OF DEVELOPMENT ZONE IV (Recreation and Tourism Development)** respectively as per City Zoning Ordinance No. 14-2016-1119 otherwise known as the Comprehensive Zoning Ordinance of Mandaue City as amended.

This certification is issued per request of **TOMOYUKI KONISHI, TEAM LEADER OF JICA SURVEY TEAM**, as a requirement for their application for Environmental Impact Assessment/Environmental Compliance Certificate (EIV/ECC) from the Environmental Management Bureau- Regional Office VII and for whatever legal purpose it may serve and is without prejudice to further land classification the City of Mandaue may declare.

Mandaue City, Philippines
July 18, 2019

Approved by:


ARCH. T. MARLO D. OCDEASA
CPDO- COORDINATOR

Mandate :

In-charge of the Planning and Development of the City as mandated Under Section. 476, Article. VI of the Local Government Code Philippines (R.A. 7160)

Annex-2 EMB Scoping Check List

ANNEX 2-7a
SCOPING and PROCEDURAL SCREENING CHECKLIST FOR ENVIRONMENTAL IMPACT STATEMENT (EIS)

EIS SCOPING AND PROCEDURAL SCREENING CHECKLIST

Project Name	NEW MACTAN BRIDGE CONSTRUCTION PROJECT	Project Location	Barangay Municipality/City Province Region
Proponent Name	DPWH Region VII	Proponent Address	Mantabue - Lapu-lapu Cebu VII
Proponent Contact Person	ENGR. EDGAR B. TABACON, RD	Proponent Means of Contact	SRP, Cebu City
EIA Consultant	ENGR. ANDRES MINEGO, JICA	Landline No : Mobile No :	Fax No : Email :
EIA Consultant Contact Person	ENGR. ANDRES MINEGO	Consultant Address	Cebu City
EMB/DENR Scoping Representatives	KMBONTO, FVBARRIGA, AGDIRAY	Consultant Means of Contact	Fax No : Email :
		Place of Scoping	DPWH Region VII, SRP, Cebu City
		Date of Scoping	March 6, 2019

NOTES:

- 1) The EIA Report shall have about 250 pages, for management purposes, inclusive of all summaries, main report and all attachments. The suggested lay-out specifications are as follows: Font 10 Arial, single space, justified margin; no indentations; 1" margin all around, A4 bond size, back to back printing; continued numbering of paragraphs per Chapter (i.e. 1.0 - paragraph number 1.2.3, etc; 2.0 - paragraph number 1.2.3, etc...)
- 2) The page breakdown per section provided below is only for GUIDANCE purposes. The Proponent is strongly encouraged to submit only the minimum information necessary to establish the key impacts of the project and to manage such impacts., e.g. only the summary/analysis of secondary information obtained by the Proponent in the course of the EIA study need to be submitted. However, the EMB or the EIA Review Committee shall exercise its discretion to ask for the detailed information when it evaluates the need for such during the EIA Review meetings.
- 3) Label the EIA Report as a DRAFT. The FINAL report is to be resubmitted after the EIA review is completed and before the ECC is issued.
- 4) The Proponent and Review Team may clarify, make changes or adjustments to the Specific Requirements and provide SPECIAL INSTRUCTIONS* for Scoping purposes.
- 5) The Proponent shall have pre-filled out this Checklist prior to submission of the Letter-Request for Scoping. For projects during the transitional period whose proponents have not filled out the checklist, the Proponent shall be first asked by the EMARC Chair to identify which items in the Technical Scoping part of this checklist it proposes to cover in terms of likely impacts and related baseline information per impact, before the EMARC discusses and confirms the final scope.

ANNEX 2-7a
SCOPING and PROCEDURAL SCREENING CHECKLIST FOR ENVIRONMENTAL IMPACT STATEMENT (EIS)

B. TECHNICAL SCOPING CHECKLIST ¹

NOTE: Attach list of issues raised by the attending community representatives during the Public Scoping (Annex 2-7c) . Integrate the issues in the Technical Scoping Checklist below.

List of Key Environmental Issues	Relevance based on PD and Project Location ¹			Basis of Assessment of Relevance: a) Proposed Method of Impact Assessment; b) Other Instructions per Project Phase?	Description of Environment	Required?		Proposed Methodology of Securing and Preserving Information ; Other Considerations in EIA Study	Page in the EIA Document	Verified acceptable by EMB/CHT?	
	LS	LI	NR			Y	N			Y	N
THE LAND											
1.0 Land Use and Classification											
1.1.1 Change/Inconsistency in land use	✓				Description of existing land use/zoning/ classification	✓		zoning certification/ zoning certification			
1.1.2 Encroachment in Protected Area under NIPAS		✓		Quality of Habitat	Land Use Map (indicate location of any ECAs and special land Features)	✓					
1.1.3 Encroachment in other ECAs		✓		Identified bird nests mangroves							
1.2 Geology/geomorphology											
1.2.1 Change in surface landform /topography/terrain/slope	✓				Geology/Geomorphology	✓					
1.2.2 Change in sub-surface/ underground geomorphology (e.g underground mining)	✓				Slope and Elevation Map	✓					
1.2.3 Inducement of subsidence					Regional/General Geological Map						
1.2.4 Inducement of landslides or other natural hazards	✓				Geological Cross-Sections	✓					
1.2.5					Sequence Stratigraphic Column of Rock Units						
1.2.6					Geomorphological Map						
1.2.7					Factor Contour Map for Rocks			Geotech Study			
1.2.8					Sismicity Map						
					Differential Settling Hazard Map						

for both landing sites (Manabana + LC)
 + advance inventory of mangroves
 * NB: carry on of ongoing - relevant
 It applies caution to this project

¹ This table has two major columns: Key environmental issues to be addressed, and the Description of Environment (primary or secondary data) based on one or more environmental issues identified. There is no one-to-one correspondence between the potential issue columns to the left, and the baseline information to the right. These columns are provided to ensure the EIA Study focuses on the most relevant environmental issues. LS = likely significant, LI = likely insignificant, NR = not relevant. LS requires in depth quantitative analysis depending on the availability of mathematical methods. LI requires qualitative analysis. NR column is provided since there are listed impacts that may not be after all existent due to the nature of the project and location. During the EIA study, some project aspects may be discovered as significant and may be the basis of Additional Information in the review.

ANNEX 2-7a
SCOPING and PROCEDURAL SCREENING CHECKLIST FOR ENVIRONMENTAL IMPACT STATEMENT (EIS)

List of Key Environmental Issues	Relevance based on PD and Project Location?				a) Basis of Assessment of Relevance; b) Proposed Method of Impact Assessment; c) Other Instructions per Project Phase?	Description of Environment	Required?		Proposed Methodology of Securing and Presenting Information; Other Considerations in EIA Study	Page in the EIA Document	Verified acceptable by EMB/CH?
	LS	LI	N	R			Y	N			
1.2.9.						Bathymetric and Morphostructural Map					
1.2.10.						Results of Petrographic and Mineralogical Analyses					
1.2.11.						Results of Geochemical Analyses of Rock Samples					
1.3						Pedology					
1.3.1.	✓					Summary of Soil Investigation Report on soil types and quality					
1.3.2.			✓			Laboratory Results of Soil Sample Analysis					
1.4						Erodibility Potential					
1.4.1.	✓					Terrestrial Biology					
1.4.2.	✓					Flora and Fauna Species Inventory or Survey	✓				
1.4.3.	✓					Summary of Endemism / Conservation Status	✓				
1.4.4.	✓					Summary of Abundance, Frequency and Distribution	✓				
2.0						Site Observation/ Transect Walk Map	✓				
2.1						THE WATER					
2.1.1.	✓					Hydrology/Hydrogeology					
2.1.2.						Topographic Map showing Drainage System	✓				
2.1.3.						Regional Hydrogeologic Map	✓				
2.1.4.	✓					Streamflow Measurements/ Mean Monthly Flow Data	✓				
2.1.5.	✓					Flood Peaks, Volumes, Frequency rating curves and Stormwater flow estimates	✓				
2.1.6.	✓					Spring and Well Inventory and location map	✓				

* fringing line (concept)

ANNEX 2-7a
SCOPING and PROCEDURAL SCREENING CHECKLIST FOR ENVIRONMENTAL IMPACT STATEMENT (EIS)

List of Key Environmental Issues	Relevance based on PD and Project Location: LS = Likely Significant; LI = Likely Insignificant; NR = Not Relevant				Basis of Assessment of Relevance; b) Proposed Method of Impact Assessment; c) Other Instructions per Project Phase?			Description of Environment	Re-quired?	Proposed Methodology of Securing and Presenting Information; Other Considerations in EIA Study	Page in the EIA Document	Verified accepts file by EMB/CH?
	LS	LI	N	R	a)	Y	N					
Oceanography												
2.2.1 Change in circulation pattern	✓								✓			
2.2.2 Change in bathymetry	✓								✓			
2.2.3									✓			
Water Quality												
2.3.1 Groundwater pollution	✓											
2.3.2 Stream water pollution												
2.3.3 Lake water pollution												
2.3.4 Marine water pollution	✓											
Freshwater Ecology												
2.4.1 Threat to abundance, frequency and distribution of species												
2.4.2 Loss of important species												
2.4.3 Loss of habitat												
Marine Ecology												
2.5.1 Threat to abundance, frequency and distribution	✓											
2.5.2 Loss of important species	✓											
2.5.3 Loss of habitat	✓											
2.5.4	✓											

* turbidity
 * vibration
 * circulation pattern

135 only (3 Stations in Mindanao Coastal & 1 station in LLC)

Marine Study (consult) if survey later available, maybe use

ANNEX 2-7a
SCOPING and PROCEDURAL SCREENING CHECKLIST FOR ENVIRONMENTAL IMPACT STATEMENT (EIS)

List of Key Environmental Issues	Relevance based on PD and Project Location?				Basis of Assessment of Relevance: a) Proposed Method of Impact Assessment; b) Other Instructions per Project Phase?	Description of Environment	Required?		Proposed Methodology of Presenting and Information; Other Considerations in EIA Study	Page in the EIA Document	Verified acceptable by EMB/CH?
	LS	LI	N	R			Y	N			
2.5.5.						plankton, etc					
3.0						THE AIR Sampling Site Map					
3.1						Meteorology/Climatology					
3.1.1.	✓					Change in the local climate, e.g local temperature	✓				
3.1.2.	✓					Contribution to global greenhouse gas	✓				
3.2						Air Quality (& Noise)					
3.2.1.	✓					Air pollution	✓				
3.2.2.	✓					Increase in noise	✓				
4.0						THE PEOPLE					
4.1.1.	✓					Displacement of settler	✓				
4.1.2.	✓					Change in land ownership	✓				
4.1.3.	✓					Displacement of property	✓				
4.1.4.						Right-of-way conflict					
4.1.5.	✓					In-migration	✓				

Map of Ovaras Ship - Passthead
ETC - SLUP
** Technical Instrument - Timberland*
** Map of ownership*
** et*
** Inventory of affected*

ANNEX 2-7a
SCOPING and PROCEDURAL SCREENING CHECKLIST FOR ENVIRONMENTAL IMPACT STATEMENT (EIS)

List of Key Environmental Issues	Relevance based on PD and Project Location: LS = Likely Significant; LI = Likely Insignificant; NR = Not Relevant			a) Basis of Assessment of Relevance; b) Proposed Method of Impact Assessment; c) Other Instructions per Project Phase?			Description of Environment	Re-quired?	Proposed Methodology of Securing and Presenting Information; Other Considerations in EIA Study	Page in the EIA Document	Verified acceptable by EMB CH?	
	LS	LI	NR	Y	N	Y						N
4.1.6. Presence of Indigenous People							Indigenous Peoples Health					
4.1.7. Cultural Change							Morbidity and Mortality Rates (Infants and Adults) from Direct Impact Areas					
4.1.8. Threat to public health							5-Year Trend in Morbidity and Mortality					
4.1.9. Local benefits from the project							Notifiable Diseases in the Area including Endemic Diseases					
							Local Health Resources (Government and Private)					
							Environmental Health and Sanitation Profile: water supply, human excrete mgt, waste mgt and disposal systems and food hygiene					
4.1.10. Threat to delivery of basic services							Water Supply and Demand					
4.1.11. Traffic congestion							Power Supply and Demand					
							Transportation/Traffic situation					
SUMMARY/HIGHLIGHTS OF TECHNICAL SCOPING												
Considering all project activities and phases, select the most critical Environmental Aspects (major sources of most significant impacts)	List of Associated Most Significant Environmental Issues/Stressors			Agreed EIA Approach in Impact Assessment and Migration on key environmental aspects and impacts/issues			Remarks		Page in EIA Document		Verified Acceptable by EMB CH?	
1												
2												
3												
4												
5												
6												
7												
8												

* Indicate drawings within direct areas in Mainframe + LLC indirect

Traffic Mgt. Scheme - Construction

" " - Construction/Op

Traffic Impact Assessment - Operation

ANNEX 2-7a
SCOPING and PROCEDURAL SCREENING CHECKLIST FOR ENVIRONMENTAL IMPACT STATEMENT (EIS)

C. ENVIRONMENTAL RISK ASSESSMENT

If the project has the following:		Y	N
1.	Facilities for the production or processing of organic or inorganic chemicals using: alkylation, amination by ammonolysis, carbonylation, condensation, dehydrogenation, esterification, halogenation and manufacture of halogens, hydrogenation, hydrolysis, oxidation, polymerization, sulfonation, desulfurization, manufacture and transformation of sulphur-containing compounds, nitration and manufacture of nitrogen-containing compounds, manufacture of phosphorus-containing compounds, formulation of pesticides and of pharmaceutical products, distillation, extraction, solvation		
2.	Installations for distillation, refining or other processing of petroleum products.		
3.	Installations for the total or partial disposal of solid or liquid substances by incineration or chemical decomposition		
4.	Installations for the production or processing of energy gases, for example, LPG, LNG, SNG		
5.	Installations for the dry distillation of coal or lignite		
6.	Installations for the production of metals or non-metals by a wet process or by means of electrical energy		
7.	Installations for the production of metals or non-metals by a wet process or by means of electrical energy		
8.	Specific facilities or the use of certain processes listed in the Risk Thresholds Table below.		
9.	Facilities that would use, manufacture, process or store hazardous materials in excess of Level 1 threshold inventory in Risk Thresholds Table below.		
10.	Facilities that would use, manufacture, process or store hazardous materials in excess of Level 2 threshold inventory in Risk Thresholds Table below.		
	Required Study/Report		
	Risk Screening Study		
	Risk Screening Study		
	Risk Screening Study		
	Risk Screening Study		
	Risk Screening Study		
	Risk Screening Study		
	Hazard Analysis Study, and Emergency/Contingency Plan based on the study and worst-case scenario.		
	Quantitative Risk Assessment (QRA) and Emergency/Contingency Plan based on the QRA		




Risk Thresholds Table

CATEGORY	LEVEL 1 (tons)	LEVEL 2 (tons)	CATEGORY	LEVEL 1 (tons)	LEVEL 2 (tons)
1.			7.		
2.			8.		
3.			9.		
4.			10.		
5.			11.		
6.			12.		

NEED FOR PUBLIC HEARING/CONSULTATION/SITE VISIT OR SITE VALIDATION DURING EIA REVIEW

1) Proponent's Request	
2) EIARC Evaluation	
3) EMB Evaluation	

SCOPED BY : EIARC MEMBERS

NAME	EXPERTISE	SIGNATURE
CLIPPIO N. Bacalisu Jr	EIARC Chair	
RIZAL B. RABAGA	Manobare DPO	
ALLAN S. PEDRICKI	Local-level CEO	
MA. CLOA A. PALACIO	DENS-LPO	
Joselito Palacio	EIARC	

ANNEX 2-7a
SCOPING and PROCEDURAL SCREENING CHECKLIST FOR ENVIRONMENTAL IMPACT STATEMENT (EIS)

<p>EIA PERSONNEL REPRESENTATIVE DURING TECHNICAL SCOPING: Signature over Printed name: <u>ANEDITA B. DIBAY</u> CPD Chief</p>	<p>REPRESENTATIVES OF THE PROJECT PROPONENT: Signature over Printed name: <u>ROSADE SURALISA</u> Signature over Printed name</p>	<p>Signature over Printed name _____ Signature over Printed name _____ Signature over Printed name _____ Signature over Printed name _____</p>
<p>NOTED BY: EIA Section Chief</p>		
<p>PROCEDURAL SCREENING RECOMMENDATION BY EMB CASEHANDLER:</p>		
<p>1st Procedural Screening: Check <input type="checkbox"/> Return Document <input type="checkbox"/> Accept Document for Filing of Application for Substantive Screening</p> <p>REMARKS: Printed Name of EMB Caschandler: _____ Signature: _____ Date: _____</p>		
<p>2nd Procedural Screening: Check <input type="checkbox"/> Return Document <input type="checkbox"/> Accept Document for Filing of Application for Substantive Screening</p> <p>REMARKS: Printed Name of EMB Caschandler: _____ Signature: _____ Date: _____</p>		

Annex-3 Attendance List of Project Related Meetings

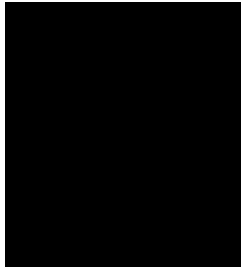
Annex-3.1 Information, Education and Communications (IEC)

Good day!

Here's the attendance of last LZBA Meeting

MARCH 27, 2019- Zoning Board Members Attendance

Present:



- Member/ Presiding Officer
- Member/ Rep. of the Chairman
- Member/ Rep. of Atty. August Lizer Malate
- Member
- Member
- Member/ Rep. Engr. Richard Flores
- Member/ Rep. of Engr. Cerwhena Bernados
- Member
- Member
- Member

On Official Business:



- Member
- Member

Regards
Beverly- CPDO Office Staff

DEPARTMENT OF PUBLIC WORKS & HIGHWAYS			
Title/Description:			
Coordination Meeting w/ DPWH, UICA and Lapu-Lapu City Planning & Rev'd Office re: New Mactan (4th) Bridge in preparation for the stakeholders' Meeting			
Date:	Started:	Adjourned:	Venue:
April 11, 2019	10:20 AM	11:20 AM	Lapu-Lapu City Engineering's Office
ATTENDANCE SHEET			
Name	Office	Contact Number	Signature
[REDACTED]			
12.			
13.			
14.			
15.			
16.			
17.			
18.			
19.			
20.			
21.			
22.			
23.			
24.			
25.			
26.			
27.			
28.			
29.			
30.			
31.			
32.			
33.			
34.			
35.			



PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Barangay Opao RAP Coordination Meeting

April 13, 2019, 9:00 AM

Opao Barangay Hall

NO.	NGALAN	KONTAK/NUMERO	PIRMA



PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Barangay Opao RAP Coordination Meeting

April 13, 2019, 9:00 AM

Opao Barangay Hall

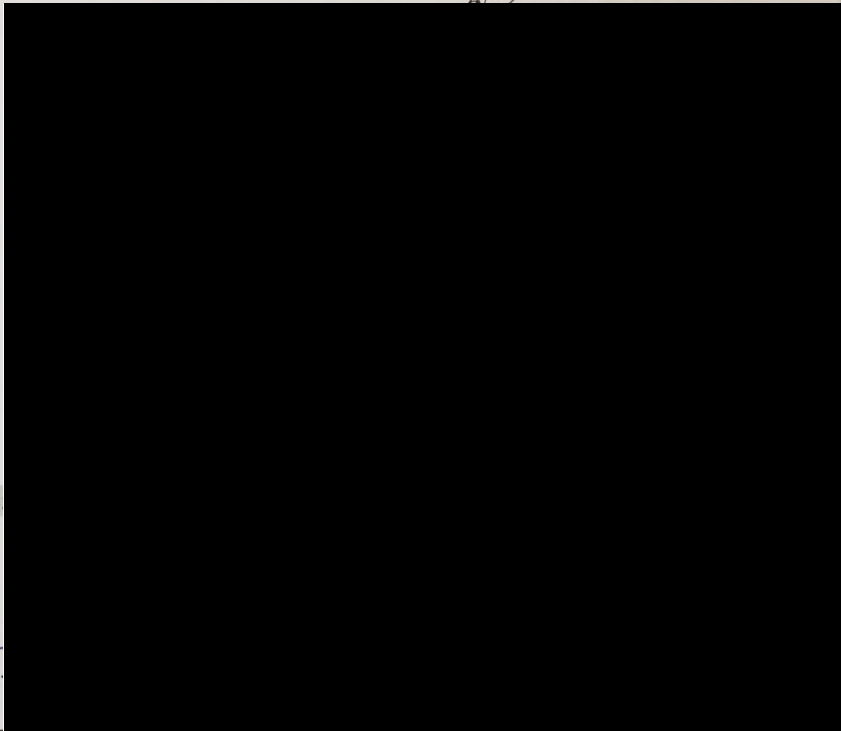
NO.	NGALAN	KONTAK/NUMERO	PIRMA
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			



Republic of the Philippines
Province of Cebu
City of Mandaue
Barangay Paknaan
Contact #517-6562 | Email: barangaypaknaanmandaue7@gmail.com

Office of the Punong Barangay

8TH REGULAR SESSION
(Sangguniang Barangay of PAKNAAN)
ATTENDANCE
APRIL 16, 2019



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Republic of the Philippines

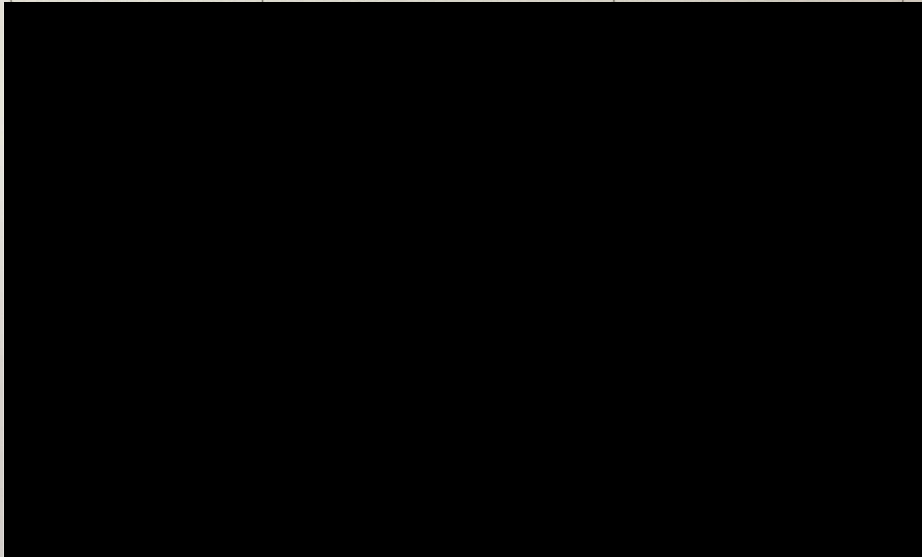
City of Mandaue
BARANGAY UMAPAD
Tel. No. 232-3274

OFFICE OF THE PUNONG BARANGAY

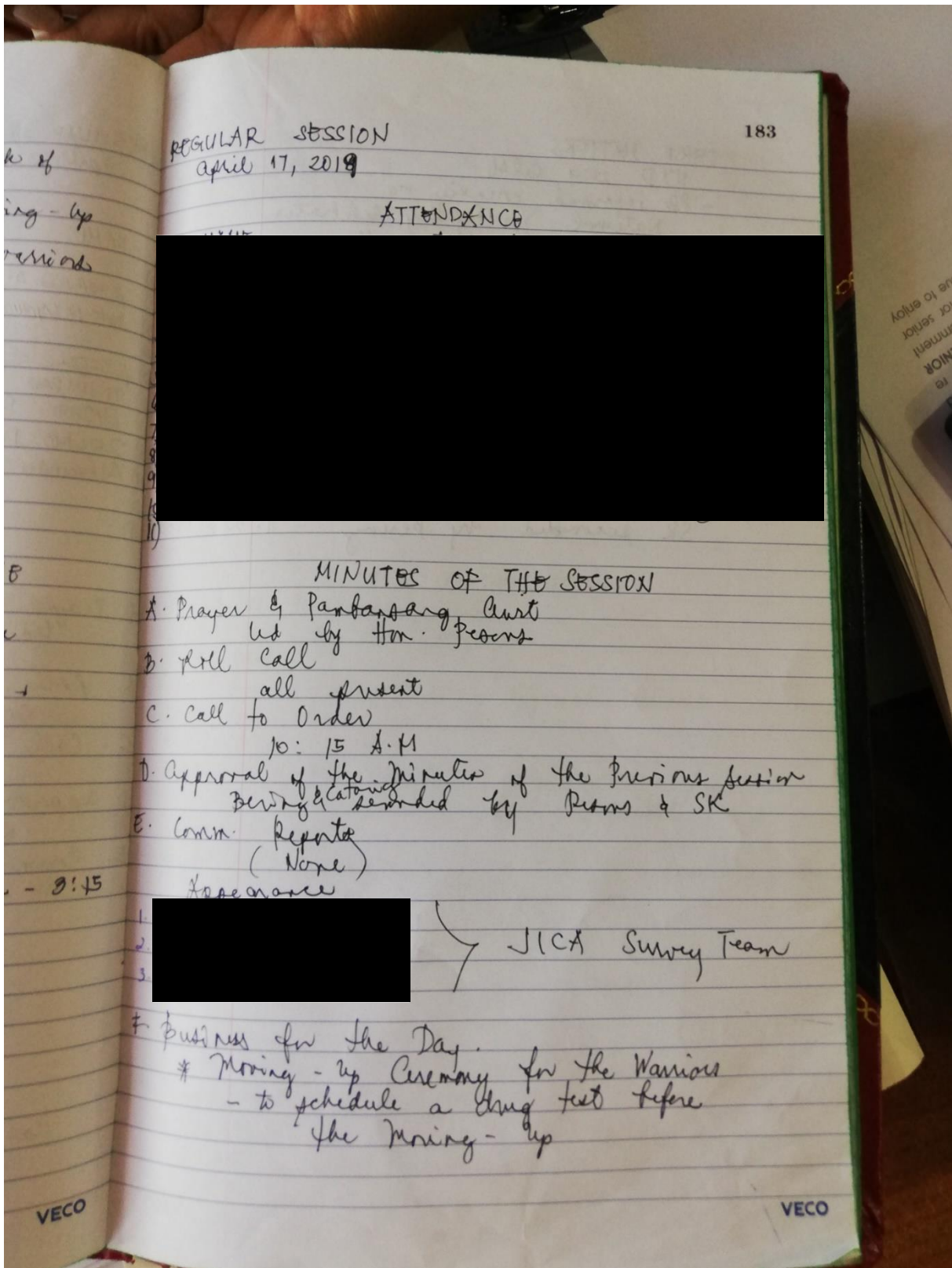
REGULAR SESSION
April 16, 2019 (Tuesday)
9:30 A.M.

ATTENDANCE

DESIGNATION	NAMES	SIGNATURE
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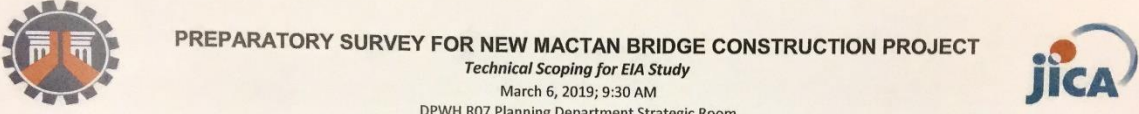


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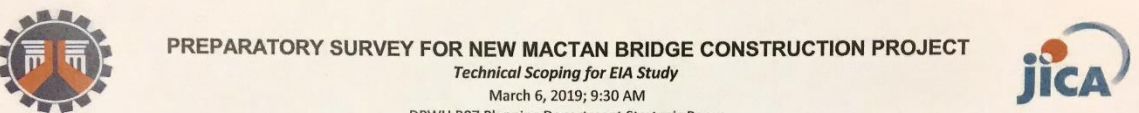
Note) Attendance list of project related meetings is shown in Annex-3.1

Annex-3.2 Public Scoping



PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT
Technical Scoping for EIA Study
 March 6, 2019; 9:30 AM
 DPWH R07 Planning Department Strategic Room

NO.	NAME	DESIGNATION	ORGANIZATION	CONTACT DETAILS/EMAIL	SIGNATURE
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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT
Technical Scoping for EIA Study
 March 6, 2019; 9:30 AM
 DPWH R07 Planning Department Strategic Room

NO.	NAME	DESIGNATION	ORGANIZATION	CONTACT DETAILS/EMAIL	SIGNATURE



PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Technical Scoping for EIA Study

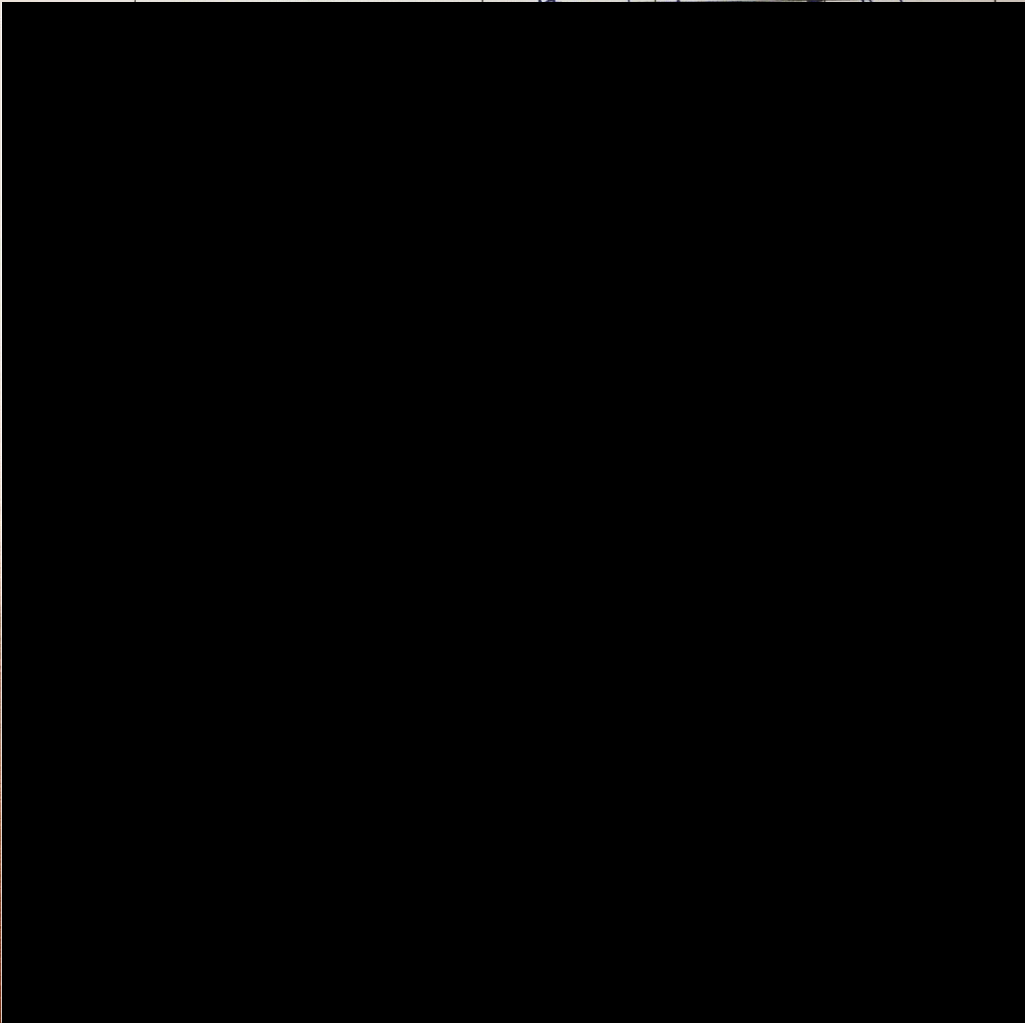
March 6, 2019; 9:30 AM

DPWH R07 Planning Department Strategic Room




NO.	NAME	DESIGNATION	ORGANIZATION	CONTACT DETAILS/EMAIL	SIGNATURE

DEPARTMENT OF PUBLIC WORKS & HIGHWAYS			
Title/Description:			
Preparatory survey for the New (4th) Mactan Bridge Construction Project: Stakeholders' meeting and public scoping			
Date:	Started:	Adjourned:	Venue:
March 11, 2019	2:00 PM	4:00 PM	Mandaue CSWS Conference Room
ATTENDANCE SHEET			
Name	Office	Contact Number	Signature




DEPARTMENT OF PUBLIC WORKS & HIGHWAYS			
Title/Description:			
Preparatory survey for the New (4th) Mactan Bridge Construction: Stakeholders' Meeting and Public Hearing			
Date:	Started:	Adjourned:	Venue:
March 6, 2019	2:00PM	4:00PM	Mandaue CSWS Conference Room
ATTENDANCE SHEET			
Name	Office	Contact Number	Signature
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Republic of the Philippines
City of Lapu-Lapu
ATTENDANCE


ACTIVITY:	Public Scoping / Stakeholder's Meeting	Date:	4/12/19
VENUE:		Time:	

FULL NAME	SEX (✓)		OFFICE, AGENCY, COMPANY	SIGNATURE	CONTACT #
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 **LAPU-LAPU**
The Historic Resort City





City of Lapu-Lapu
ATTENDANCE

ACTIVITY:		Date:			
VENUE:		Time:			
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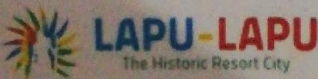

 **LAPU-LAPU**
The Historic Resort City 

Annex-3.3 Public Hearing/Consultation

City of Lapu-Lapu

 **ATTENDANCE**

ACTIVITY:					Date:	
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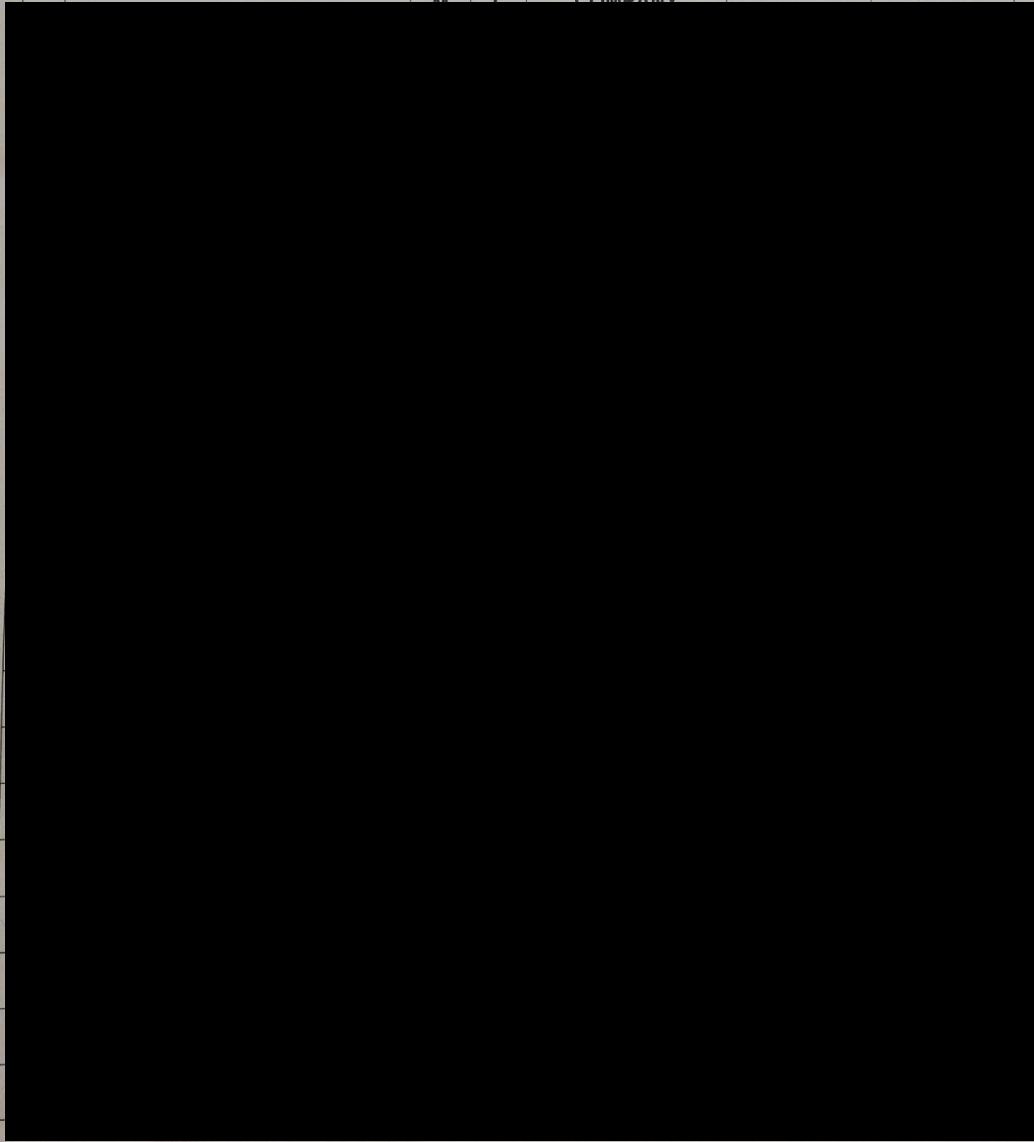
 



Republic of the Philippines
City of Lapu-Lapu

ATTENDANCE


ACTIVITY:	4th Bridge Public Consultation	Date:	June 4, 2019		
VENUE:	Songginiang Panglungsod Session Hall	Time:	8:00am - 9:20am		
FULL NAME	SEX (✓)		OFFICE, AGENCY, COMPANY	SIGNATURE	CONTACT #
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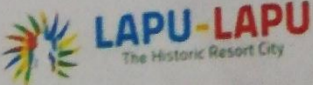

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Republic of the Philippines
City of Lapu-Lapu

ATTENDANCE

ACTIVITY:		Date:			
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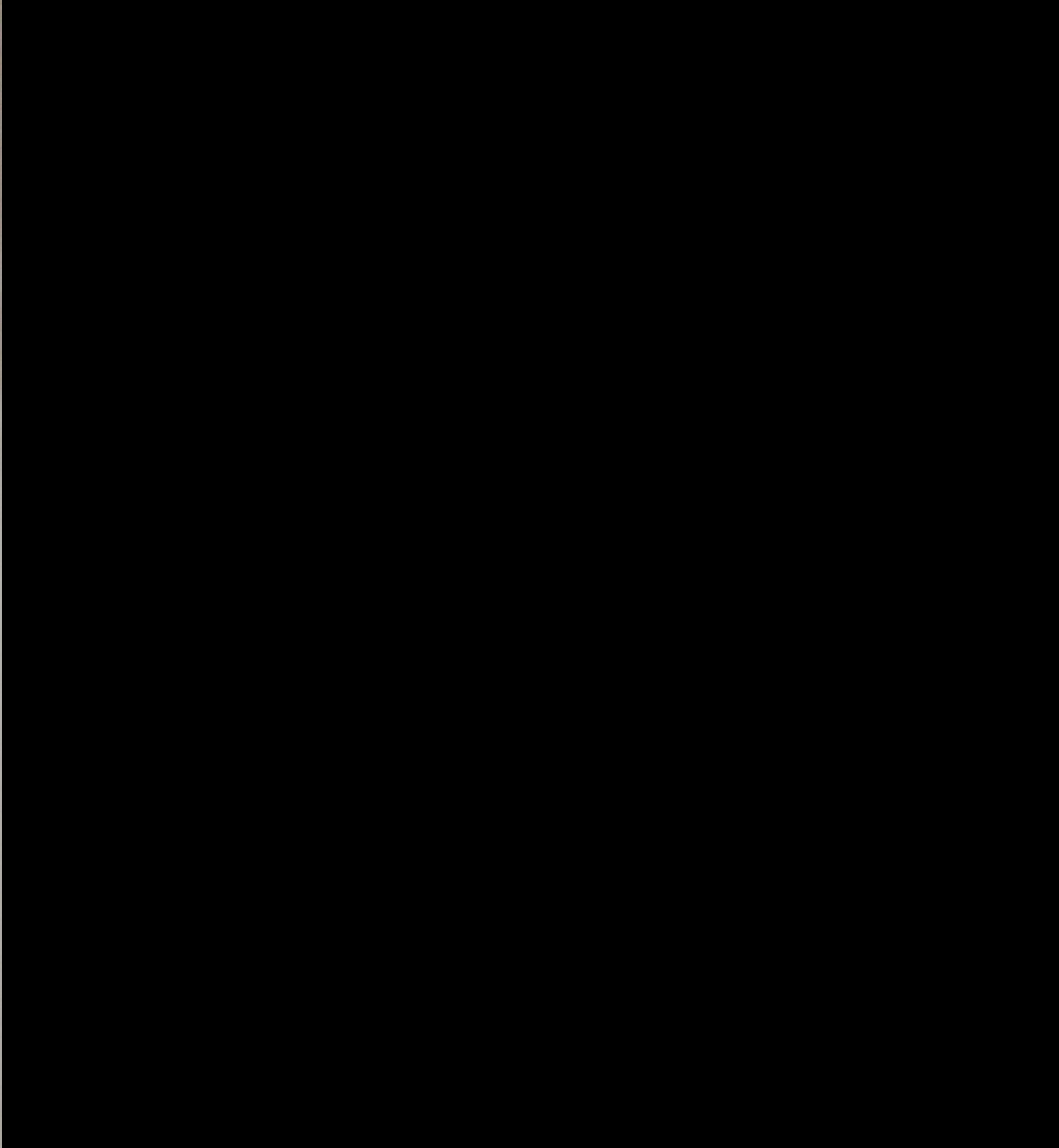
 



Republic of the Philippines
City of Lapu-Lapu

ATTENDANCE

ACTIVITY:		Date:			
VENUE:		Time:			
FULL NAME	SEX (✓)		OFFICE, AGENCY, COMPANY	SIGNATURE	CONTACT #
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Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Regional Office VII
South Road Properties, Cebu City

TITLE / DESCRIPTION:
PUBLIC HEARING - MANDAME CITY

DATE:	STARTED:	ADJOURNED:	VENUE:
June 04, 2019	1:00 - 5:00 PM		Brgy. Paknaan - Gymn

ATTENDANCE SHEET

NAME	OFFICE	CONTACT NO.	SIGNATURE

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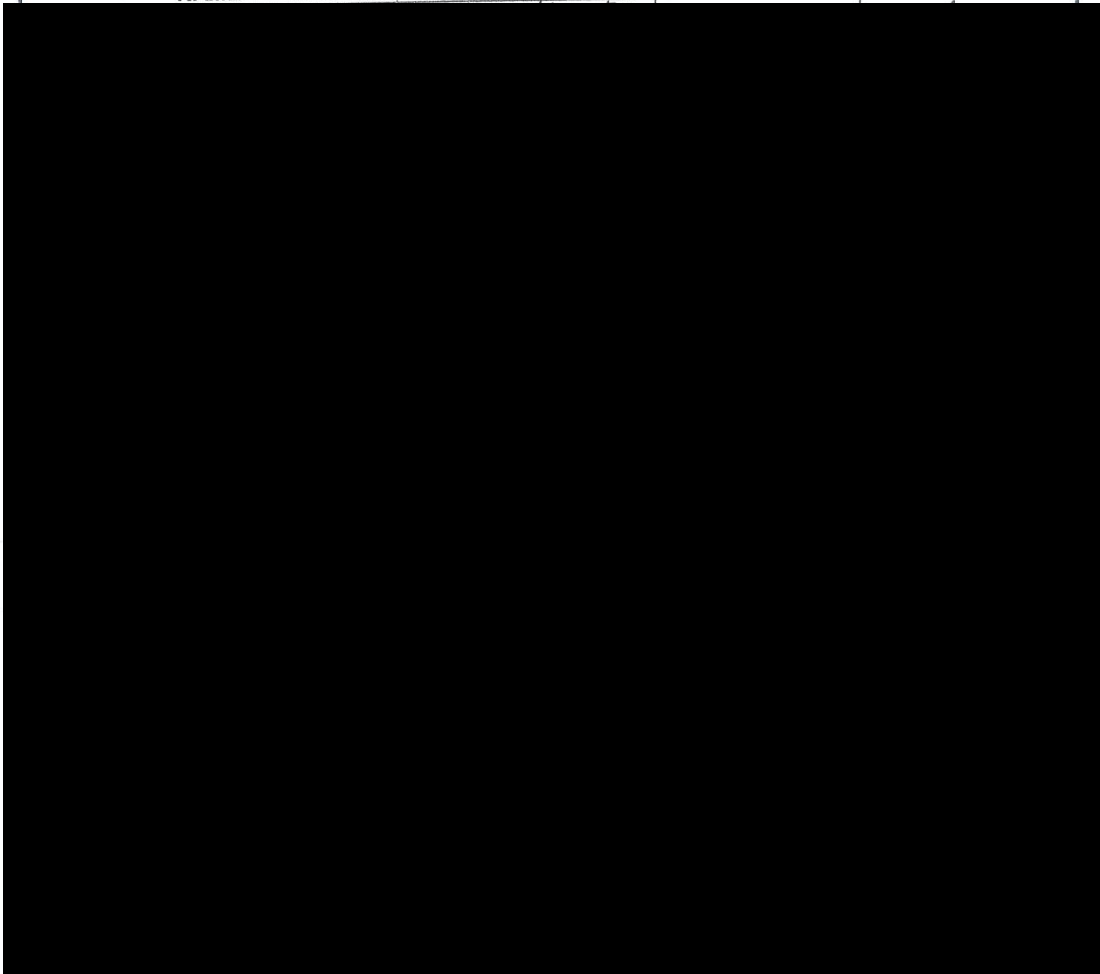


Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Regional Office VII
South Road Properties, Cebu City

TITLE / DESCRIPTION:

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Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Regional Office VII
South Road Properties, Cebu City

TITLE / DESCRIPTION:

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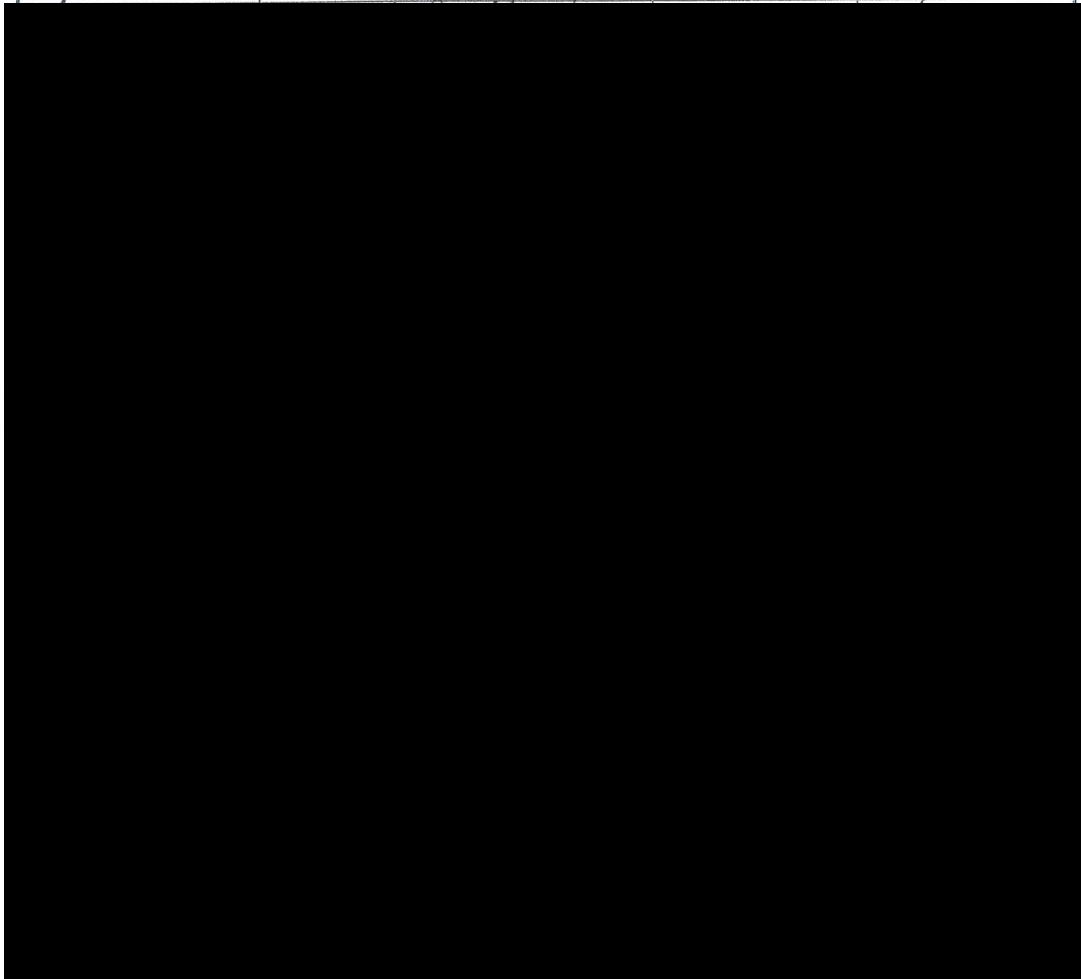


Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Regional Office VII
South Road Properties, Cebu City

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Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Regional Office VII
South Road Properties, Cebu City

TITLE / DESCRIPTION:

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ATTENDANCE SHEET			
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Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Regional Office VII
South Road Properties, Cebu City

TITLE / DESCRIPTION:

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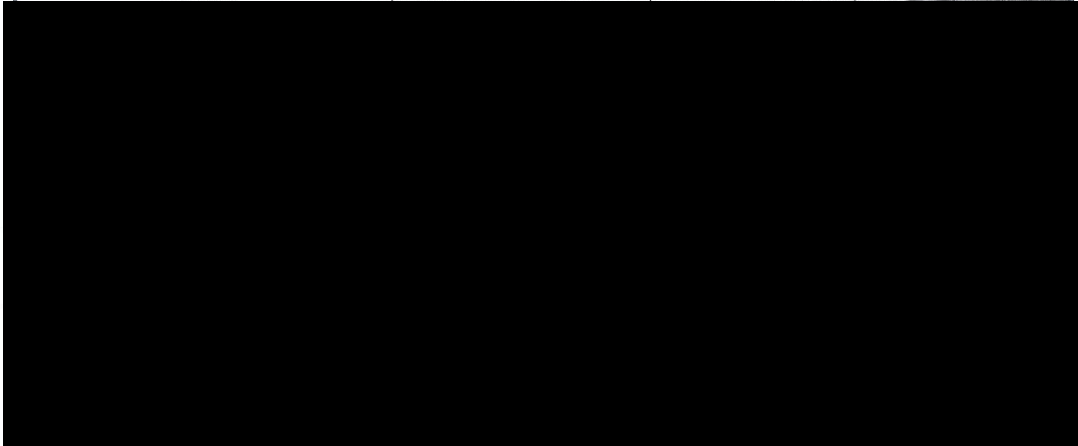


Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
 Regional Office VII
 South Road Properties, Cebu City

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Republic of the Philippines
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
Regional Office VII
South Road Properties, Cebu City

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ATTENDANCE SHEET			
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Annex-3.4 Focus Group Discussions for Sectoral Group

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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: Fishermen's Association
 May 21, 2019, 10:00 AM-11:00 AM
 Mandaue City Social Welfare Services Conference Room





PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: PWD's Association
 May 21, 2019, 1:00 PM-2:00 PM
 Mandaue City Social Welfare Services Conference Room



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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: PWD's Association
 May 21, 2019, 1:00 PM-2:00 PM
 Mandaue City Social Welfare Services Conference Room



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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: PWD's Association
 May 21, 2019, 1:00 PM-2:00 PM
 Mandaue City Social Welfare Services Conference Room



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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: Women's Association

May 21, 2019, 3:00 PM-4:00 PM

Mandaue City Social Welfare Services Conference Room



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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: Women's Association
 May 21, 2019, 3:00 PM-4:00 PM
 Mandaue City Social Welfare Services Conference Room



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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: Fishermen's Association
 May 23, 2019, 10:00 AM-11:00 AM
 Lapu-Lapu City Tourism Bldg Session Hall



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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: Fishermen's Association
 May 23, 2019, 10:00 AM-11:00 AM
 Lapu-Lapu City Tourism Bldg Session Hall



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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: Senior Citizens' Association
May 23, 2019, 1:00 PM-3:00 PM
Lapu-Lapu City Tourism Bldg Session Hall



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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: PWD's Association

May 23, 2019, 1:00 PM-3:00 PM

Lapu-Lapu City Tourism Bldg Session Hall



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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: PWD's Association

May 23, 2019, 1:00 PM-3:00 PM

Lapu-Lapu City Tourism Bldg Session Hall





PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: PWD's Association
 May 23, 2019, 1:00 PM-3:00 PM
 Lapu-Lapu City Tourism Bldg Session Hall



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PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT

Focus Group Discussion: PWD's Association
 May 23, 2019, 1:00 PM-3:00 PM
 Lapu-Lapu City Tourism Bldg Session Hall



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Annex-4 Sworn Statement

Annex-4.1 Sworn Statement from DPWH

Environmental Impact Statement (EIS) for the New Mactan Bridge Construction Project

SWORN STATEMENT OF ACCOUNTABILITY OF THE PROPONENT

This is to certify that all the information and commitments in this **ENVIRONMENTAL IMPACT STATEMENT REPORT** for the **NEW MACTAN BRIDGE CONSTRUCTION PROJECT** are accurate and complete to the best of my knowledge, and that an objective and thorough assessment of the Project was undertaken in accordance with the dictates of professional and reasonable judgement. Should I/we learn of any information, which would make this **ENVIRONMENTAL IMPACT STATEMENT REPORT** inaccurate, I shall immediately bring the said information to the attention of DENR-EMB.

I hereby certify that no DENR-EMB personnel was directly involved in the preparation of this **EIS** for the **NEW MACTAN BRIDGE CONSTRUCTION PROJECT** other than to provide procedural and technical advice consistent with the guidelines in the DAO 03-30 Revised Procedural Manual.

I hereby bind myself to answer any penalty that may be imposed arising from any misrepresentation of failure to state material information in this **ENVIRONMENTAL IMPACT STATEMENT**.

In witness whereof, I hereby set my hand this ___ day of _____ at _____.



VIRGILIO C. CASTILLO
NAME OF PROPONENT HEAD

SIGNATURE

Position

Department of Public Works & Highways, Roads
Management Cluster I - UPMO

Company Name

SUBSCRIBED AND SWORN TO before me this ___ day of ___ 201___, affiant exhibiting his/her Community Tax Certificate No. _____ issued at _____ on _____.

Doc No. _____
Page No. _____
Book No. _____
Series of _____

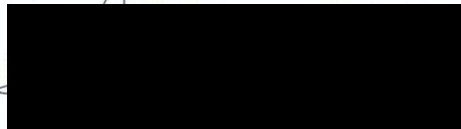
Annex-4.2 Sworn Statement from Prepare

**ACCOUNTABILITY STATEMENT OF EIA / JICA
SURVEY TEAM LEADER**

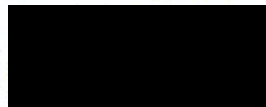
This is to certify that all data/information contained in this Environmental Impact Statement for **New Mactan Bridge Construction Project to be located at the Cities of Mandaue and Lapu-lapu, Cebu Province** are accurate and complete to the best of our knowledge, and that an objective and thorough assessment of the Project was undertaken in accordance with the dictates of professional and reasonable judgment. Should I learn of any information which would make this EIS inaccurate, I shall immediately bring the said information to the attention of the DENR-EMB.

I hereby certify that no DENR-EMB personnel was directly involved in the preparation of this EIS other than to provide procedural and technical advice consistent with the guidelines in the DAO 03-30 Revised Procedural Manual.

I hereby bind myself to answer any penalty that may be imposed arising from any misrepresentation or failure to state material information in this EIS. In witness whereof, I hereby set my hand this ____ day of ____ at _____.



Registered EIA Preparer (IPCO 317)



Team Leader
JICA Survey Team

Annex-5 DENR-CENRO Certification

Page 1 / Page 2

Republic of the Philippines
Department of Environment and Natural Resources
COMMUNITY ENVIRONMENT AND NATURAL RESOURCES OFFICE
Cebu City

CENRO, CEBU CITY (LANDS VERIFICATION)
(Mandaue City &
Lapulapu City)

July 15, 2019

OUT-GOING

Subscribed 7-18-19

19-568

CERTIFICATION

TO WHOM IT MAY CONCERN:

This is to certify that as per projection conducted by RICARDO A. POLACHE AND NOEL C. DEL MONTE, a tract of land situated at Mandaue City and Lapulapu City was found to be wit;

COLOR PINK, was found to be within TIMBERLAND, Project No. 32-A, per Land Classification Map No. 2962 of Mandaue City, Cebu certified under Forestry Administrative Order No. 4-1555 dated December 09, 1980.

COLOR GREEN, was found to be within ALIENABLE AND DISPOSABLE, Project No. 37-B, per Land Classification Map No. 3411 of Lapulapu City certified under Forestry Administrative Order No. 4-2049 dated June 29, 1980

This certification is issued upon the request of JICA REP. BY TOMOYUKI KONISHI for the purpose of ascertaining the land classification status only and does not entitle (him/her) preferential/priority rights of possession until determined by competent authorities.

RAUL C. PASOC
CENR Officer

SWORN STATEMENT

WE, RICARDO A. POLACHE AND NOEL C. DEL MONTE after having been duly sworn to under oath in accordance with law do hereby depose and say that we personally projected the land classification status of the subject area and the result is the basis of the aforementioned certification.

NOEL C. DEL MONTE
Cartographer III

RICARDO A. POLACHE
Engineer II

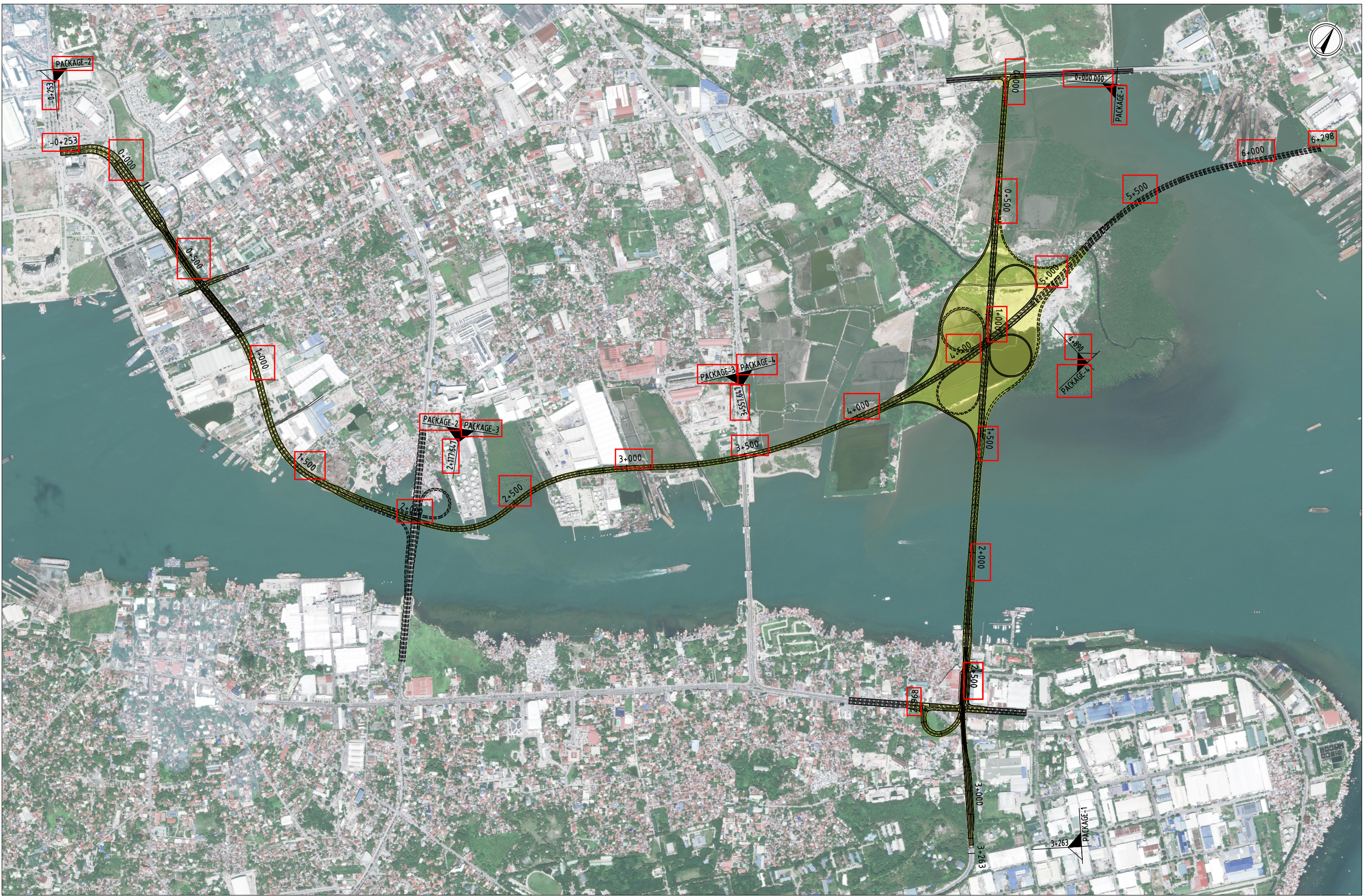
SUBSCRIBED AND SWORN to before me this 15th day of July 2019 at Cebu City, Philippines.

RAUL C. PASOC
CENR Officer

Certification Fee 50.00
O.R. No. 310555
Issued On 07-18-19
Issued by CENRO CEBU CITY



Annex-5 Project Site Map and Vertical Alignment



COORDINATE SYSTEM: UTM WGS 84 ZONE 51 NORTH

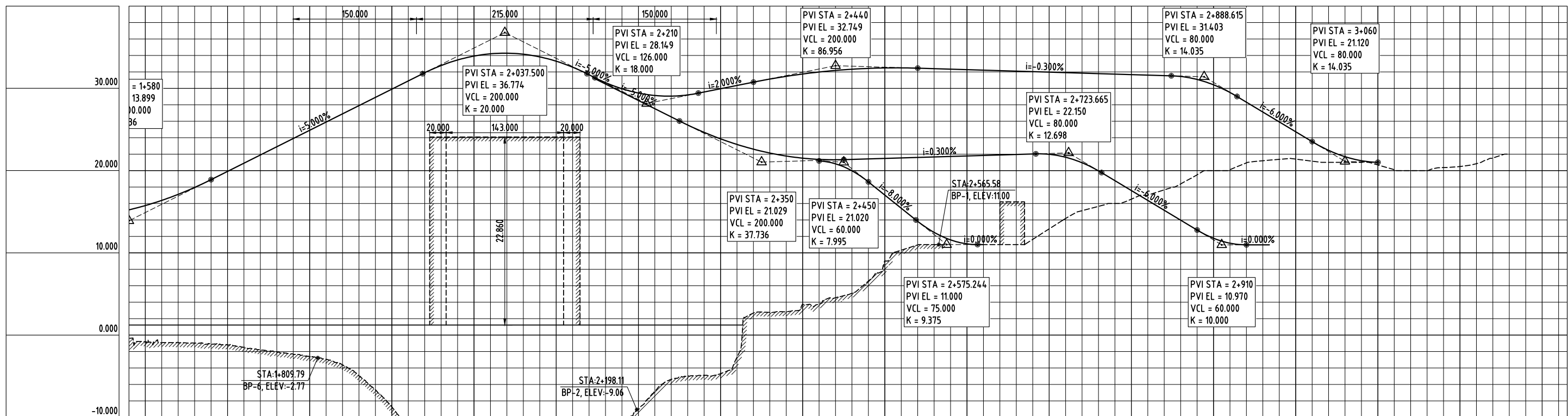
PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT IN THE REPUBLIC OF THE PHILIPPINES

Japan International Cooperation Agency
Oriental Consultants Global Co., Ltd.
Chodai Co., Ltd.
Nippon Koei Co., Ltd.
Almec Corporation

Drawing No. 01

LOCATION MAP

Scale (A3) 1:15,000



VERTICAL ALIGNMENT	<div style="display: flex; justify-content: space-between;"> 1+580 2+037.500 2+210 2+440 2+888.615 3+060 </div>																																																																																						
FINISHED GROUND	15.747	16.376	17.111	17.952	18.899	19.899	20.899	21.899	22.899	23.899	24.899	25.899	26.899	27.899	28.899	29.899	30.899	31.897	32.772	33.922	34.917	36.774	37.500	38.297	39.129	29.051	29.196	29.549	29.949	30.349	30.749	31.126	31.457	31.742	31.981	32.174	32.440	32.719	31.403	30.428	29.494	28.320	27.120	25.920	24.720	23.520	22.462	21.690	21.202	20.687	20.100	20.009	20.000	20.000	20.377	20.497	20.847	21.537																													
EXISTING GROUND	-0.81	-0.94	-0.90	-0.96	-1.05	-1.22	-1.48	-1.81	-2.04	-2.32	-2.62	-2.94	-3.62	-4.94	-6.67	-8.75	-11.43	-14.17	-17.15	-18.95	-19.71	-19.65	-19.53	-19.41	-18.70	-17.31	-15.28	-12.91	-10.71	-9.05	-6.82	-4.96	-4.88	-2.71	2.68	2.76	2.83	3.14	3.74	3.78	4.54	5.09	5.71	6.57	9.00	10.32	10.96	11.00	11.06	11.39	11.64	12.25	12.84	13.35	13.82	14.18	15.12	15.65	16.00	16.53	17.01	17.65	18.37	19.48	20.00	20.11	20.94	21.20	21.40	21.40	20.68	20.09	20.00	20.00	20.37	20.49	20.84	21.53									
STATION	1+600	1+620	1+640	1+660	1+680	1+700	1+720	1+740	1+760	1+780	1+800	1+820	1+840	1+860	1+880	1+900	1+920	1+940	1+960	1+980	2+000	2+020	2+040	2+060	2+080	2+100	2+120	2+140	2+160	2+180	2+200	2+220	2+240	2+260	2+280	2+300	2+320	2+340	2+360	2+380	2+400	2+420	2+440	2+460	2+480	2+500	2+520	2+540	2+560	2+580	2+600	2+620	2+640	2+660	2+680	2+700	2+720	2+740	2+760	2+780	2+800	2+820	2+840	2+860	2+880	2+900	2+920	2+940	2+960	2+980	3+000	3+020	3+040	3+060	3+080	3+100	3+120	3+140	3+160	3+180	3+200	3+220	3+240	3+260	3+280	3+300	3+320
HORIZONTAL ALIGNMENT	<div style="display: flex; justify-content: space-between;"> 1+913.240 L=648.980 2+562.220 R=1500.00 L=185.986 2+748.206 R=1500.00 L=91.522 2+839.728 R=1500.00 L=168.864 2+931.250 R=1500.00 L=64.726 3+100.114 3+164.889 3+229.562 3+263.237 L=64.725 </div>																																																																																						
SUPERELEVATION																																																																																							

PREPARATORY SURVEY FOR NEW MACTAN BRIDGE CONSTRUCTION PROJECT IN THE REPUBLIC OF THE PHILIPPINES

Japan International Cooperation Agency
 Oriental Consultants Global Co., Ltd.
 Chodai Co., Ltd.
 Nippon Koei Co., Ltd.
 Almec Corporation

Drawing No. 10

PLAN AND PROFILE
4th CEBU-MACTAN BRIDGE STA 1+600 - XXX

Scale (A3): H=1/2,500, V=1/200

