REPUBLIC OF THE PHILIPPINES

DATA COLLECTION SURVEY
ON
URBAN INFRASTRUCTURE DEVELOPMENT IN GREATER COTABATO CITY

FINAL REPORT

MAIN TEXT
< VOLUME 2 >

FEBRUARY 2022

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

CTI ENGINEERING INTERNATIONAL CO., LTD.
ORIENTAL CONSULTANTS GLOBAL CO., LTD.
IC NET LIMITED

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MAIN TAXT

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ACRONYMS AND ABBREVIATIONS

AAGR	: Annual Average Growth Ratio
AAIIB	: Aircraft Accident Investigation and Inquiry Board
AC	: Aircraft
ADB	: Asian Development Bank
ADM	: Administration
ADSDPP	: Ancestral Domains Sustainable Development and Protection Plan
AG	: Agriculture
AGR	: Agrometeorological Station
AIP	: Annual Investment Program
AIS	: Aeronautical Information Service
AMACC	: AMA Computer College
AQ	: Aquaculture
ARMM	: Autonomous Region in Muslim Mindanao
ASEAN	: Association of Southeast Asian Nations
ASEP	: Access to Sustainable Energy Project
ASG	: Abu Sayyaf Group
ASTI	: Advanced Science and Technology Institute
AUB	: Asia United Bank
B/D	: Basic Design
BARMM	: Bangsamoro Autonomous Region in Muslim Mindanao
BAU	: Business as usual
BC	: Black carbon
BDA	: Bangsamoro Development Authority
BDC	: Bangsamoro Development Corridor
BDO	: Banco de Oro
BDP - I	: Bangsamoro Development Plan
BDP - II	Bangsamoro Development Plan for the Bangsamoro
BHERT	: Barangay Health Emergency Response Teams
BHW	: Barangay health workers
BI	: Bureau of Immigration
BIMP – EAGA	: Brunei Darussalam – Indonesia – Malaysia – Philippines East ASEAN Growth Area
BIMP – FC	: BIMP Facilitation Center
BNR	: Business Name Registration
BOC	: Bureau of Customs
BOR	: Berth occupancy rate
BPDA	: Bangsamoro Planning and Development Authority
BSP	: Bangko Sentral ng Pilipinas
BTA	: Bangsamoro Transition Authority
BTSI	: Bangsamoro Terminal Services, Inc
CAAP	: Civil Aviation Authority of the Philippines
CADT	: Certificate of Ancestral Domain Title
CAGM	: Coastal area growth management
CBD	: Central Business District
CBO	: Cotabato Airport
CC	: Cooperative Climatological
CCA	: Climate Change Adaptation
CCEDR	: Cotabato City East Diversion Road
CCF	: Central Composting Facility
CCI	: Cotabato City Institute

CCLM	:COSMO Climate Limite - Area Model
CCTV	:Close - Circuit Television
CCWD	:Cotabato City Water District
CDC	:City Development Council
CDEO	:Cotabato City District Engineering Office/DPWH
CDP	:Comprehensive Development Plan
CDPs	:Comprehensive Development Plans
CDRRMC	:City Disaster Risk Reduction Management Council
CDRRMO	:City Disaster Risk Reduction Management Office
CebuPac	:Cebu Pacific Air
CENRO	:City Environment and Natural Resources Office
CEO	:City Engineering Office
CEPALCO	:Cagayan Electric Power and Light Company
CGM	:Corridor growth management
CLPC	:Cotabato Light and Power Company, Inc
CLUP	:Comprehensive Land Use Plan
CMGC	:Council of Mayors for Greater Cotabato
CNC	:Certificate of Non - Coverage
CNS/ATM	:Communication Navigation and Surveillance/Air Traffic Management
CO2 e	:CO2 equivalent
COM - BIZ	:Commercial and business
COTELCO - PPALMA	:Cotabato Electric Cooperative / Pikit-Pigkawayan, Alamada, Libungan, Midsayap & Aleosan
CPDO	:City Planning & Development Office
CR	:Cooperative Rain Station
CRMC	:Cotabato Regional and Medical Center
CRP	:Cotabato River Port
CSOs	:Civil society organizations
CSPC	:Cotabato State Polytechnical College
CSTI	:Coland Systems Technology Institute
CSWMB	:City Solid Waste Management Board
CTKs	:Cargo Ton Kilometers
D/D	:Detail design
DAO	:Department Administrative Order
DBM	:Department of Budget and Management
DDI	:Domestic direct investment
DENR	:Department of Environment and Natural Resources
DENR - EMB	:Department of Environment and Natural Resources – Environmental Management Bureau
DEO	:District Engineering Office
DFR	:Draft Final Report
DHSUD	:Department of Human Settlements and Urban Development
DICT	:Dept. of Information and Communication Technology
DILG	:Department of the Interior and Local Government
DLPC	:Davao Light and Power Company
DOE	:Department of Energy
DOH	:Department of Health
DOS	:Datu Odin Sinsuat
DOST	:Department of Science and Technology
DOTr	:Department of Transportation and Communication
DPWH	:Department of Public Works and Highways
DRRM	:Disaster Risk Reduction and Management
DRRMC	:Disaster Risk Reduction and Management Council
DRRMP	:Disaster Risk Reduction and Management Plan
DSWD	:Department of Social Welfare and Development

DTI	: Department of Trade and Industry
DUs	: Distribution utilities
EC	: Electric Cooperatives
ECAs	: Environmentally Critical Areas
ECC	: Environmental Compliance Certificate
ECPs	: Environmentally Critical Projects
ECs	: Electric cooperatives
EIA	: Environmental Impact Assessment
EIS	: Environmental Impact Statement
EM	: Effective Microorganisms
EMB	: Environmental Management Bureau
EMP	: Environmental Management Plan
EO	: Executive Orders
EPIRA	: Electric Power Industry Reform Act
EPRMP	: Environmental Performance Report and Management Plan
ERC	: Energy Regulatory Commission
ESWM Plan	: Ecological Solid Waste Management Plan
EWB	: East - West Bank
F/S	: Feasibility Study
FDI	: Foreign Direct Investment
FGD	: Focus Group Discussion
FHSIS	: Field Health Services Information System
FIC	: Fully Immunized Children
FMR	: Farm to Market Road
FNRI	: Food and Nutrition Research Institute
FR	: Final Report
FY	: Fiscal Year
GAA	: General Appropriations Act
GC	: Greater Cotabato
GIDA	: Geographically Isolated and Disadvantaged Areas
GIS	: Geographic Information System
GL	: Guidelines
GOCC	: Government Owned and Control Corporation
GOP	: Government of the Philippines
GRDP	: Gross regional domestic product
HF	: High Frequency
HLURB	: Housing and Land Use Regulation Board
HPBS	: High Priority Bus System
HT	: Handheld transceiver/radio
HUC	: highly urbanized cities
HUDGC	: Housing and Urban Development Coordinating Council
IATA	: International Air Transport Association
ICAO	: International Civil Aviation Organization
ICC	: Independent Component City
ICR	: Inception Report
ICTs	: Information and communication technologies
IEC	: Information, Education and Communication
IEEC	: Initial Environmental Examination Checklist Report
ILPC	: Iligan Light and Power Company
IM4Davao	: Infrastructure Modernization for Davao City
IMR	: Infant mortality rate
IPPs	: Independent Power Producers
IRR	: Implementing Rules and Regulations
ITR	: Interim Report
IWA	: International Water Association

JICA	:Japan International Cooperation Agency
JV	:Joint Venture
LARAP	:Land Acquisition and Resettlement Action Plan
LCCAP	:Local Climate Change Action Plan
LDIP	:Local Development Investment Program
LDRRMP	:Local Disaster Risk Reduction and Management Plan
LFPR	:labor force participation rate
LFS	:Labor Force Survey
LGOO	:Local Government Operations Office
LGU	:Local Government Units
LGUOU	:Local Government Unit Owned Utilities
LOS	:Level of Service
LTFRB	:Land Transportation Franchising and Regulatory Board
LTO	:Land Transportation Office
LWUA	:Local Water Utilities Administration
M/P	:Master Plan
MAGELCO	:Maguindanao Electric Cooperative
MCRAIC	:Metro Cotabato Regional Agri－Industrial Center
MCWD	:Metro Cotabato Water District
MENRE	:Ministry of Environment, Natural Resources and Energy
MET	:Meteorological Facilities
MFBM	:Ministry of Finance, Budget and Management
MILF	:Moro Islamic Liberation Front
MinDA	:Mindanao Development Authority
MLIN	:Mindanao Logistics Infrastructure Network
MMR	:Maternal Mortality Ratio
MNLF	:Moro National Liberation Front
MOOE	:Maintenance and other Operating Expenses
MOTC	:Ministry of Transportation and Communication
MPO	:Maguindanao Provincial Office
MPW	:Ministry of Public Works
MRB	:Mindanao River Basin
MRBIMDMP	:Mindanao River Basin Integrated Management and Development Master Plan
MRCRAIC	:Metro Cotabato Regional Agri－Industrial Center
MRF	:Materials Recovery Facilities
MSS/DF	:Mindanao Spatial Strategy/Development Framework
NA	:National Authority
NBSAP	:National Biodiversity Strategy and Action Plan
NCCA	:National Commission for Culture and the Arts
NCIP	:National Commission on Indigenous Peoples
NCMA	:North Central Mindanao Area
NDRVMCC	:Notre Dame RVM College of Cotabato
NDU	:Notre Dame University
NDU - URC	:Notre Dame University - University Research Center
NEA	:National Electrification Administration
NEDA	:National Economic Development Agency
NEMA	:North Eastern Mindanao Area
NGCP	:National Grid Corporation of the Philippines
NGO	:Non-governmental organizations
NHCP	:National Historical Commission of the Philippines
NIPAS	:National Integrated Protected Areas System
NM	:National Museum
NOAH	:Nationwide Operational Assessment of hazards
NPC	:National Power Corporation

NPC - SPUG	:National Power Corporation - Small Power Utilities Group
NPFP	:National Physical Framework Plan
NRW	:Non Revenue Water
NSS	:National Spatial Strategy
NSSMP	:National Sewerage and Septage Management Program
OC	:Official Climatological Station,
OD	:Origin - Destination
ODA	:Official Development Assistance
OGS	:Office on General Services
OIC	:Office in Charge
OJT	:On the Job Training
OLS	:Obstacle Limitation Surface
OPAPP	:Office of the Presidential Adviser on the Peace Process
OR	:Official Rain Station
PAF	:Philippine Air Force
PAGASA	:Philippine Atmospheric, Geophysical and Astronomical Services Administration
PAL	:Philippine Airlines
PAMANA	:Payapa at Masaganang Pamayanan
PB104	:Power Barge 104
PBSAP	:Philippine Biodiversity Strategy and Action Plan
PC	:Provincial Center
PCCP	:Portland cement concrete pavement
PCG	:Philippine Coast Guard
PCU	:Passenger Capacity Unit
PD	:Presidential Decrees
PDP	:Philippine Development Plan
PDPFP	:Provincial Development and Physical Framework Plan
PDR	:Project Description Report
PEISS	:Philippine Environmental Impact Statement System
PEPRMP	:Programmatic Environmental Performance Report and Management Plan
PFEZ	:Polloc Freeport and Ecozone
PFPEZ	:Polloc Free Port Economic Zone
PHIVOLCS	:Philippine Institute of Volcanology and Seismology
PIOUs	:Private Investor - Owned Utilities
PMP	:Philippine Maritime Police
PNP	:Philippine National Police
PPA	:Philippine Ports Authority
PPP	:Public Private Partnership
PR	:Progress Report
PRD	:Production
Pre-F/S	:Pre - Feasibility Study
PSA	:Philippine Statistics Authority
PSALM	:Power Sector Assets and Liabilities Management
PSSR	:Philippine Sustainable Sanitation Roadmap
PTB	:Passenger Terminal Building
PTF	:Presidential Task Force
PUA	:proximity to an urban area
PUC	:Primary Urban Center
PUV	:Public Utility Vehicles
R/W	:Runway
RA	:Regional Authority
RAIC	:Regional Agro - Industrial Center
RBCO	:River Basin Control Office
RC	:Regional Center

RCA	:Residual Containment Area
RDC	:Regional Development Council
RDCRM	:Regional disaster and climate resilience management
RDP	:Regional Development Plan
RDRMSF	:Regional Disaster Risk Management Spatial Framework
REDPE	:Regional Economic and Development Planning Board
RESA	:Runway End Safety Area
REZA	:Regional Economic Zone Authority
RFF	:Rescue and Fire Fighting
RNA	:Radio Navigational Aids
RNDP	:Road Network Development Project in Conflict - Affected Areas in Mindanao
RO	:Regional Office
RoCond	:Road Condition Assessment
RoRo	:Roll On – Roll Off
RPKs	:Revenue Passenger Kilometers
RPMA	:Regional Port Management Authority
RVR	:Runway Visual Range
SC	:Steering Committee
SCMDC	:South - Central Mindanao Development Corridor
SDF	:Special Development Fund
SEA	:Strategic Environment Assessment
SEMA	:South Eastern Mindanao Area
SEZ	:Special Economic Zones
SGCC	:State Grid Corporation of China
SHMs	:Stakeholders Meetings
SIDA	:Swedish International Development Cooperation
SLCPs	:Short - lived climate pollutants
SLF	:Sanitary Landfill Facilities
SMEs	:Small and Medium Enterprises
SMP	:Septage Management Program
SOCCSKSARGEN	:A region of the Philippines, located in central Mindanao, and is officially designated as Region XII
SRC	:Sub - Regional Center
ST	:Stage
STI	:Systems Technology Institute
SUC	:Secondary Urban Center
SUC-A	:Secondary Urban Center (A)
SUC-B	:Secondary Urban Center (B)
SWM	:Solid waste management
SWMA	:South Western Mindanao Area
SYN	:Synoptic Station
T/W	:Taxiway
TADP	:Third Airport Development Project
TAF	:The Asia Foundation
TDM	:Transportation Demand Management
TDP	:Transport Development Plan
TMC	:Traffic Management Center
TMP	:Traffic Management Program
TMU	:Traffic Management Unit
TransCo	:Transmission Corporation
TRSC	:Multi Transceiver
UC	:Urban Center
UGM	:Urban growth management
UHPAP	:United Harbor Pilot Association of the Philippines
UNCTAD	:United Nations Conference on Trade and Development

UNFPA	:United Nations Population Fund
UPA	:Urbanization Potential Area
USAID	:United States Agency for International Development
USGS	:United States Geological Survey
VHF	:Very High Frequency
VPA	:Vehicle Parking Area
WACS	:Waste Analysis and Characterization Study
WASAC	:Water and Sanitation Corporation

CHAPTER 20
INSTITUTIONAL ARRANGEMENT FOR THE INTEGRATED DEVELOPMENT OF THE GREATER COTABATO AREA

20.1 Introduction

As mentioned earlier, there are many identified projects in this survey where successful implementation requires collaboration of various Local Government Units (LGUs). This is because these projects straddle over areas of the different city and municipalities. Typical examples are road projects and flood control projects. Similarly, the survey encourages collaboration of the six (6) LGUs within the area of the Greater Cotabato to have an integrated development plan which is already prepared in this survey. However, preparation, resource mobilization, implementation and regular updating (e.g. every five years) further calls for a stronger collaboration from now on. The strengths and weaknesses of the LGUs involved were also identified in this survey, hence proposed interventions and suitable urban function for each LGU taking advantage of its natural strength is put forward (see Chapter 9 for detailed discussion). For the above reasons, possible institutional arrangement among the LGUs is studied.

20.2 Key Challenges for the Integrated Development of Greater Cotabato Area (GCA)

20.2.1 Necessary Improvement to Reduce Unbalanced Development in Greater Cotabato Area

<u>Unbalanced urban services in Cotabato City associated with negative generated impacts on traffic, land, environment and accessibility to services</u>

The current development situation where Cotabato City is almost the sole provider of various services (regional government services, trade and commerce, banking and finance, higher education, health services, etc.) creates the problem of traffic congestion, exposure to hazards of attracted informal settlers in the city, overstretch of urban facilities among others. The above-described negative scenario is one of the drivers in recommending the multi-polar spatial development scenario (see Chapter 7) which calls for balanced development of the GCA. Socioeconomic development in every municipality within the Greater Cotabato Area therefore should consider important role towards integration into a united Regional Center. Essential urban facilities and services that could be shared among these municipalities altogether with the rational use of hinterland agricultural lands and coastal resources shall be provided with necessary intervention. Cotabato City will lead in the delivery of these urban services as the center for institution, education, health, finance and commerce. These services, however, are expected to grow in nearby municipalities and develop integration and complementation of resources.

20.2.2 Indispensable Inter-Municipal Services To Promote Efficient Socioeconomic Development in GCA

Potential cooperative/common services among municipalities with weak capacity

Cooperation amongst municipalities is necessary to address common issues, such as disaster response and management for emergency situations, and other required urban services like waste management, water supply, power supply, transportation, and others. These municipalities must be organized through the principle of cooperation in undertaking common programs, activities and services for common benefits. Reinforcement and complementation of resources between and amongst resources-deficient areas may result to efficient and effective response to issues at hand.

Cooperative partnership between Cotabato City and the surrounding municipalities in the provision of basic services is necessary for the efficient delivery of regionwide public services, such as for waste management particularly for the identification of a common disposal area, water supply system with common and shared water sources, area clustered disaster risk management, and others.

Insufficient road and transportation network for inter-municipal connectivity and agri-based economic linkage

There are still significant wide areas and communities in the GCA that have very limited available roads which make these sites difficult to access to further improve social and economic development. Strengthening the road network is pre-requisite to promote agri-based economic development. Similarly, the road network in Cotabato City is not proportionally expanding with the growth of settlements, hence, new communities are deficient with good roads. In other cases, where roads had been built, they are usually narrow and/or have limited road ROW that prevent further road widening to increase its capacity. Public transport which is the main mode of transport of many commuters is observed to had very low level of service. Therefore, upgrading the level of service of the public transport system is essential to make it a truly public transport-oriented system and becomes a viable alternative to the growing number of car-users. Public transport system is an important element to pursue the preferred development scenario of Multi-polar urban centers for Greater Cotabato.

20.2.3 Critical consideration for the reduction of disaster risk and climate change impacts in the GCA

Necessary environmental integration toward regional wide climate resilience

The effect of climate change is already evident in Mindanao with recurring substantial damages suffered brought by recent typhoons. Mindanao was tagged before as a typhoon-belt free area. However, due to climate change phenomenon, the island is now susceptible to different extreme weather events. The Greater Cotabato Area had experienced in the recent years inundation that caused significant damage to properties and livelihood in the area. Massive flooding due to typhoons and heavy downpour occurred in 2008, 2009 and 2011.

Some identified factors that caused inundation within the Greater Cotabato Area include, among others, the non-priority watershed management, unprotected and silted rivers, improper solid waste management in some communities which resulted to river pollution and obstructed discharge among others. Proper watershed management and river protection programs must involve the joint efforts of several municipalities and city since the geographical coverage of these resources and the benefits they bring transcend and cut across municipalities and city within the Greater Cotabato Area. Integrated management of these resources through holistic approach among the concerned municipalities and city may prove effective to attain climate change resilient communities.

Cotabato City and the municipalities of Datu Odin Sinsuat, Sultan Kudarat, Sultan Mastura and Parang have settlements that are exposed to hazards exacerbated by climate change, such as sea level rise and storm surges. Flooding during strong typhoons and heavy downpour in Cotabato City and the surrounding municipalities always cause damage to properties, endanger lives, disrupt economic activity, and impede the delivery of basic services (see Chapter 5 for detailed discussion).

The local government units (LGUs) are considered first responders to deal with the effects of climate change as provided under the Climate Change Act of 2009 and the National Climate Change Action Plan. This is further mandated through mainstreaming climate change and disaster risks in the formulation of the Comprehensive Land Use Plan (CLUP) of every LGU.

Necessary efficient management for regional wide disaster risks

Every city/municipality is mandated to establish their respective City/ Municipal Disaster Risk Reduction Management Office (C/MDRRMO) primarily for the prevention and mitigation against natural hazard risks. As such, Cotabato City and the surrounding municipalities that compose the Greater Cotabato Area have their respective disaster risk reduction management offices. Each MDRRMO performs disaster risk reduction activities solely within the area of jurisdiction of their municipality. To cover a wider scope of disaster risk reduction management (DRRM) for the entire Greater Cotabato Area, an inter-municipality and city DRRM center must be established through a cooperative mechanism amongst the concerned LGUs. This GCA-wide DRRM Center may lead and guide activities for disaster preparedness and response for the entire area against natural hazards that usually strike irrespective and beyond territorial boundaries of LGUs. Additionally, regional evacuation center, regional logistic center for delivery of relief materials and rescue supply could play an important role to mitigate secondary negative impacts after disaster.

Necessary integrated resilient urbanization and infrastructure development

Among the development issues besetting the Greater Cotabato Area include the following: overcoming flood and storm surge prone areas; coping with vulnerable urban structure along with informal settlements exposed to flood risks; and existing infrastructure facilities are generally in poor condition. Correspondingly, a strategy to establish a resilient urban infrastructure and facilities to prevent and mitigate risks from natural hazards and improve public safety and living environment to attain a secured community life through cooperative mechanism among municipalities has been put forward in this survey.

20.3 Goal and Institutional Challenges

The Vision and Goals established by the BARMM Government (for wider area) and the City Government of Cotabato City (city-wide area) were adopted by this survey as discussed in Chapter 8. Figure 20.3-1 shows the overall development goal for the GCA and the three major institutional challenges that have to be addressed to advance the said goal. These are discussed below.

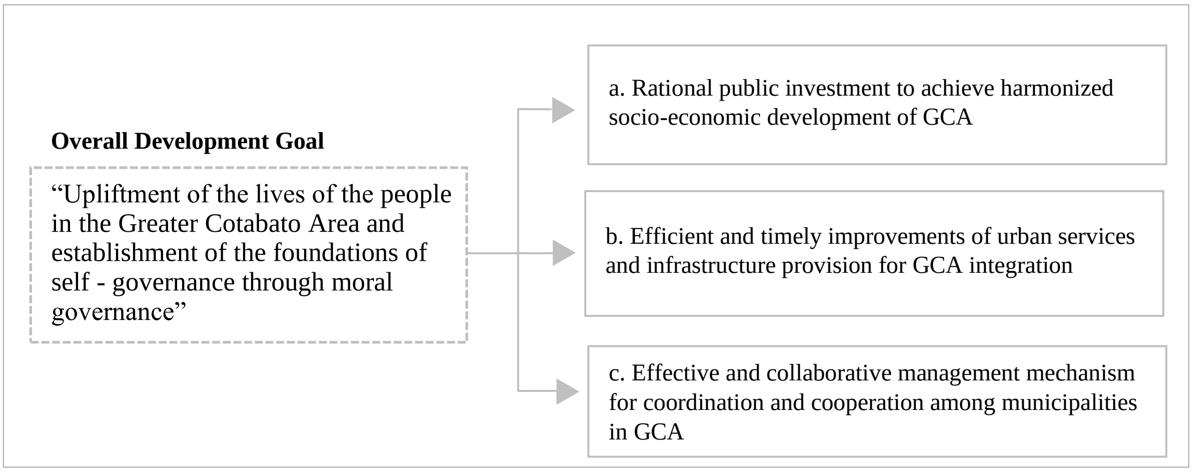


Figure 20.3-1 Goal and Institutional Challenges

a) Ensure rational public investment to achieve harmonized socio-economic development of the Greater Cotabato Area.

After coming up with this Masterplan for the development of the Greater Cotabato Area, the next issue that needs to be addressed is finding the necessary public investment for the implementation of programs and projects across sectors and area beneficiaries within the planned period of implementation to achieve harmonized socioeconomic development. This challenge will require diligent resource mobilization activities and rationalized investment programming.

LGUs are expected to provide the essential range of services to their constituents. However, many LGUs, particularly those belonging to low level income classification have scarce resources to fund different programs, projects and services. The Greater Cotabato Area LGUs are not spared of this situation. The wide range of services oftentimes compete among themselves in the hierarchy of budget allocation priority. The situation is even getting worse with slowing down economy caused by the Covid 19 pandemic. The challenge to implement new projects and provide quality services to the increasing population of every municipality/city in the GCA is putting greater pressure on LGUs budget. Inter-LGU cooperation within the GCA may help respond to a common purpose even under fiscal pressure.

b) Undertake efficient and timely improvements of urban services and infrastructure provision for the Greater Cotabato Area integration.

Once public investments are already in place, undertaking efficiently with vigor the needed improvements on urban services and infrastructure facilities is another challenge to be reckoned with. The essential urban services and infrastructure projects that cut across municipalities, e.g., water supply systems, improvement of road network and transportation systems, flood control projects along rivers that pass several municipalities, etc. may be better planned out and implemented in an integrated manner through close coordination amongst the stakeholders.

c) **Carry-out effective and collaborative management mechanism for coordination and cooperation among municipalities and city in Greater Cotabato Area.**

An integrated development through collaborative management of programs for the Greater Cotabato Area would promote strong coordination and cooperation among municipalities and city. The cooperative approach among these LGUs would enhance the planning and implementation of interrelated services and facilities.

20.4 Institutional Arrangement Options for Greater Cotabato Area Integration

20.4.1 Background on Inter-LGU Alliance

The legal basis of the inter-LGU cooperation or alliance is guided from the provisions of the 1987 Philippine Constitution Article X, Section 13 which states that "Local government units may group themselves, consolidate or coordinate their efforts, services, and resources for purposes commonly beneficial to them in accordance with law." This is further reinforced by the provisions under Republic Act No. 7160 or the Philippine Local Government Code of 1991, Book I General Provisions, Title One, Chapter Three, Section 33 which provides the Cooperative Undertakings among Local Government Units: "Local government units may, through appropriate ordinances, group themselves, consolidate, or coordinate their efforts, services, and resources for purposes commonly beneficial to them. In support of such undertakings, the local government units involved may, upon approval by the sanggunian concerned after a public hearing conducted for the purpose, contribute funds, real estate, equipment, and other kinds of property and appoint or assign personnel under such terms and conditions as may be agreed upon by the participating local units through Memoranda of Agreement".

The inter-LGU alliances is considered a significant arrangement that supports administrative decentralization and local autonomy of LGUs. Economic development, common infrastructure projects, environmental protection, ecosystem, coastal resource, tourism and landscape management, and integrated health development, among others, are the major purpose of establishing among many existing alliances of LGUs in the Philippines. Through the formation of alliances, LGUs will be able to achieve the attainment of an integrated plan with joint efforts and shared agreements to solve any problem that may arise. This arrangement is also promoting the principle of economy of scale where project implementation becomes cost-effective compared to projects implemented independently from one another.

a) Type of LGU alliances

Natural Inter-LGU Alliance Created through Memorandum of Agreement

The common type of LGU alliances in the Philippines is the Natural LGU Alliance. It is formed between or among LGUs for either a general or sectoral but with a common purpose of member-LGUs which motivated usually by the alliance-wide impact in the delivery of basic services and facilities that transcends local political boundaries and may entail large expenditure.

The basic legal instrument to initiate this type of alliance is a Memorandum of Agreement (MOA) signed by participating LGUs. The specific roles and responsibilities of the member-LGUs and the details of the purpose or focus programs of the alliance are stated in the MOA. The Local Chief Executives of member-LGUs are required to sign the MOA to formalize the organization of the alliance. But before the formalization of the MOA, legislative body or Sangguniang Bayan or Panglunsod of member-LGU should pass a resolution authorizing the LCE to sign on behalf of the local government and the enactment of an appropriation ordinance authorizing the budget for the financial contribution of the member-LGU to the alliance. The MOA creating the alliance should be ratified by the respective legislative bodies or Sangguniang Bayan or Panglunsod of member-LGUs so that it will become binding even to the next LGU administration. The alliance formed does not give a new juridical personality to the group, but each member retains its legal personality as a local government unit.

Examples of this type of alliance are the Pigkawayan-Alamada-Libungan-Midsayap-Aleosan-Pikit- Banisilan (PALMA- PB) in Cotabato province with revised MOA signed in 2004 and the common purpose of the alliance is for economic development with more focus in transportation infrastructure; the Southwestern Ligawasan Alliance of Municipalities (SLAM) was organized through a MOA signed on June 25, 2008 among the municipalities of Paglat, Datu Paglas, Sultan Sa Barongis, and Gen. Salipada K. Pendatun, all of Maguindanao province. The primary purpose of the alliance is economic development and environmental and ecosystem protection of the Ligawasan Marsh, a natural inland water resource.

Quasi-Public Alliance Created through Congressional Act

The quasi-public alliances are natural alliances among LGUs with common objective for public service but being managed and controlled as a government-owned and controlled corporation (GOCC) through a separate juridical personality through congressional legislation. The Act of Congress shall stipulate the detailed powers and responsibilities of every party involved and providing the necessary funds under the General Appropriation Act annually. This type of alliance may also be created through Executive Order by the President or Provincial Governor of the province having administrative jurisdiction over the member-LGUs. However, an alliance created through Republic Act is more permanent compared to ones created by an Executive Order. A Republic Act cannot be easily amended or modified. Any amendment or modification requires a tedious procedure that is similar to the enactment of any law by the congress itself.

A classic example for this type of inter-LGU alliance is the Metro Manila Development Authority (MMDA) covering 17 LGUs that constitute the National Capital Region (NCR) in Luzon. The MMDA was created through the enactment of Republic Act No. 7924 on March 1, 1995. An amount of P1 billion Pesos was appropriated for its initial operation. Subsequently, the yearly budget of the authority had come from the General Appropriation Act passed annually by Congress.

b) Advantages and Benefits in Forming Inter-LGU alliance

Based on a widely cited 2011 document entitled "Alliances of Local Governments in the Philippines" by Johny Natad, the following are the insights gained about the inter-LGU alliances in the Philippines:

- Resources can be maximized and augmented to share out with resources and ecosystems in those cross-political or administrative boundaries.
- Alliances also allow the local government units to raise and improve priorities and plans to higher planning authorities (i.e., provincial, regional and national government).
- Other organizations have benefited from building alliances in the implementation of their programs. Alliances have been demonstrating to be cost-effective to scale up programs.
- The alliance building or inter-local cooperation allows local government units to deal with environmental management and socio-economic agenda not covered by national government programs as part of the decentralization.
- The alliance permits the organization of LGUs and their LCEs based on a common cause, (e.g., geographical proximity, common needs, similar passion, similar problems, has borne very good results). Alliance served as the venue for Local Chief Executives (LCEs) to support each other, share-learning experiences in informal meetings, complement each other's strengths, and exert a pressure on other LCEs and communities to participate in similar reforms.

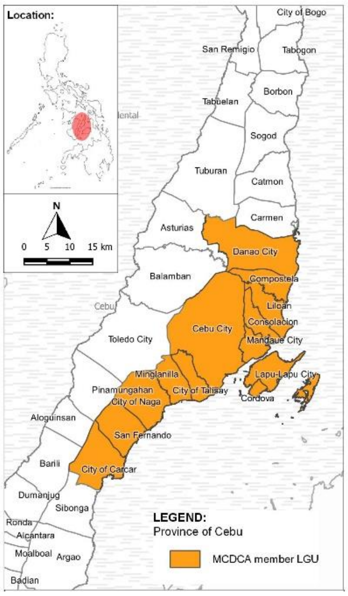
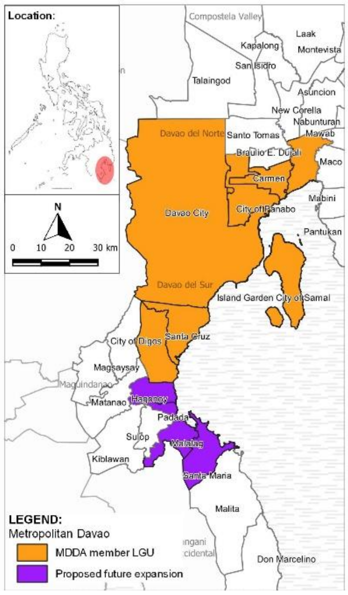
According to the Philippine Development Forum (2010), there are three critical ingredients in the formation of an "alliance" – legal, institutional, and financial. Legal ingredients refer to instruments that formalize the alliance among members. Institutional ingredients refer to the operational guidelines that form the backbone of the alliance. Finally, financial ingredients refer to resources that operationalize and sustain the programs, projects, or activities of the alliance.

c) Comparison of Metropolitan Development Authority in Manila, Cebu and Davao

The institutional arrangements created to facilitate collaboration among LGUs in Metro Manila, Metro Cebu and Metro Davao may serve a guide in advancing the creation of similar arrangement in the Greater Cotabato Area. Both Metro Manila and Metro Davao opted to have act of congress to create the Development Authority (note: the case of Metro Davao is still under the deliberation in the Congress). On the other hand, the Metro Cebu Development and Coordinating Board (MCDCB) was created through a MOA signed by the different local executives. As mentioned earlier, this kind of arrangement is prone to changing political environment and degree of commitment by the members. For the case of Cebu, after the death of its Vice Chair of the Board (and President of the Ramon Aboitiz Foundation, Inc. (RAFI)), the MCDCB became inactive. Most of its fund in its earlier operation came from the RAFI. Bills from the Senate and House of Representatives for the establishment of a Metro Cebu Development Authority, however did not prosper to become a law.

Table 20.4-1 Comparative Matrix of the Creation of the Metropolitan Development Authority for Manila, Cebu, and Davao

	Metro Manila Development Authority	Metro Cebu Development and Coordinating Board	Metro Davao Development Authority (proposed)
History	**Nov. 7, 1975**: President Ferdinand Marcos issued *Presidential Decree 824* creating Metro Manila and its managing corporation, the **Metropolitan Manila Commission (MMC).** **Jan. 9, 1990**: President Corazon Aquino issued *Executive Order No. 392*, which replaced the MMC with the **Metropolitan Manila Authority (MMA).** **Mar. 1, 1995:** The Congress of the Philippines passed *Republic Act 7924* creating the **Metropolitan Manila Development Authority (MMDA).**	**Apr. 1, 2011**: The **Metro Cebu Development and Coordinating Board (MCDCB)** was created through a Memorandum of Agreement (MOA), signed by local government executives, heads of national agencies, and leaders of the private and civil society sectors.	**Mar. 25, 2021**: The House of Representatives approved *House Bill 8930* seeking the establishment of the **Metropolitan Davao Development Authority (MDDA).**
Legal basis	**Republic Act 7924**: "An Act Creating the Metropolitan Manila Development Authority, defining its powers and functions, providing funding therefor and for other purposes"	MCDCB does not have legal and institutional powers, and was only created through a MOA. There were proposals for its establishment including *Senate Bill 436*, but these did not evolve into a law.	The *House Bill 8930* is undergoing legislative processes before being enacted into law.
Area coverage/ composition	MMDA is comprised of the following seventeen (17) local government units within the National Capital Region: • Caloocan • Las Piñas • Makati • Malabon • Mandaluyong • Manila • Marikina • Muntinlupa • Navotas • Parañaque • Pasay • Pasig • Pateros • Quezon City • San Juan • Taguig • Valenzuela	MCDCB is a consortium of the Cebu Province, including 13 cities and municipalities: • Carcar • Cebu City • Compostela • Consolacion • Cordova • Danao • Lapu-lapu • Liloan • Mandaue • Minglanilla • Naga • San Fernando • Talisay	The following local government units were identified to be part of the Metropolitan Davao: • Carmen • Davao City • Digos City • Island Garden City of Samal • Panabo • Sta. Cruz • Tagum City There were also proposals to include the following municipalities in Davao del Sur: • Hagonoy • Malalag • Padada • Santa Maria

	Metro Manila Development Authority	Metro Cebu Development and Coordinating Board	Metro Davao Development Authority (proposed)
Location Map			
Source of Funds and Operating Budget	An amount of PhP 1,000,000,000 was authorized for the initial operations of the MMDA, in accordance with *RA 7924*. Thereafter, the agency sources its funds from the following: a) General Appropriations Act (GAA) b) Internal Revenue Allotment (IRA) c) Levy fines, impose fees and charges for various services rendered d) Five percent (5%) of the total annual gross revenue of the preceding year, net of the internal revenue allotment of each local government unit	Previous activities were mostly funded by the **Ramon Aboitiz Foundation, Inc. (RAFI)**.	The amount of necessary for operation of the MDDA shall be induced in the annual General Appropriation Act. The operations of the MDDA be supported through contributions and technical assistances from member LGUs, national agencies and government-owned or controlled corporations, private sector, and local and international organizations in the form of grants, donation, fees and charges. MDDA is empowered to levy fines, and impose fees and charges for various services rendered.
Function	The MMDA is in charge of planning, monitoring and coordinative functions, and in the process regulates and supervises the delivery of metro-wide services within Metropolitan Manila.	The MCDCB serves as the coordinating body for inter-local coordination and public-private sector collaboration, towards a more sustainable city-region.	The council, as the policy-making body of the MDDA which exercises in plan approval, recommending investment program, promulgating rules and regulations, etc.
Head	MMDA is headed by the **Chairman** • Appointed by the President of the Republic • Carries the rank, rights, privileges, disqualifications and prohibitions of a cabinet member	MCDCB is headed by the **Chairman** • Served by the Governor of the Province of Cebu • Supported by two Vice Chairs selected among LGU executives and the private sector/civil society organizations representatives	The chairperson as head of the implementing arm of the MDDA, shall be assisted by a General Manager for finance and administration of MDDA.
Scope of services	MMDA's jurisdiction cover the following: a) Development Planning b) Transport and Traffic Management	MCDCB's areas of cooperation include: a) Urban and land use planning and zoning b) Transport and traffic management	MDDA's scope of service include: a) Development planning and including medium-long term development plans with coordination and monitoring functions

	Metro Manila Development Authority	Metro Cebu Development and Coordinating Board	Metro Davao Development Authority (proposed)
	c) Solid Waste Disposal and Sewage Management d) Urban Renewal, Zoning, and Land Use e) Health and Sanitation, Urban Protection and Pollution Control f) Public Safety	c) Pollution control and solid waste management d) Flood control, drainage, and sewerage management e) Urban renewal and shelter provision f) Health and sanitation g) Public safety h) Road improvement and infrastructure development i) Coastal resources, watershed, and environmental management j) Disaster risk reduction and climate change adaptation	b) Transport and traffic management c) Solid waste disposal and management d) Flood control, drainage, and sewerage management e) Urban renewal, zoning, land use planning f) Health and sanitation and urban protection g) Public safety
Governing board and policy making body	The **Metro Manila Council** (MMC) serves as the governing board and policy-making body of the MMDA. The MMC consists of the mayors of the sixteen (16) cities and one (1) municipality within the National Capital Region. Heads of various national agencies shall attend council meetings as non-voting members.	The MCDCB became inactive following the demise of Mr. Roberto Aboitiz, Vice Chair of the Board and President of the Ramon Aboitiz Foundation, Inc.	Board and The **Metropolitan Davao Development Council** (MDDC) serves as the governing board and policy-making body of the MDDA. The MMC consists of the governors of the five (5) provinces and nine mayors (9) municipality and cities.

20.4.2 Opinions from Key Officials on the Proposed Institutional Arrangement

The JICA Study Team conducted a quick consultation from July 2021 to September 2021 on the appropriate institutional mechanisms that may be put in place to efficiently and effectively plan out, implement, operate and ensure sustainability of the priority programs and services enunciated under the survey for the Greater Cotabato Area. The local chief executives of the municipalities of DOS, Parang, the City Administrator with some heads of offices of Cotabato City Government, and heads of the following ministries and offices in BARMM: Ministry of the Interior and Local Government (MILG), Bangsamoro Planning and Development Authority (BPDA), Ministry of Human Settlements and Development (MHSD) were interviewed personally and solicited their views and recommendations about the proposed institutional arrangement for GCA integration (Table 20.4-1) .

Table 20.4-2 List of BARMM Ministries/Agencies and LGUs Interviewed

LGU/Agency		Date of Interview
BARMM Ministries/Agencies	MHSD	August 11, 2021
	MILG	September 3, 2021
	BPDA	August 18, 2021
City/ Municipalities	Cotabato City	July 14, 2021
	Datu Odin Sinsuat Municipality (DOS)	August 11, 2021
	Sultan Kudarat Municipality	Interview is not secured
	Sultan Mastura Municipality	Interview is not secured
	Parang Municipality	August 20, 2021

Note: MHSD=Ministry of Human Settlements and Development; MILG=Ministry of the Interior and Local Government; BPDA= Bangsamoro Planning and Development Authority

The result of the interview revealed that the respective stakeholders commonly agree on the establishment of an inter-LGU cooperative mechanism or alliance that will facilitate the planning, programming, resource mobilization and implementation of different sectoral programs, projects and services of common interest and cut across boundaries of LGUs within Greater Cotabato Area. This will be a good venue where LGUs could discuss issues of common interest among themselves and come up with viable and collegial decision. Details of the survey result is available in the Table 20.4-3.

Table 20.4-3. Summary of Opinions by the Key Officials

List of Questions	Response from Key Stakeholders
1. If they are in agreement of having Metro Cotabato Development Authority (or Greater Cotabato Development Authority) covering Cotabato City, DOS, Sultan Kudarat, Sultan Mastura and Parang as a mechanism to facilitate development similar to MMDA in Metro Manila.	• The LCEs (local chief executives) and representatives of the three LGUs and heads of MILG and MHSD were all agreeable to the establishment of such authority. • These are their views: LGUs may form partnerships and other cooperative arrangements as provided under the Philippine Constitution and the Local Government Code; this will be a good venue for the LGUs to discuss matters of common interest; this is similar to the erstwhile Metro Kutawato Development Alliance; it is practical to have a body to discuss projects and concerns affecting these LGUs; it is also similar to PALMA-PB alliance in Cotabato province, and a regional structure could be organized since there are several LGUs involved. • One responded however raised the possible negative effect of having such authority which could be another layer of bureaucracy.
2. Perceived benefits of establishing such development authority.	• The primary goal is for efficient and effective implementation of programs and projects in the master plan for urban infrastructure development in Greater Cotabato Area; • Cooperation among LGUs will be strengthened, matters like law and order could be discussed, and residents of member-LGUs would benefit; • Promote complementation of services among LGUs (e.g. Parang could host the Seaport, DOS the airport, Cotabato City the institutional and commercial center, etc.); • It will unify the direction of the LGUs; it could have separate arrangement for planning at regional and local levels; it can help in preventing and/or attending to potential calamities.
3. Perceived drawbacks/ disadvantages of having such body?	• Cotabato City and DOS believe that there are no disadvantages in organizing a development authority; • Others viewed that the operation of the authority could be affected by political differences and dynamics of the LGU heads; • Rivalries and periodic changes in administration of leaders of the member-LGUs can affect the operation of the body; and • Having such body could result in slowing of process since there would be a need for agreement or consensus to be reached and LGU leaders have differences in outlook and interests.
4. Opinion on the possible functions of the Metro or Greater Cotabato Development Authority.	• It could establish cooperation on trade, tourism, solid waste management; • It can serve as coordinative/ consultative body for peace and order; • It can facilitate in harmonizing policies on transportation, health protocols on COVID-19, etc.; • It could be a mechanism for more effective and unified planning (a basic function of the body), promote better security, and facilitate projects that involve several LGUs or cut across borders; • Complementation among LGUs with their own attributes and respective contributions/roles for the common good/interest; • It can also be a means to improve the relationships among LGUs and services to their constituents.

List of Questions	Response from Key Stakeholders
5. Opinion on what sectors and services should be covered by the development authority.	The inter-LGU cooperation may cover the following sectors: • Roads and Transportation Systems; Solid Waste Management; Water Systems; Power/Electrification; Communication; Trade, Industry and Investment; Tourism Development and Promotion; Environmental Management; Disaster Risk Reduction Management; Urban Planning and Zoning; other large infrastructure projects; other sectors that are of common interest and agreed upon by the LGUs; cooperation on some sectors program/project implementation would promote cost-effectiveness as expenses could be shared.
6. Possible reasons that would make it difficult to establish the Metro Cotabato Development Authority.	• Political interests and differences among LGUs could have adverse effects and cause difficulty in establishing the body; • Resources would also be required to put up and operate such body; • Some LGUs may only advance their own interest and those who would hold leadership of the body could corner the projects and other benefits from the alliance; • In some areas of cooperation, all LGUs would participate in discussion and decision-making, like in Roads and Transport, but an LGU may not opt to participate in certain aspects, such as Tourism Development if they are not involved or interested; • The Development Authority may be affected or weakened by changes in leadership since the term of Local Chief Executives is only three years.
7. Opinion on what may be the first step to quickly establish the Metro or Greater Cotabato Development Authority (MCDA).	• The formation of the MCDA could start at the regional level and then at the local level. The BPDA can initiate the formation, however, if the arrangement would be similar to the PALMA-PB alliance, the MILG could be the facilitator. • A technical working group (TWG) may first be established to lay down the ground works and bring in the LCEs together. • It might be best that the formation of the MCDA be initiated by JICA, a neutral entity; there should be a levelling off session to clarify the functions of MCDA, the roles and responsibilities of the member-LGUs, and the MCDA should be managed by a professional non- politician who is not biased for one LGU. • The Cotabato City Government is willing to initiate the creation of the MCDA by reaching out to the LGUs within the Greater Cotabato Area. • The BARMM bureaucracy should first mature before the MCDA is established (that would take about 3-4 terms of office); there should be an enabling law passed by the BTA for the creation of the MCDA.
8. Other comments put forward by the Key Officials	• MCDA should be organized as a Government Owned and Controlled Corporation (GOCC) and an income-generating entity; • JICA could arrange for the prospective LGU members of the development authority to go on local study mission to areas where there are functional development authorities or alliances, e.g., PALMA-PB and MMDA; • JICA should invite the LCEs and/or MPDCs in its planning sessions and other activities related to this; • Parang is open to be the host of common facilities, e.g., Solid Waste Facility, as long as other LGUs would comply with agreement had been made; • LGU DOS is willing to make a small contribution, e.g., P100,000 per year to help fund the initial operation of the MCDA; • The details of the proposed MCDA need to be further studied and these will be referred to other officials of Cotabato City Government. • The masterplan should include a sports complex to allow BARMM to host national sports competition;

20.4.3 Three (3) Institutional Arrangement Options Initially Identified for the Greater Cotabato Area

There are three (3) options that maybe pursued by the officials of the Greater Cotabato Area as illustrated in the Figure 20.4-1 below. These are:

Option 1: Establishing an Authority for Greater Cotabato Area Development

- Establishing a development authority or corporation (SPC) with roles and functions for inter-municipal services with 1) decision-making; 2) budgeting; and 3) project implementation.
- LGUs will manage own municipal (local) services, except the services by the organization or authority.

Option 2: Formulating a Corporation in Specific Sector by Cooperative System

- Establishing a cooperative corporation for inter-municipal services in specific sector entrusted by LGUs accompanied with equity share of the corporation
- LGUs will manage municipal services and administration except their services for specific inter-municipal services

Option 3: Attaching Subordinate Organization under a Similar Organization

- Establishing a coordination committee for economic and infrastructure development of each LGU to discuss and determine common and mutual beneficial development
- LGUs will manage not only own services independently, but also cooperative services through the committee

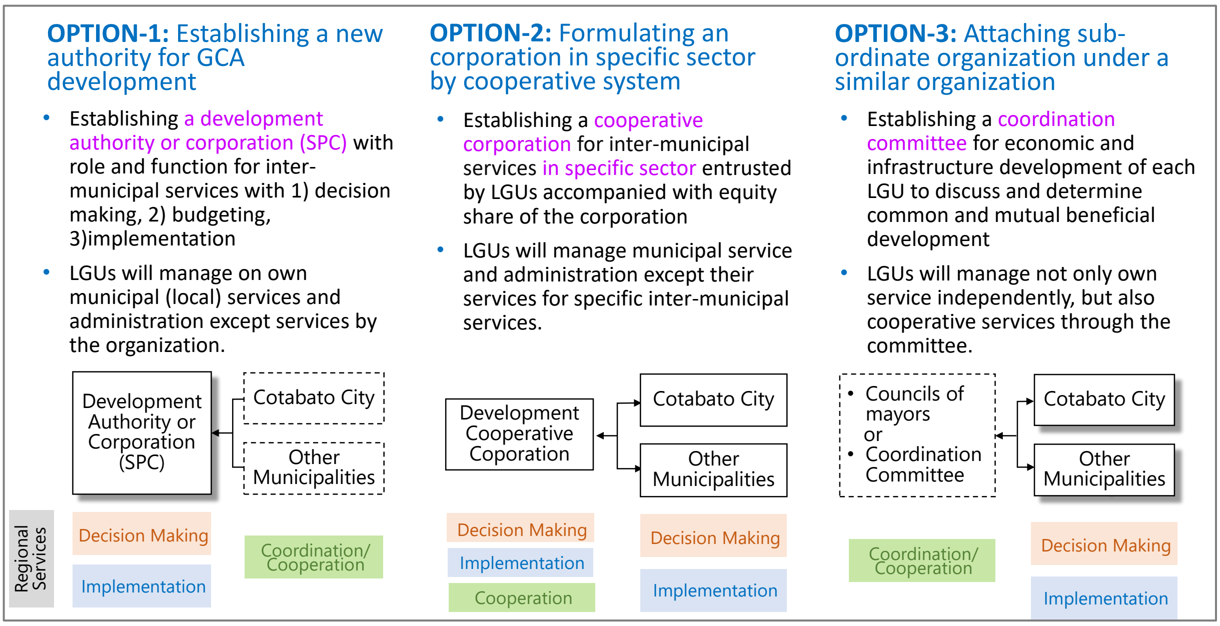


Figure 20.4-1 Three Institutional Arrangement Options

Similarly, the possible sectors and urban services that may cover by each option is indicated in the Figure 20.4-2 below.

Sector (Role)	Key Activities for Inter-municipal Service	Scope of Urban Service & Management		
		Option-1: Dev Authority or SPC	**Option-2**: Cooperative Corporation	**Option-3**: Coordination Organization
Administrative	Coordination/ Cooperation	●	○	●
	Independent financing and budgeting	●	●	--
	Operation and management staff	●	●	--
Planning and Programing	Development plan formulation	●	○	○
	Formulation of standards and rules	○	--	--
	Monitoring and evaluation	●	●	○
Implementa-tion and Management	Project and Program implementation	●	○	--
	Development control & management	○	--	--

Legend: ● = Fully functioning; ○= Partially functioning; -- = not functioning

Figure 20.4-2 Scope of Inter-municipal Urban Services by Organizational Options

a.) Option 1: Establishing an Authority for Greater Cotabato Area Development

__Characteristics__

- This type of institutional arrangement is popular for metropolitan urban areas, such as in Metro Manila, Metro Davao, and Metro Cebu. Although, the proposed creation of the Metro Cebu Development Authority from a Metro Cebu Development and Coordinating Board has not yet evolved into a law; meanwhile, the establishment of Metro Davao Development Authority (MDDA) is already in the advanced stage of deliberation in the Philippine Congress.
- Under this arrangement, cluster of LGUs mostly contiguous are organized to become one juridical person with vested rights of a government-owned and controlled corporation (GOCC), but each member-LGU still retains its original legal personality as a local government unit and in no way diminishes the autonomy concerning purely local matters.
- The municipalities of DOS, Sultan Kudarat, Sultan Mastura, and Parang will maintain their identity as political units under the province of Maguindanao, also with Pigcawayan which is under Cotabato province. Hence, the provincial leaderships of these two provinces should be consulted in the matter of the formation of this inter-LGU alliance for their support.
- The metro development authority is perceived to have relative institutional permanence, greater corporate powers and functions and fiscal security. This holds true since the congressional act establishing the development authority is not easily amended, modified or repealed, as it needs to pass another law going through the tedious process of congressional consultations, hearings and deliberations. The annual budget for the operation of the development authority is assured with yearly allocation from the General Appropriation Act (GAA), and normally complemented with contribution from every member-LGU. Another feature of the metro development authority is, it

is more of a technical than a political organization and headed by a chief executive officer appointed by the President, and who is not presently holding any elective position.

- In the case of a metropolitan development authority for the Greater Cotabato Area, it is most appropriate that the congressional act necessary for its establishment be lodged with the Bangsamoro Transition Authority (BTA) or the legislative body of the Bangsamoro Autonomous Region in Muslim Mindanao (BARMM), and its yearly budget becomes part of the annual allocation for the BARMM as provided for under the General Appropriations Act (GAA) from the national government.

Basic Function

- The basic function of the metropolitan development authority is to render services that are multi-LGU or metropolitan-wide coverage and impact, transcending local geographic boundaries for different sectoral programs and projects which may entail substantial fund requirements. Corresponding to this, the decision-making/planning, programming and budgeting, and project implementation are to be undertaken in collegial approach by the organization or authority, with strong coordination and support from every member-LGU. However, each member-LGU continues to manage its purely local activities or services as a distinct local government unit.

b.) Option 2: Formulating a Corporation in Specific Sector by Cooperative System

Characteristics

Currently, most facilities and services being provided by the LGUs within the Greater Cotabato Area are specifically managed by the individual LGU to serve and benefit the constituents of each particular LGU. These include solid waste management, water supply systems, sewage management, and transportation facilities. LGUs differ in the management of their respective services to their population. The Development Cooperative Corporation type of alliance is an alternative over the independent LGU management that is presently obtaining in every LGU within the GCA.

This type of alliance aims to integrate the operation and management of certain service or sector into inter-municipal services by a development cooperative corporation to be organized by the LGU alliance. This cooperative corporation type of alliance is espousing the principle of the economy of scale for capital intensive services like public utilities and transportation facilities which lower income class LGUs would normally find difficulty financing. Usually, a professional technical individual takes the lead in the management of the corporation rather an elected politician who may favor or give undue advantages to some groups for his past and future political aspirations. Further, this type of alliance promotes greater cost recovery for the facility which will result to the improvement of the service.

Possible inter-municipal facility and services that may be implemented, operated and managed by the development cooperative corporation to be organized by the inter-LGU alliance in Greater Cotabato Area are the integrated septage management, water supply system, solid waste management, integrated transportation facilities, holistic flood control management and others.

The LGU alliance may decide whether to establish one cooperative corporation for an individual facility/service identified or one cooperative corporation for two or more interrelated facilities/services.

The inter-LGU alliance is formalized through a Memorandum of Agreement (MOA) among the member-LGUs signed by the respective LCEs and ratified by the legislative bodies or Sangguniang Bayan or Panglunsod of every LGU. The development cooperative corporation to be organized shall be registered with the Securities and Exchange Commission (SEC) and shall operate as a private corporation and follow the existing processes and regulations of the corporation laws.

The development cooperative corporation organized by LGUs should ideally be officially recognized by the BARMM Parliament to enhance the stature of the corporation and allow the BARMM Government to provide financial and other forms of support.

Basic Function

The development cooperative corporation shall implement the specific inter-municipal facility/service as provided for in the establishment of the corporation. The corporation shall perform the tasks of decision-making through its governing board, project/ service implementation, and cooperation among member-LGUs.

Each member-LGU continues to implement the usual municipal projects and services within the local jurisdiction of the city/municipality.

c.) Option 3: Attaching Subordinate Organization under a Similar Organization

Characteristics

This type of LGU alliance also conforms to a Constitutional provision of allowing LGUs to form a collegial body for common purposes but still maintaining the individual powers of LGUs composing it. The leadership of this body lies on the Council of Mayors composed of local chief executives representing all member-LGUs constituted as a development council. The Council of Mayors shall choose among themselves its Chairperson for a fixed period of time. The Council may organize different sectoral coordination committees, e.g., economic and infrastructure development committees which are tasked to discuss matters concerning specific sectoral programs, projects and services across different LGU boundaries in coordination with concerned LGUs and national agencies implementing units. The Council of Mayors may be formalized through a Memorandum of Agreement (MOA) signed by the local chief executives of member-LGUs. This is similar to the Metro Kutawato Development Alliance (MKDA) that was formed in the past with Cotabato City, Sultan Kudarat, Datu Odin Sinsuat, Upi, and other towns as members. This body could be provided formal recognition by the BARMM Government through the issuance of an Executive Order or an act of the BARMM Parliament. This type of institutional mechanism is considered a mini-Regional Development Council (RDC) that exist in all administrative regions in the country.

Basic Function

The Council of Mayors together with the sectoral coordination committees shall act to discuss and determine common and mutual beneficial development across LGUs in an integrated approach. The concerned LGUs, however shall undertake the implementation of these inter-municipal projects or services within their respective area of jurisdiction in coordination with the concerned sectoral committees and other implementing agencies. National funded projects across LGUs may continue to be implemented by national government agencies or BARMM agencies, however they must establish strong coordination with the Council and the concerned sectoral committees. Each LGU shall continue to retain its local government autonomy to plan and implement purely local projects and services.

20.5 Assessment of Options and Recommendation

20.5.1 Comparison of Advantages and Disadvantages of Options

The comparison matrix below shows the advantages as well as disadvantages of each option. In terms of easiness to establish, Option 3 (Coordination Organization) is the easiest, fastest and the most common arrangement among the LGUs. However, it has also many limitations and major of which is the inability to promote and implement large-scale projects which is one of the aims of the establishment of the inter-LGU alliance. On the other hand, Option 1 (Development Authority) perhaps has the strongest power to promote and lead the implementation of the projects identified in the survey. The succeeding discussion provides in-dept look at each Option. Recommendation is then made as well as the corresponding roadmap.

Table 20.5-1. Advantages and Disadvantages of Options

Options	Advantages	Disadvantages	Degree of Difficulty
Option 1 (Development Authority or SPC)	• Enable Greater Cotabato Area (GCA) to achieve quickly and efficiently expected key infrastructure development targets. • Enable development finance to raise and manage easily projects and programs. • Enable GCA to maintain certain level of services quality in each LGU. • Enable GCA to give opportunities to involve private sector investment.	• Duplication of development authority with the Bangsamoro Planning and Development Authority (BPDA). • Requiring certain level of funding and financial capability to operate and manage sustainably. • There might be negative effect such as political interference beyond consensus of LGUs, misuse of its power of development ignoring interests of LGUs.	Difficult and takes time to establish
Option 2 (Cooperative Corporation)	• Cooperative corporation would be able to offer direct services through beneficial programs to each member of LGU in cooperative manner. • Corporation may be controllable by members of LGU within organizational capabilities.	• This corporation may have limitation to operate and manage project or program in terms of scale and budget. • There are some negative factors to operate and manage due to potential weakness of governance without sufficient full-time staffs equipped with appropriate technical capacities.	Moderately difficult and may take a bit of time
Option 3 (Coordination Organization)	• Enable GCA to launch a coordination mechanism immediately utilizing existing institutional frameworks. • Enable GCA to coordinate and cooperate with subjects to achieve mutual and beneficial projects and programs.	• This organization of coordination among LGUs may have limitation to implement projects or programs within capabilities of LGUs. • Coordination may not guarantee successful projects and programs depending on each LGU capability.	Easy and can quickly be established

20.5.2 Discussion of Options and Recommendations

Option 1: **Establishing a Metro Cotabato Development Authority**

The experience of the MMDA showed that the body was not outrightly formed as MMDA but rather it has metamorphosed from being a Metro Manila Commission in 1975 to Metropolitan Manila Authority in 1990 and finally to become the Metro Manila Development Authority in 1995 which is clothed with more power and authority than the previous two bodies.

The proposed establishment of the Metro Cebu Development Authority evolved from the previous inter-LGU Metro Cebu Development and Coordinating Board organized in 2011 through a Memorandum of Agreement (MOA) of Cebu province and 13 cities and municipalities. However, until now, the proposed Metro Cebu Development Authority filed before the Senate and House of Representatives has not become a law. These foregoing scenarios suggest that the establishment of a metropolitan development authority will take some time and it has to undergo a process of gradual transformation of the inter-LGU alliance until it reaches the right time to become a metropolitan development authority.

In view of the foregoing, the option of establishing the Metro Cotabato Development Authority outright as an institutional mechanism in the delivery of facilities and services for the Greater Cotabato Area in an integrated approach may not yet feasible within the short-term.

Option 2: Formulating a Corporation in Specific Sector by Cooperative System

This type of inter-LGU alliance would necessarily require a careful examination of the present situation analysis of the different sectors performance across the Greater Cotabato Area. The key officials during consultation by the JICA Study Team identified various sectors and services that they think should be covered by the inter-LGU alliance. Establishing a cooperative development corporation to manage a particular sector or service is a very technical endeavor and this will entail a required sufficient skills and managerial expertise to avoid failure. Further, the necessary capital investment needed for such undertaking is another significant concern. An integrated water supply system or an electrification project or a communication system or even a solid waste management with sanitary landfill across Greater Cotabato Area is a business venture requiring huge capital outlay which practically the inter-LGU alliance will find difficulty to put up.

Hence, a newly organized inter-LGU alliance will find difficulty to engage immediately in this cooperative development corporation type of institutional mechanism owing to huge outlay requirements and technical skills necessary to run this kind of corporate venture. Therefore, this institutional arrangement is not recommended as the initial inter-LGU alliance in the Greater Cotabato Area. But as the initial LGU alliance matures and becomes equipped with sufficient logistics and capacities, this development cooperative corporation arrangement may be adopted as another institutional mechanism option.

Option 3: Attaching Subordinate Organization under a Similar Organization

Most inter-LGU alliances in the country began their cooperation with this type of organization. This is established as a Council of Mayors where the Local Chief Executives (LCEs) of member LGUs form an alliance through a Memorandum of Agreement (MOA) entered among themselves. The PALMA-PB in Cotabato Province and the Southwestern Ligawasan Alliance of Municipalities (SLAM) in Maguindanao are examples of this type of inter-LGU alliance in Mindanao.

Among the three options, this is the simplest to establish and sustain its operation. The workforce of this alliance is lodged with the coordination committees (initially proposed are the economic and infrastructure development committees but may expand to other sectors in the future). These committees undertake the coordination/cooperation with the technical personnel of member-LGUs and national and/or BARMM implementing agencies for matters related to the delivery of economic and infrastructure services that transcend boundaries across the Greater Cotabato Area. The implementation of these services continues to be with the implementing agencies for national-funded projects/services and the respective LGUs for local-funded ones.

For a start of an inter-LGU alliance for the Greater Cotabato Area, this institutional arrangement is recommended to be put in place in the short-term. As the alliance progressed in the future, it may transform into a higher level of cooperation as necessity requires.

20.6 Proposed Roadmap for GCA Development Integration

Roadmap to Establish Development Authority

The preceding section showed that among the three institutional arrangement options, Option 3: Attaching Subordinate Organization under a Similar Organization or the establishment of the Council of Mayors is the most appropriate to start an inter-LGU alliance in the Greater Cotabato Area. This could be formalized through a Memorandum of Agreement among the member-LGUs and concurred by the BARMM through an Executive Order from the Chief Minister. The creation of this Council may be facilitated by BARMM Ministry of the Interior and Local Government (MILG) and the Bangsamoro Planning and Development Authority (BPDA).

Since this alliance shall function as a mini- Regional Development Council (RDC) for the Greater Cotabato, this Council of Mayors shall be organizationally under the umbrella of the Bangsamoro Economic and Development Council (BEDC). However, prior to formally organizing this inter-LGU alliance, an interim Technical Working Group (TWG) composed of technical personnel from the BARMM-MILG, BPDA, Maguindanao Provincial Government and member-LGUs shall be established first to do the necessary groundwork, such as, consultations with respective LGU officials, preparation of draft Operations Manual of the alliance, conduct necessary research and interviews on stakeholders of similar inter-LGU alliances, field and observation trips in areas with similar inter-LGU alliances, preparation of the draft MOA, and other necessary activities. Once the TWG has come up with the necessary preliminary materials and recommendations, BARMM could initiate the meetings of the proposed Council of Mayors to agree on the formalization of the alliance and other matters.

As the initial or take off inter-LGU alliance (Council of Mayors/ GCA Development Coordination Council) performs its functions expectedly to begin by 2022, and over time, the alliance may expand to engage into development cooperative corporation which can implement specific sector services, when it becomes capable. Further, probably by year 2040 or even earlier, the alliance may already qualify to establish a metropolitan development authority which can implement integrated inter municipal projects and services. The Figure 20.6-1 below describes the roadmap for establishment of institutional arrangement.

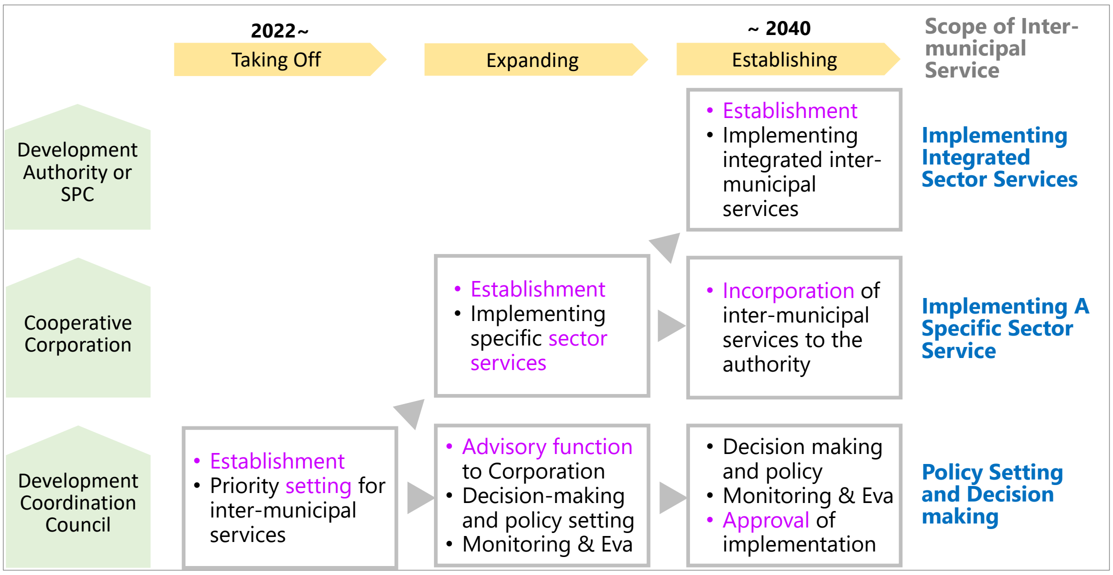


Figure 20.6-1 Roadmap to Establish Development Authority

Organization Structure and Key Responsibilities of the Council

The draft organization structure of the Development Coordination Council as a first step towards the establishment of a development authority is presented in the Figure 20.6-2 below. The key responsibilities of the Council are:

- To formulate policies and make decision for inter-municipal services and management
- To monitor and evaluate impacts of policies and programs

The sectors to be covered may start from road, flood control, transportation management and disaster risk reduction and waste management. These are some of the most pressing issues in the GCA. As the operation of the council improves, other sectors and services maybe added. In its full operation, the following sectors and services maybe covered:

Infrastructure and Utilities:

- Road improvement and connectivity
- Public transport management
- Traffic administration
- Flood control, stormwater management, drainage, and sewerage system

- Solid waste management
- Water supply

Economic, Environment and Public Safety Development

- Industry, trade and investment
- Tourism development and promotion
- Coastal resource protection
- Environmental management
- Disaster risk reduction and management
- Preparedness for preventive and rescue operations during calamities
- Maintenance of peace and security
- Health and sanitation services

Detailed Functions

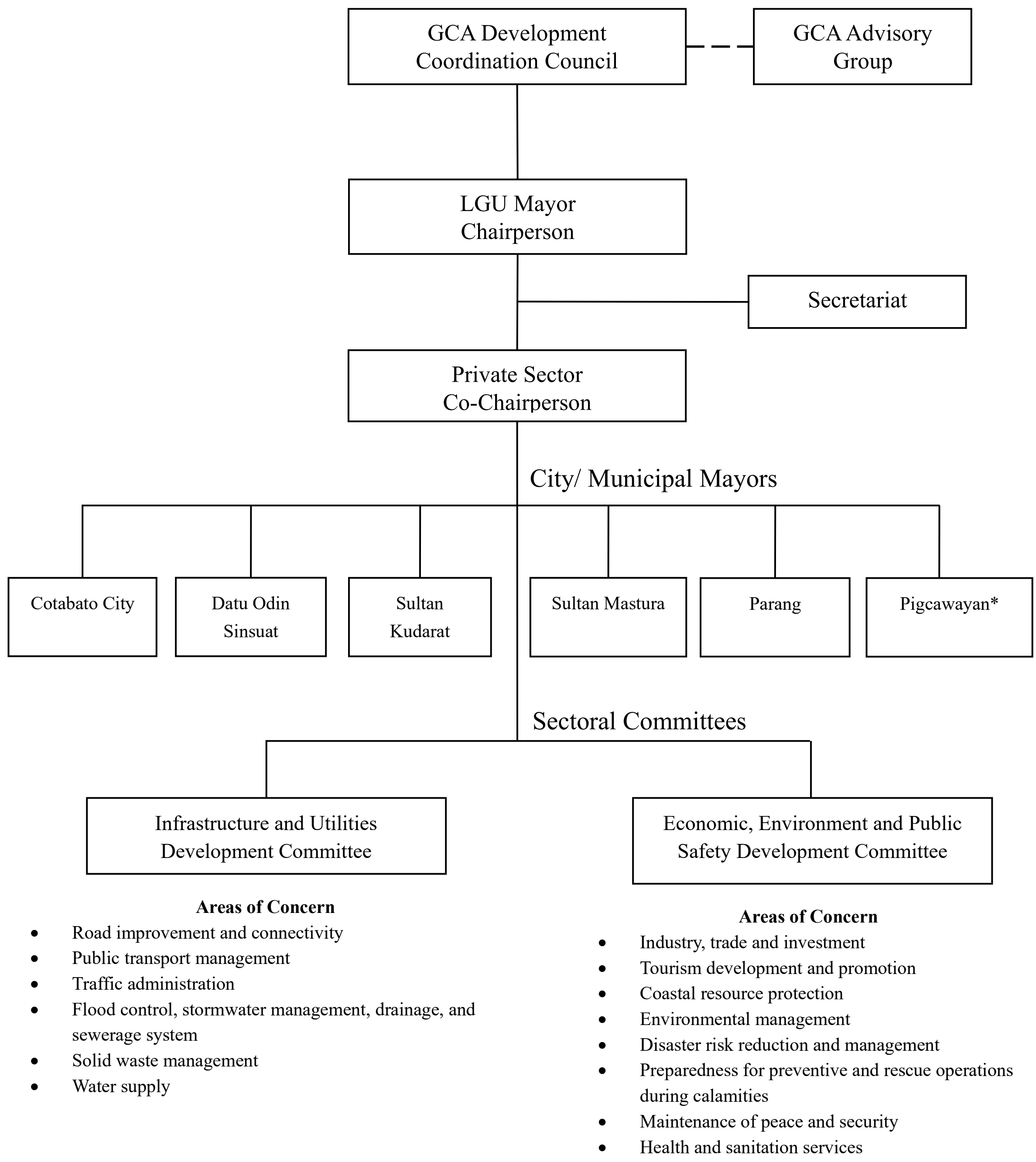
The presentation below provides initial description and insights on the proposed GCA Development Coordination Council as an institutional mechanism to carry out development initiatives for the GCA. This, however, may be enhanced further through the Council's Operations Manual (to be drafted soon once the alliance is ready to be formally organized) that shall guide and govern the specific activities of the Council.

Composition:

The GCA Development Coordination Council is composed of Mayors of six LGUs (Cotabato City, Datu Odin Sinsuat, Sultan Kudarat, Sultan Mastura, Parang, Pigcawayan); a representative from the private sector; chairpersons of the sectoral committees (Infrastructure and Utilities Development Committee; and Economic, Environment and Public Safety Development Committee).

GCA Advisory Group:

An advisory group composed of the following: Congressman 1st District of Maguindanao; Provincial Governor of Maguindanao; BARMM MILG Minister; BARMM BPDA Director-General, shall be recommended by the Council to become its pool of advisers/consultants.



Note 1: * Referring to the 11 barangays which joined the BARMM and under the study area

Note 2: Organization structure will evolve as the inter-LGU alliance progresses from "council" to "authority" as illustrated in the roadmap

Figure 20.6-2 Proposed Organization Structure of GCA Development Coordination Council

Leadership of the GCA Development Coordination Council:

The Chairperson of the GCA Development Coordination Council shall be elected by the members from among City/Municipal Mayors; the Co-Chairperson shall also be elected by the Council members from among the private sector representatives who are members of the sectoral committees.

Duties of the Council Chairperson:

- Preside over the meetings of the Council.
- Request any agency, individual member of the Council, Sectoral Committee, Secretariat to perform other functions as the Council may deem necessary, provided that such functions are within the mandate or mission of said agency or organization.
- On behalf of the Council, accept donations, contributions, grants, bequests or gifts in cash or in kind from Council members, foreign governments, international organizations and offices, private entities, or any individual for purposes related to GCA development.
- Coordinate with implementing agencies and concerned local government units regarding CGA-wide specific challenges, problems, and projects as may be identified and deliberated upon by the concerned sectoral committees, and the Council with the end in view of facilitating solutions, coordinating smooth implementation of projects and interventions, and bridging possible gaps.
- Facilitate the monitoring of the implementation of plans and programs through the sectoral committees and the Council proper concerning inter-local and GCA-wide development programs, projects and activities.
- Guide the formulation of a strategic and integrated development plan and the preparation of proposals and investment programming priorities for GCA-wide area.
- Review, revise and approve all policy recommendations, plans, programs, and projects submitted by and originating from the Sectoral Committees and Secretariat before submission to the Council for approval, and subsequent endorsement to higher authorities, such as BEDC and other offices.
- Lead in the resource mobilization activities for investment in the GCA-wide programs, projects, services.
- Supervise all activities of the Council; and,
- Perform other functions and duties as may be requested by the BARMM BEDC, BTA, and other BARMM leaders and the GCA Advisory Group.

Duties of the Council Co-Chairperson:

- Preside over the meetings of the Council in the absence of the Chairperson.
- Assume the duties and responsibilities of the Chairperson, whenever the Chairperson is unable to perform his functions or when the position of the Chairperson becomes vacant, until such time that a new Chairperson has been selected from among the City/Municipal Mayors of GCA.
- In the absence of the Chairperson, act on matters requiring immediate decision, provided, however, that a report thereof shall be submitted to the Chairperson within a reasonable time.

Responsibilities of the Member-LGU Chief Executives:

- Be active and ever supportive members of the Council.
- Religiously attend regular meetings of the Council.
- Attend the sectoral committee meetings when deemed necessary.
- Represent the LGUs in resolving issues and concerns affecting GCA-wide programs, projects, activities.
- Make representation to the respective LGUs to share contributions to the alliance for the operations of the Council.
- Render regular reports to the respective LGUs on the activities of the Council with regard to the GCA-wide development programs, projects, services.
- Perform other activities that the Council may request relative to the functions of the Council and its sectoral committees.

Secretariat of the GCA Development Coordination Council:

The designated secretariat of the Council may be the City/ Municipal Planning and Development Office of the sitting Chairperson of the Council for effective and smooth work coordination between the Chairperson and the secretariat. The secretariat has the following functions:

- facilitate the preparation in the conduct of the Council meetings (invitation, agenda folders, other logistical requirements).
- keep a complete record of all the proceedings of the sessions of the council and sectoral committee meetings.
- certify to the veracity of all official records and documents of the council.
- prepare council resolutions.
- perform such other functions as may be assigned by the Council.

Infrastructure and Utilities Development Committee:

The basic function of the committee is to facilitate the formulation, coordination and monitoring of policies and development plans concerning inter-municipal programs, projects, and services, and come-up with recommendations for the Council to ensure efficient and effective management and implementation of these programs, projects, services under the priority subsector areas of concern (Road improvement and connectivity; Public transport management; Traffic administration; Flood control, stormwater management, drainage and sewerage system; Solid waste management; Water supply).

The committee shall act as a clearing house of all infrastructure and utilities- related concerns before elevating to the GCA Development Coordination Council Proper for its appropriate action. Thus, all matters pertaining to this sector must first be discussed and deliberated thoroughly within the committee. In cases when there is a need to get relevant information about the issue at hand, the committee may invite qualified resource persons from concerned government agencies and private organizations during its deliberations and/or organize a sub-committee task force to do a complete staff work about the matter, thereby generating sufficient information for the consumption of the committee.

Membership: The GCA Development Coordination Council Proper has the discretion in selecting members of the Infrastructure and Utilities Development Committee. Members may come from the government and private sectors. The selection of the committee members may be guided by the following criteria:

- Relevance of the agency's/ organization's/ individual's mandate/ competence/ expertise to the areas of concern of the Infrastructure and Utilities Development Committee's work and thrusts.
- Committee's need for assistance in the area of competence of the prospective member.
- Scope of influence (relative to the infrastructure sector) of the prospective member.
- Government agencies relevant to the infrastructure and utilities development should become permanent members of the Infrastructure and Utilities Development Committee.
- The City/ Municipal Planning and Development Offices of all member-LGUs in GCA should become permanent members of the Infrastructure and Utilities Development Committee.

The Chairperson of the Infrastructure and Utilities Development Committee shall be selected from among its members by themselves. The secretariat of the committee may come from the office or organization of the Committee Chairperson selected, or as determined by the committee itself.

Economic, Environmental and Public Safety Development Committee:

The committee shall be responsible to facilitate the formulation, coordination and monitoring of policies and development plans related to inter-municipal, programs, projects and services, and recommend to the Council appropriate action for efficient and effective management and implementation of these inter-municipal programs, projects, and services under the priority subsector areas of concern, such as, Industry, trade and investment; Tourism development and promotion; Coastal protection; Environmental management; Disaster risk reduction management; Preparedness for preventive and rescue operations during calamities; Maintenance of peace and security; Health and sanitation services.

The committee shall act as a clearing house of all economic, environment and public safety-related concerns before elevating to the GCA Development Coordination Council proper for its appropriate action. Thus, all matters pertaining to this sector must first be discussed and deliberated thoroughly within the committee. In cases when there is a need to get relevant information about the issue at hand, the committee may invite qualified resource persons from government agencies and/or private sectors during its deliberations and/or organize a sub-committee task force to generate more information about the matter.

The Chairperson of the Economic, Environment and Public Safety Development Committee shall be selected from among its members by themselves. The secretariat of the committee may come from the office or organization of the Committee Chairperson selected, or as determined by the committee itself.

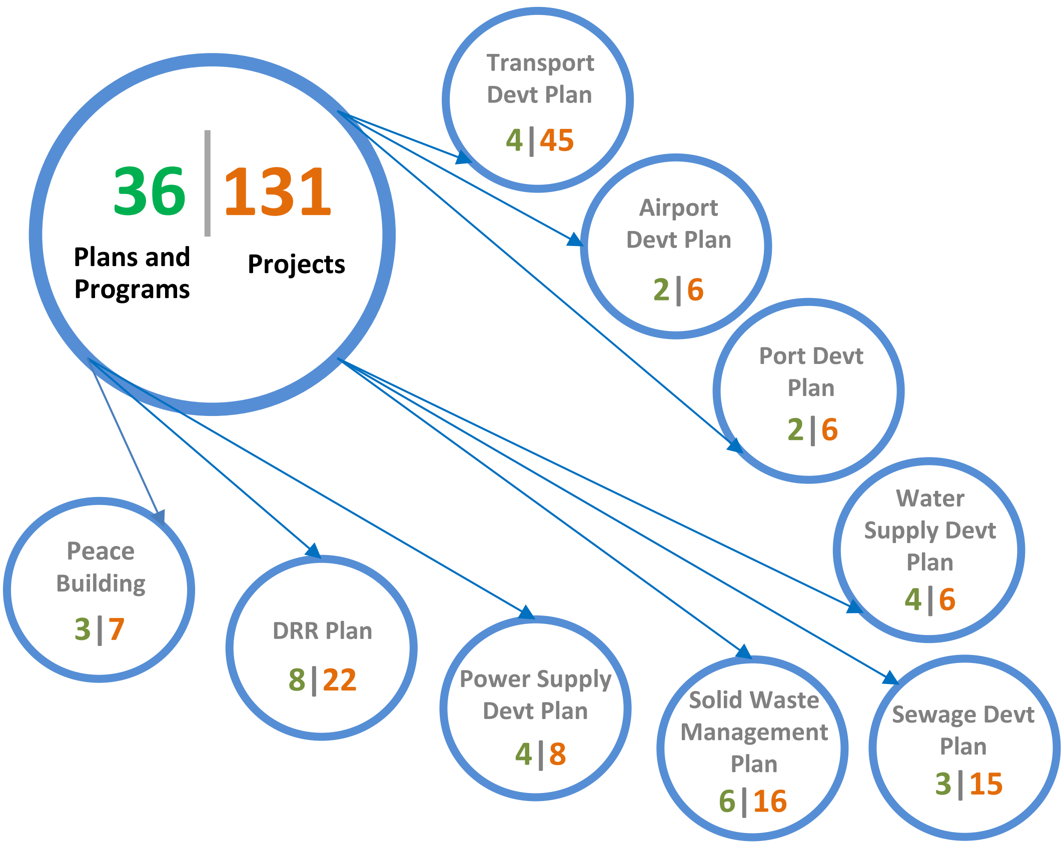
Membership: The GCA Development Coordination Council Proper has the discretion in selecting members of the Economic, Environment and Public Safety Development Committee. Members may come from the government and private sectors. The selection of the committee members may be guided by the following criteria:

- Relevance of the agency's/ organization's/ individual's mandate/ competence/ expertise to the areas of concern of the Economic, Environment and Public Safety Development Committee's work and thrusts.
- Committee's need for assistance in the area of competence of the prospective member.
- Scope of influence (relative to the economic, environment and public safety sector) of the prospective member.
- Government agencies relevant to the economic, environment and public safety development should become permanent members of the Economic, Environment and Public Safety Development Committee.
- The City/ Municipal Planning and Development Offices of the member-LGUs in GCA should become permanent members of the Economic, Environment and Public Safety Development Committee.

CHAPTER 21
OVERALL DEVELOPMENT PLAN

21.1 Overall Development Plan

The survey identified 36 plans and programs composed of 131 projects as illustrated in Figure 21.1-1. The 36 plans and programs and their corresponding cost are presented in Table 21.2-1. Details of the 131 projects are available in the nine (9) sector plan chapters. Basically, there are over 131 individual projects, but some are grouped based on the scale and implementation schedule. For example, for the case of Transport Development Plan, there are close to 100 individual road projects and transport programs (e.g. capacity building program) and these are grouped based on the scale and implementation schedule to come up with the 45 projects (Table 11.8-1 for details).



Note: The total number of projects might increase or decrease depending how the final project is packaged during implementation. Example, four (4) individual road projects are packaged as one (1) project in this study based on its scale and implementation schedule. However, this can also be implemented individually hence the count could be four (4) instead of one (1) hence the number of projects would further increase.

Figure 21.1-1 Outline of the Overall Development Plan

21.2 Budgetary Framework

21.2.1 Indicative Cost of the Projects

The total indicative cost of the projects identified is about PhP 156 billion. Of these, three sectors with largest share are Disaster Risk Reduction Plan (49.0%), Transport Development Plan (23.3%), and Water Supply Development Plan (17.2%) as illustrated in Figure 21.2-1. Plans and programs including their indicative costs are presented in Table 21.2-1.

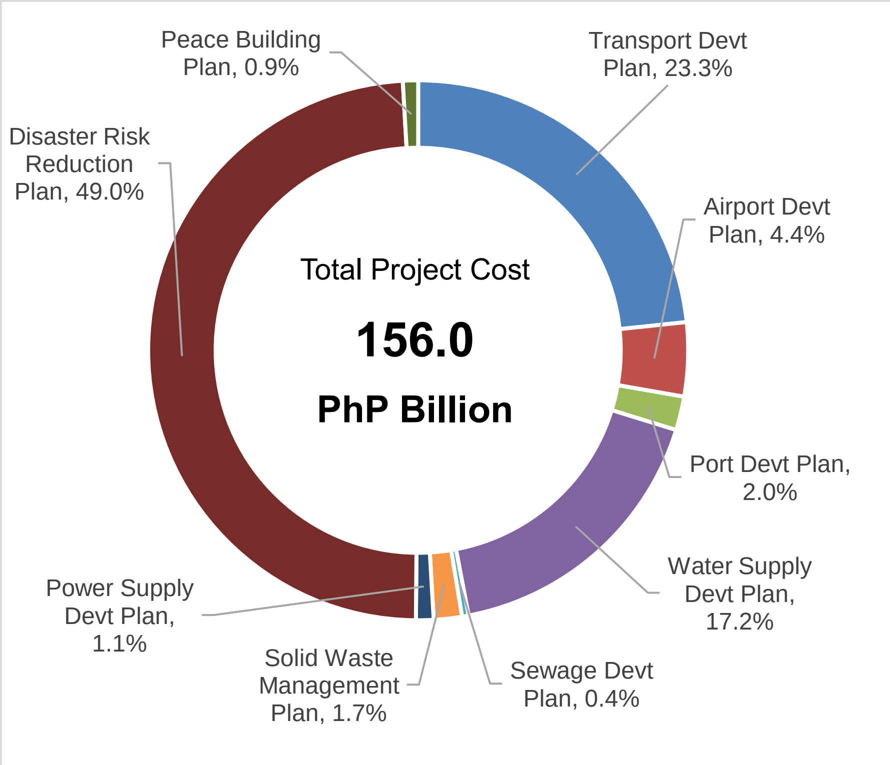


Figure 21.2-1 Distribution of Development Cost

Table 21.2-1 Indicative Cost of the Identified Projects

No.	Plans and Programs	Cost (PhP M)
I.	**Transport Development Plan**	**36,406.3**
1	Establishment of Functionally Road Hierarchal Network Sub-Programme (Concept to be adopted)	N/A
2	Road Network Development Sub-Plan	34,119.6
3	Public Transport Improvement Sub-Plan	1,712.7
4	Traffic Management Sub-Plan	574.0
II.	**Airport Development Plan**	**6,899.0**
5	Improvement of Existing Cotabato Airport	2,092.0
6	Development of New Cotabato Airport	4,807.0
III.	**Port Development Plan**	**3,151.9**
7	**Improvement of Polloc Port**	
	Feasibility Study of Short-Term Development Plan of Polloc Port	20.3
	Urgent Project to Improve the Port Operation in Polloc Port	123.0
	Polloc Port Short Term Development Plan (2028)	579.7
	Polloc Port Long Term Development Plan (2043)	1,632.3

No.	Plans and Programs	Cost (PhP M)
8	**Development of Timako Port**	
	Updating of Timako Port Feasibility Study (including Study of Demarcation of Roles for Timako Port and Polloc Port)	30.6
	Timako Port Short-Term Development Plan	766.0
IV.	**Water Supply Development Plan**	**26,899.0**
9	Strengthening the Capacity of Water Service Management by Technical Cooperation and Grant/ Loan of ODA Project	645.0
10	Master Plan of Water Supply Development for Cotabato City and Surrounding Municipalities	73.0
11	Reduction of Non-Revenue Water (NRW) for Cotabato City	136.0
12	Water Supply Development for Cotabato City and Surrounding Municipalities	26,045.0
V.	**Sewage Development Plan**	**610.0**
13	Capacity Building for Sanitation Improvement in Greater Cotabato Area	100.0
14	Creek Environment Improvement using Decentralized Treatment Plant	330.0
15	Development of Septage Treatment Facilities for Surrounding Municipalities	180.0
VI.	**Solid Waste Management Plan**	**2,625.0**
16	Integrated Solid Waste Management Master Plan in Greater Cotabato City	80.0
17	Construction of New Sanitary Landfill	650.0
18	Improvement of Existing Solid Waste Management Facilities	186.0
19	Capacity Enhancement of Solid Waste Management	309.0
20	Procurement of Solid Waste Management Equipment	327.0
21	Construction of Intermediate Treatment Facilities	1,073.0
VII.	**Power Supply Development Plan**	1,640.0
22	Distribution Network Renovation for CLPC Franchise Area	410.0
23	Distribution Substation Rehabilitation and Development for MAGELCO Franchise Area	273.0
24	Power Capacity Enhancement in the Event of a Power Outage for MAGELCO and COTELCO-PPALMA Franchise Area	491.0
25	Installation of Smart Meters for Collecting Electricity Charge for Greater Cotabato City	466.0
VIII.	**Disaster Risk Reduction Plan**	76,390.0
26	Ambal-Simuay and Rio Grande de Mindanao River Flood Control Project	39,220.0
27	Tamontaka River Flood Control Project	20,120.0
28	Project for Flood Control and Drainage Improvement in Cotabato City	7,230.0
29	Project for Developing Flood Forecasting and Warning System (FFWS) for the Lower Mindanao	810.0
30	Project for Enhancing Flood Response Capacity of Cotabato City	540.0
31	Project for Building Tsunami Disaster Resilient Community	5,040.0
32	Project for Strengthening Capacity of Tsunami Early Warning System (TEWS)	70.0
33	Project for Building Earthquake Disaster Resilient Community in Cotabato City	3,360.0
IX.	**Peace Building Plan**	1,420.0
34	**Community Infrastructure Development**	
	Comprehensive community infrastructure development project	240.0
	Comprehensive community service facility development project	230.0
	Construction of a new Farm to Market Road (FMR)	250.0
35	**Community Technical Project**	
	Community livelihood project with income generation scheme	150.0
	Special occupation training project for out of school youth (OSY) and women of IPs	100.0
	Administrative capacity development project	50.0
36	**Priority Infrastructure and Technical Project Against COVID-19**	400.0
	Grand Total	156,041.2

21.2.2 Indicative Cost vs Available Budget

The following are the possible sources of fund in the study area which could be tapped to implement the identified projects and programs.

a. Budget from the National Government (under the General Appropriations Act)
b. Budget from the National Government sourced from the Official Development Assistance (ODA) or Loan Assistance from International Funding Institutions
c. Budget from the BARMM Regional Government
d. Budget from the LGUs under the study area
e. Budget from Private Sector (MAGELCO, CLPC, MCWD)

<u>DPWH budget for Cotabato City and surroundings (average= 1.0 billion/Year)</u>

From 2015 to 2020, a total of PhP 5.6 billion budget was allocated by DPWH to various infrastructure projects in Cotabato City mostly for roads, bridges and riverbank protection. The average yearly budget of the DPWH for Cotabato City is about PhP 1.0 billion.

<u>BARMM's support projects to LGUs (about 1 billion in 2021)</u>

A total of PhP 1.068 billion was allocated by the BARMM government to LGUs under the study area. Most of these projects are under the MPW.

<u>LGUs Internal Revenue Allocation for Infrastructure Projects (about 200 million)</u>

About two hundred million pesos is the estimated total amount allocated by the LGUs under the study area for various infrastructure projects.

<u>Private Sector's Budget (MCWD=PhP 20 Million)</u>

The Metro Cotabato Water District (MCW) allocated infrastructure budget of PhP 27.98 million in 2016, PhP 31.16 million in 2017 and PhP 20.50 million in 2018. Budget of the power companies (MAGELCO and CLPC) was not secured and not included in the assumption.

Based on the above, the assumed available budget is PhP 2.28 billion per year provided in the Table 21.2-2. This available budget will be compared with the required investment fund to implement the projects identified.

Table 21.2-2 Indicative Cost vs Assumed Available Budget

<table>
<tr><th>Source of Fund</th><th>Assumed Expenditure in the GCA (Billion PhP)</th><th>Indicative Cost (Billion PhP)</th><th>Deficit</th></tr>
<tr><td>a. DPWH</td><td>1.000</td><td rowspan="4">PhP 156 billion/ 19 Years = 8.2/year</td><td rowspan="4">8.2-2.28 = Billion PhP 5.92/year</td></tr>
<tr><td>b. BARMM support projects to LGUs</td><td>1.068</td></tr>
<tr><td>c. LGU IRA (fund for infrastructure)</td><td>.200</td></tr>
<tr><td>d. Budget from private sectors*</td><td>.020</td></tr>
<tr><td></td><td>2.28/year</td><td>8.2/year</td><td>5.92/year</td></tr>
</table>

Note 1: Budget of MCWD only; MAGELCO and CLPC could not be confirmed yet
Note 2: 19 years is the duration of the Plan (2022-2040)

By comparing the amount of fund needed to implement the identified projects by the survey until 2040 with the available budget, the following were noted:

- The indicative cost needed is about PhP 156 billion. It has a timeframe of 2022-20240 hence there is a need for an expenditure of PhP 8.2 billion/year.
- However the budget available is more or less PhP2.28 billion/year hence there is a gap of PhP 5.92 billion/year
- This is a huge gap hence three actions are needed: (i) prioritization of implementation of the projects, (ii) further increase of budget allocation for the Greater Cotabato Area, and (iii) extending the implementation plan beyond 2040.

21.3 Implementation Schedule of the Plan

The implementation schedule of the plans and programs are presented in Table 20.1-1. Detailed implementation plan for individual project is available in the sector plan chapters. The implementation schedule is composed of the following:

- Short-term (2021-2022)
- Medium-term (2023-2028)
- Long-term (2029-2040)

Table 21.3-1 Implementation Schedule of the identified projects

	Plans and Programs	Implementing Agency	Implementation Schedule																			
			Short-Term		Medium-Term						Long-Term											
			2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
	Transport Development Plan																					
1	Establishment of Functionally Road Hierarchal Network Sub-Programme	DPWH, MPW, LGU																				
2	Road Network Development Sub-Plan	DPWH, MPH, LGU																				
3	Public Transport Improvement Sub-Plan	LGU, Private Sector																				
4	Traffic Management Sub-Plan	DPWH, LGU, Traffic Police																				
	Airport Development Plan																					
1	Existing Cotabato Airport Development	DOTr, MOTRC																				
2	New Cotabato Airport Development	DOTr, MOTC, LGU																				
	Port Development Plan																					
1	Polloc Port Short-term Development Plan	PPA, BPMA-BARMM																				
2	Timako Port Short-term Development Plan	PPA, BPMA-BARMM																				
	Water Supply Development Plan																					
1	Strengthening the Capacity of Water Service Management by Technical Cooperation and Grant/Loan of ODA Project	MCWD																				
2	Master Plan of Water Supply Development for Cotabato City and Surrounding Municipalities	MCWD																				
3	Reduction of Non-Revenue Water (NRW) for Cotabato City	MCWD																				
4	Water Supply Development for Cotabato City and Surrounding Municipalities	MCWD																				
	Sewage Development Plan																					
1	Capacity Building for Sanitation Improvement in Greater Cotabato Area	MCWD, LGU																				
2	Creek Environment Improvement using Decentralized Treatment Plant	Cotabato City LGU																				
3	Development of Septage Treatment Facilities for Surrounding Municipalities	MCWD, LGU																				
	Solid Waste Management Development Plan																					
1	Integrated Solid Waste Management Master Plan in Greater Cotabato City	CENRO																				
2	Construction of New Sanitary Landfill	CENRO																				
3	Improvement of Existing Solid Waste Management Facilities	CENRO																				
4	Capacity Enhancement of Solid Waste Management	CENRO																				
5	Procurement of Solid Waste Management Equipment	CENRO																				
6	Construction of Intermediate Treatment Facilities	CENRO																				
	Power Supply Development Plan																					
1	Distribution Network Renovation for CLPC Franchise Area	CLPC																				
2	Distribution Substation Rehabilitation and Development for MAGELCO Franchise Area	MAGELCO																				
3	Power Capacity Enhancement in the Event of a Power Outage for MAGELCO and COTELCO-PPALMA Franchise Area	MAGELCO, COTELCO-PPALMA																				
4	Installation of Smart Meters for Collecting Electricity Charge for Greater Cotabato City	CLPC																				
	Disaster Risk Reduction Plan																					
1	Ambal-Simuay and Rio Grande de Mindanao River Flood Control Project	DPWH, MPW																				
2	Tamontaka River Flood Control Project	DPWH, MPW																				
3	Project for Flood Control and Drainage Improvement in Cotabato City	DPWH, MPW																				
4	Project for Developing Flood Forecasting and Warning System (FFWS) for the Lower Mindanao	PAGASA, LGU																				
5	Project for Enhancing Flood Response Capacity of Cotabato City	DPWH, OCD																				
6	Project for Building Tsunami Disaster Resilient Community	DPWH, OCD																				
7	Project for Strengthening Capacity of Tsunami Early Warning System (TEWS) for Cotabato City	PHIVOLCS																				
8	Project for Building Earthquake Disaster Resilient Community in Cotabato City	DPWH																				
	Peacebuilding																					
1	Community infrastructure development	MPW, LGU																				
2	Community technical project	LGU																				
3	Priority infrastructure and technical project against COVID-19	LGU																				

21.4 Institutional Framework of the Plan

The following government agencies and corporations may have major roles in the implementation of various identified projects in the plan (Table 21.4-1):

- DPWH National
- PPA (Philippine Ports Authority) and Bangsamoro Ports Management Authority under the MOTC
- BARMM Regional Government's line agencies (MPW, MOTC, MILG, etc.)
- City Government of Cotabato's various offices (City Planning and Development Office, City Engineering Office, etc.)
- GOCC (Government-owned and controlled corporation) such as MCWD, cooperatives such as MAGELCO (Maguindanao Electric Cooperative, Inc.) and private sector such as the COLIGHT (Cotabato Light and Power Co.)

Table 21.4-1 Possible Implementation Arrangement of Projects in the Plan

Sector		Implementing Agency			
		National Government	BARMM	City Government	Corporation/ Private Sector
Road/Bridges	Primary Road	O	O		
	Secondary Road		O	O	
	Tertiary Road		O	O	
Public Terminals (road)				O	
Airport		O	O		
Port	Sea Port	O	O		
	River Port			O	
Disaster Prevention/ Flood Control		O	O	O	
Water Supply				O	O
Sewage				O	
Solid Waste Management				O	
Power Supply					O

Source: JICA Study Team

CHAPTER 22
SELECTION OF PROJECTS FOR ACTION PLAN STUDY

22.1 Overview of Selection Process

From the initial list of identified plans, programs and projects in the various sectoral reports discussed in Chapter 21, the JICA Study Team established a selection process to determine the three (3) projects for action plan study. The steps involved in the prioritization of projects are discussed as follows:

- **Step 1: Determining a High Priority Project per Sector**

  Each sector expert evaluated the list of projects in a relevant Sector Plan to come up with the candidate high priority project/s. Some of the variables applied in coming up with the high priority projects include: urgency, support from concerned authorities among others.

- **Step 2: Ranking the High Priority Projects using the Evaluation Criteria**

  A total of nine (9) projects were identified by sectors experts as high priority projects as shown in Table 22.1-1. Another set of criteria is then applied to rank them from 1 to 9, 1 being the most important project.

- **Step 3: Selection of Candidates for action plan study**

  Of the nine (9) high priority projects, three (3) projects with the highest scores were selected for the conduct of action plan study.

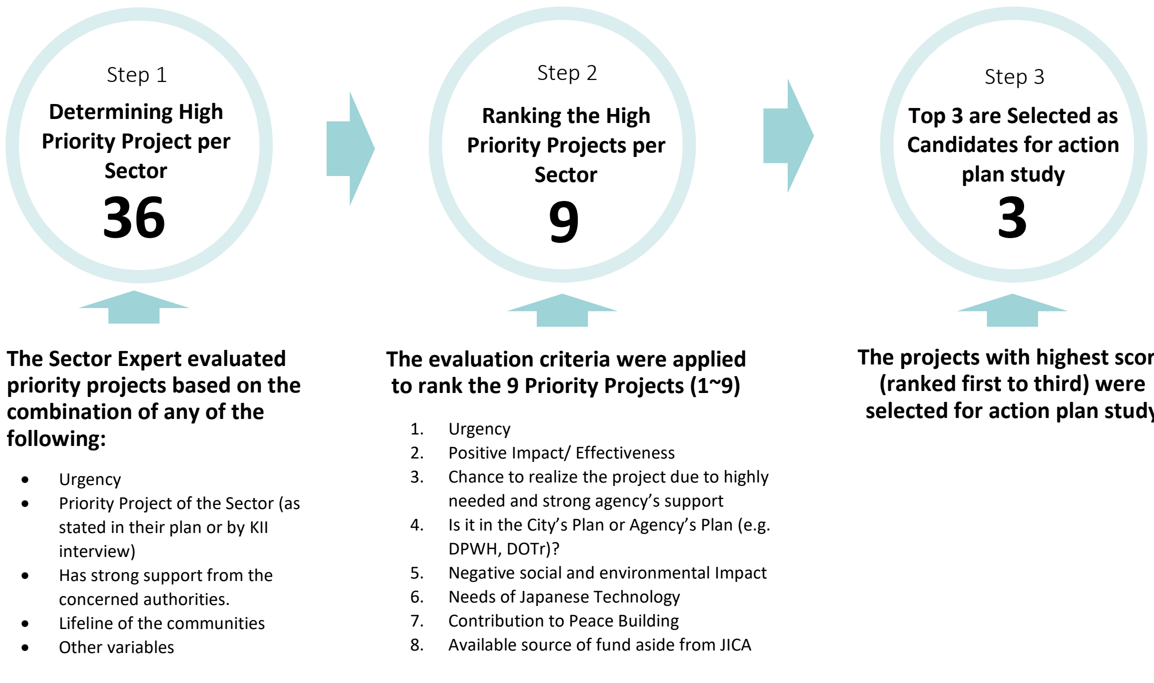


Figure 22.1-1 Selection Procedure of Candidate Projects for action plan study

Table 22.1-1 List of High Priority Projects per Sector

Sector	Program/Project	Scope of Work	Estimated Cost (PhP B)
Road/ Disaster Risk Reduction	West Diversion Road (Tsunami barrier)	17.49 km (Dike road/tsunami barrier)	7.96
Road	Mindanao River Southside Road Development Project	14.8 km (proposed as national road)	4.15
Airport	Improvement of Existing Cotabato Airport (until 2025)	Various components (taxiway, passenger building expansion, control tower, etc.)	1.98
Port	Updating of Timako Port FS and Construction of the Port	Various components (FS, wharf, buildings, utilities, fence gate, etc.)	0.77
Water Supply	Water Supply Improvement in Greater Cotabato Area	Various components (pipe replacement, additional water treatment plan, solar panel, etc.)	0.60
Sewage	Capacity Building for Sanitation Improvement in Greater Cotabato Area	Various components (Training for septage collection and enforcement of regulations, promotion activities including pilot plant of Johkaso, etc.)	0.20
Solid Waste	Construction of New Sanitary Landfill (SLF)	1 unit	0.65
Power Supply	Power Capacity Enhancement in the Event of Power Outage	Installation of solar panel on the roofs of cooperative households	0.49
Disaster Risk Reduction	Project for Building Tsunami Disaster Resilient Community	Various components (study and design of structural measures, tsunami disaster risk reduction capacity dev't.)	4.96

22.2 Evaluation Criteria

The candidate projects were assessed using a set of criteria which included eight evaluation items, as shown in Table 22.1-1. The evaluation items given the highest weight include urgency, number of beneficiaries, and support from concerned agencies.

Table 22.2-1 Evaluation Criteria

Evaluation Item	Assigned Points	Details	Specific	Weight
1. Urgency	20	Very High	• Existing facility: Function is severely affected or about to reach its capacity. • New facility: The lack of this facility may cause serious disaster in the near future.	20
		High	• Existing facility: Function is notably affected including users' convenience, or its capacity is halfway reached. • New facility: The facility provides stable access of people to basic services (health, education, government services, etc.)	18
		Moderate	• Existing facility: Function is slightly affected. • New facility: The facility enhances the services in the area.	16
2. Positive Impact/ Effectiveness	20	Very High	• The number of beneficiaries is very high, and effectiveness of the facility function is assured or restored.	20
		High	• The number of beneficiaries is slightly lower, and effectiveness of the facility function is assured or restored.	18
		Moderate	• The number of beneficiaries is lower, and impact is moderate because the facility continued to function although not at desired level.	16
3. Chance to realize the project due to highly needed and strong agency's support	20	Very High	• Needs for the project is very high and concerned agencies support is strong	20
		High	• Needs for the project is high but realization of it might be complicated due to required cooperation among various concerned agencies	18
		Moderate	• Needs for the project is moderate and support of concerned agencies might be moderate due to consideration with other projects	16
4. Is it in the City's Plan or Agency's Plan (DPWH, DOTr)?	10	Yes	• Included in the CLUP and/or concerned agency's plan	10
		No	• Not included in the CLUP and/or concerned agency's plan (but still important project as judged by the JICA Study Team)	8
5. Social and Environmental Impact	10	Very High	• Located or traversing Protected Area	6
		High	• New large-scale project involves acquiring new land and/or affecting social and natural environment	8
		Moderate	• Existing project and impact expected to be minimal	10
6. Needs of Japanese Technology	5	High	• Possible Japanese technology to be deployed is identified	5
		Moderate	• Some Japanese technology (spare parts) might be used	3
		None	• No application of Japanese technology	0
7. Contribution to Peace Building	10	Very High	• Enhances security and public order due to the project which would lead to harmonious relationship in the community. • Avoiding occurrence of major disaster so not to disturb peaceful co-existence.	10
		High	• Contributes to improving various LGUs cooperation	8
		Moderate	• Contributes to job creation (high jobless rate is cause of instability) but no specific group as beneficiaries	6
8. Available source of fund aside from JICA	5	No	• To date, no other source of fund for the project	5
		Yes	• There are other sources of fund outside from JICA	2
Total	100			

22.3 Selection Result

Following the results of the evaluation process, the three (3) candidate projects which yielded highest scores are as follows:

- West Diversion Road and Bridge Construction Project (Road and Disaster Risk Reduction Sector)
- Mindanao River Southside Road Development Project (Road Sector)
- Water Supply Capacity Expansion of Metro Cotabato Water District (Water Supply Sector)

These three (3) projects are selected after consultation with the City Government of Cotabato and the BARMM Regional Government. The final scores and respective ranking of candidate projects are shown in Table 22.3-1. Table 22.3-2 discusses the comprehensive assessment of candidate projects. Table 22.3-3 shows the full breakdown of scores.

Table 22.3-1 Final Scores and Ranking of High Priority Projects

Sector	Project/Program	Score	Rank
Road/ Disaster Risk Reduction	West Diversion Road (Tsunami barrier)	**96**	**1**
Road	Mindanao River Southside Road Development Project	**96**	**1**
Airport	Improvement of Existing Cotabato Airport	83	6
Port	Updating of Timako Port FS and Construction of the Port	78	9
Water Supply	Water Supply Improvement in Greater Cotabato Area	**95**	**3**
Sewage	Capacity Building for Sanitation Improvement in Greater Cotabato Area	94	4
Solid Waste	Construction of New Sanitary Landfill (SLF)	94	4
Power supply	Power Capacity Enhancement in the Event of Power Outage	79	8
Disaster Risk Reduction	Project for Building Tsunami Disaster Resilient Community	91	5

Table 22.3-2 Details of the Evaluation of the 9 Candidate Projects

Sector	Project/Program	Urgency	Impact/ Effectiveness	Chance to realize the project due to strong needs and agency support	Is it in the City's Plan or Agency's Plan (DPWH, DOTr)?	Social and Environmental Impact	Needs of Japanese Technology	Contribution to Peace Building	Available source of fund aside from JICA
Road/ Disaster Risk Reduction	**West Diversion Road (Dike Road as Tsunami Barrier) and Bridge Construction Project**	Very High (high due to possible occurrence of tsunami)	Very high (reduce tsunami affected people from 245,000 to just 33,000 among others)	Very high since stakeholders realized the danger of tsunami and its contribution to traffic decongestion	No but to be adopted by the City in their CLUP per discussion with them	High (new large-scale project involving taking of land)	Yes (Tsunami barrier facility is new to the Philippines hence needs Japanese technology. Four bridges on a soft ground needs Japanese technology)	Very High (New road will lead to stronger presence of law enforcers hence public order is enhanced)	No
	Mindanao River Southside Road Development Project	High (since it will provide reliable access to the communities without road access (current they are using water transport)	Very High (Very effective in providing stable access to basic services; will improve agricultural/ fishery production)	Very high since it matched with the plan of the City Government to provide roads in the eastern part of the City to support agricultural production	Yes, Compatible with CDP 2017-2022	High (new large-scale project involving taking of land and close to Liguasan Marsh)	Yes (Soft ground treatment)	Very High (New road will lead to stronger presence of law enforcers hence public order is enhanced)	No
Airport	**Improvement of Existing Cotabato Airport**	Moderate (to secure aviation security and passenger satisfaction on the airport facilities).	Moderate (Will improve aviation safety and passengers' comfort)	Very high since DOTr has in their plans and programs	Yes, included in the Annual Operation and Management Plan of DOTr	Minimal (improving existing facility)	Limited/Moderate (Some equipment may be imported from Japan)	Moderate (Aside from the new generated jobs, no new group is expected to benefit the project)	Yes, DOTr
Port	**Updating of Timako Port FS and Construction of the Port**	Moderate (Polloc Port as alternative is available but this Timako Port must be completed since causeway has been installed)	Moderate (since Polloc Port utilization is not yet full and just 16 km away from the city)	Very High (Due to strong support from the City Government)	Yes, Compatible with CDP 2017-2022	High (new project in an open sea)	No	Moderate (It will contribute through creation of new job opportunities since jobless rate is high in the area)	Yes, PPA
Water Supply	**Water Supply Capacity Expansion of Metro Cotabato Water District (MCWD)**	Very High (water supply rate is still around 50% in Cotabato city)	Very High (Will increase service area of MCWD and contribute to fight COVID19)	Very High (due to strong support from the City Government and MCWD)	Yes, Compatible with CDP 2017-2022 and MCWD Plan	Moderate (Components are existing facility except the new treatment plan and riverbank protection)	Limited/Moderate (Some equipment may be imported from Japan)	Very High (Historically lack of safe water could be a cause of friction in many cases, thus stable supply of water is essential to peace building)	Yes, some components might be funded by ADB
Sewage	**Capacity Building for Sanitation Improvement in Greater Cotabato Area**	High (Septage treatment will start in Cotabato city accordingly to current SMP, so training of officers	High (If this creek is improved, it might trigger to improve other creeks as well).	High (city environmental office expresses strong needs on this program)	No, but this project will commit the remaining wastewater issues which are not covered by the	Moderate (No adverse environmental impact is expected)	Yes (Japanese on-site wastewater treatment technology will be utilized.)	High (for sustainable and efficient septage collection system, corporation of Cotabato city and	No

Sector	Project/Program	Urgency	Impact/ Effectiveness	Chance to realize the project due to strong needs and agency support	Is it in the City's Plan or Agency's Plan (DPWH, DOTr)?	Social and Environmental Impact	Needs of Japanese Technology	Contribution to Peace Building	Available source of fund aside from JICA
		for septage collection is urgent)			existing septage management plan.			surrounding municipalities will be studied)	
Solid Waste	**Construction of New Sanitary Landfill (SLF)**	Very high (Capacity of the existing SLF is nearing capacity and expectation that the amount of waste generated is increasing in the future)	Very high (A landfill site that can be used for more than 10 years will be constructed. In addition, securing disposal site promotes the collection and transportation of the waste and intermediate treatment, which has a high ripple effect on the overall proper SWM.)	High (needs is high but it requires cooperation of various LGUs to find suitable area. This cooperation might require extra push)	Yes, Compatible with CDP 2017-2022 and the Ecological Solid Waste Management Plan (ESWMP) of Cotabato City.	High (large scale project and impact is expected depending on the site selected)	Yes (It is useful to utilize the knowledge and technology (semi-aerobic landfill, etc.) for proper management of disposal sites with less environmental load.)	High (successful implementation of the project requires cooperation of Cotabato City LGU and other LGUs hence it will help foster cooperation/ peace building)	No
Power supply	**Power Capacity Enhancement in the Event of Power Outage**	Moderate (This project is a countermeasure in the event of a power outage)	Moderate since this is just a standby back up power supply	Moderate (MAGELCO and PPALMA might have other higher priority projects such as replacement of existing electrical equipment and old distribution lines)	Yes (MAGELCO is planning to have emergency generators)	Moderate (No adverse environmental impact is expected)	No	Moderate (stable electricity supply brings sense of security to the communities)	No
Disaster Risk Reduction	**Project for Building Tsunami Disaster Resilient Community**	Very High (tsunami prevention is highly needed by the city and drainage improvement which is contributing to flooding)	Very high (it will reduce casualty and damage to properties in times of tsunami).	Very high (the City is calling for the implementation of a project which would address issues of tsunami)	Yes, Compatible with CDP 2017-2022	High (Large scale road dike will affect the local environment and landscape)	Yes (Japanese knowledge and technology gained through many tsunami experiences will be utilized)	Moderate (It will contribute through creation of new job opportunities since jobless rate is high in the area)	Yes, China fund

Table 22.3-3 Scoring of the 9 Candidate Projects

Sector	Project/Program	Urgency	Impact/ Effectiveness	Chance to realize the project due to strong needs and agency support	Is it in the City's Plan or Agency's Plan (DPWH, DOTr)?	Social and Environmental Impact	Needs of Japanese Technology	Contribution to Peace Building	Available source of fund aside from JICA	Score	Rank
Road	West Diversion Road and Bridge Construction Project	Very High Score=20	Very High Score=20	Very High Score=20	No Score=8	High Score=8	Yes, High Score=5	Very High Score=10	No Score=5	**96**	**1**
	Mindanao River Southside Road Development Project	High Score=18	Very High Score=20	Very High Score=20	Yes Score=10	High Score=8	Yes, High Score=5	Very High Score=10	No Score=5	**96**	**1**
Airport	Improvement of Existing Cotabato Airport	Medium Score=16	Moderate Score=16	Very High Score=20	Yes Score=10	Moderate Score=10	Moderate Score=3	Moderate Score=6	Yes Score=2	**83**	**6**
Port	Updating of Timako Port FS and Construction of the Port	Moderate Score=16	Moderate Score=16	Very High Score=20	Yes Score=10	High Score=8	No Score=0	Moderate Score=6	Yes Score=2	**78**	**9**
Water Supply	Water Supply Improvement in Greater Cotabato Area	Very High Score=20	Very High Score=20	Very High Score=20	Yes Score=10	Moderate Score=10	Moderate Score=3	Very High Score=10	Yes Score=2	**95**	**3**
Sewage	Capacity Building for Sanitation Improvement in Greater Cotabato Area	High Score=20	High Score=18	High Score=20	No Score=8	Moderate Score=10	Yes, High Score=5	High Score=8	No Score=5	**94**	**4**
Solid Waste	Construction of New Sanitary Landfill (SLF)	Very High Score=20	Very High Score=20	High Score=18	Yes Score=10	High Score=8	Yes, High Score=5	High Score=8	No Score=5	**94**	**4**
Power supply	Power Capacity Enhancement in the Event of Power Outage	Moderate Score=16	Moderate Score=16	Moderate Score=16	Yes Score=10	Moderate Score=10	No Score=0	Moderate Score=6	No Score=5	**79**	**8**
Disaster Risk Reduction	Project for Building Tsunami Disaster Resilient Community	Very High Score=20	Very High Score=20	Very High Score=20	Yes Score=10	High Score=8	Yes, High Score=5	Moderate Score=6	Yes Score=2	**91**	**5**

22.4 Profile of the Selected Projects for action plan study

(1) West Diversion Road (Dike Road to serve as Tsunami Barrier)

Objectives

- To protect Cotabato City and nearby municipalities from the possible damage caused by tsunami (Without WDR=245,000 people are affected by tsunami; With WDR=33,000).
- To construct an arterial road on the west side of Cotabato City to guide sound urbanization of the city.
- To reduce traffic congestion by constructing another arterial road to divert a portion of the traffic away from the lone arterial road of Cotabato City (Sinsuat Avenue).
- To strengthen the link of Cotabato City and the primary port of Bangsamoro – Polloc Port.

Scope of Work

- The project involves the construction of a 17.5 km arterial road (dike road which serve as tsunami barrier) with four (4) bridges.

Estimated Cost

- PhP 7.96 Billion

Implementing Agency

- DPWH National

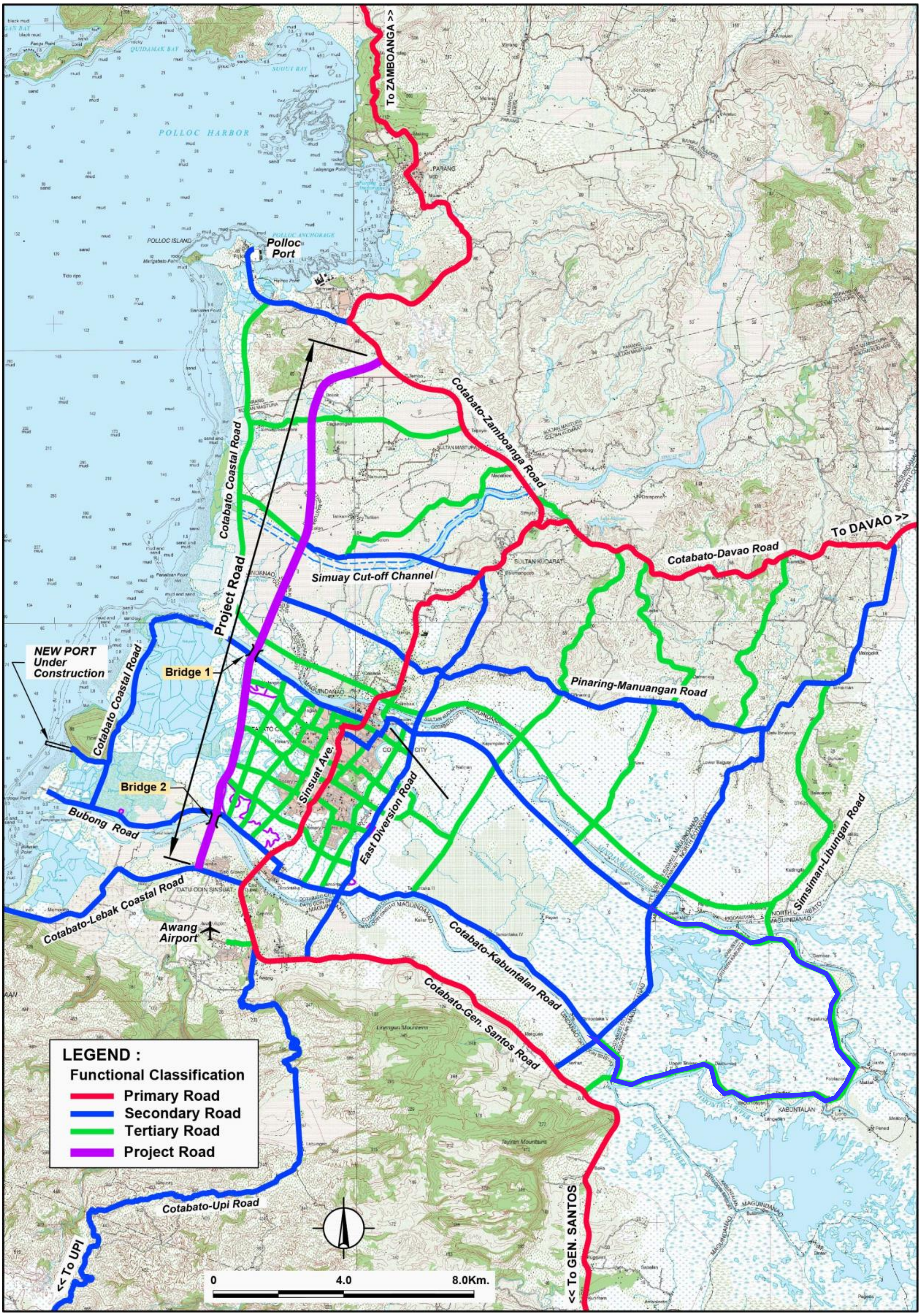


Figure 22.4-1 Location Map of West Diversion Road

(2) Mindanao River Southside Road

Objectives

- To complete the east circumferential road of Cotabato City
- To promote social and economic integration of the four LGUs (Cotabato City, Sultan Kudarat, Kabuntalan and Pigcawayan)
- To provide access to barangays in Liguasan marsh (currently using water transport) including the 11 barangays which joined the BARMM
- To promote agricultural development in the eastern side of Cotabato City and Liguasan marsh in general

Scope of Work

- The project involves the construction of a 14.7 km road and a bridge.

Estimated Cost

- PhP 4.15 Billion

Implementing Agency

- DPWH National

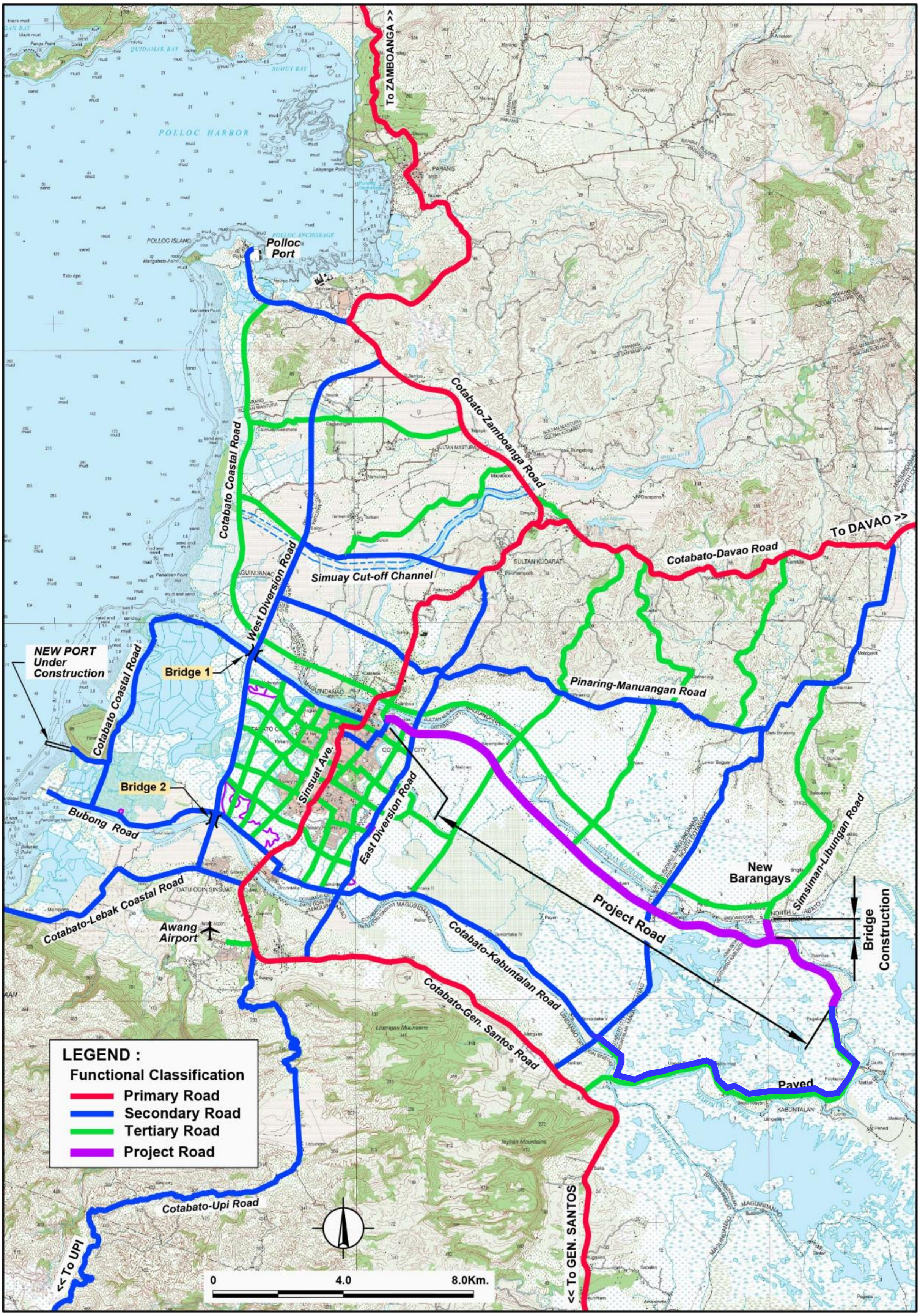


Figure 22.4-2 Location Map of the Mindanao River Southside Road

(3) Water Supply Improvement in Greater Cotabato Area

Objectives

- To improve and increase the water services of Metro Cotabato Water District and ensure safer operation.
- To sustain the good quality of potable water to its consumers
- To provide sustainable power supply to the system for efficient delivery of water service
- To provide riverbank protection at the upstream portion of Dimapatoy River (one of the sources of water of MCWD) to prevent erosion.

Scope of Work

- Replacement of dilapidated pipes, which are 30-40 years old
- Construction of additional Water Treatment Plant with capacity of 5,000-8,000 cu.m. a day (it will increase MCWD capacity by 20% to 25%)
- Installation of Solar Panel for Electric Power Production with accessories
- Riverbank Protection at Dimapatoy River (50 meters upstream)

Estimated Cost

- PhP 0.60 Billion

Implementing Agency

- Metro Cotabato Water District (MCWD)

		
Existing Treatment Plant	Area of the proposed additional Treatment Plant (owned by MCWD)	Pumping Station

Figure 22.4-3 Existing Condition of MCWD Facilities

22.5 Draft Implementation Schedule of Selected Projects for action plan study

The draft implementation plan for the West Diversion Road and Mindanao River Southside Road is shown in Table 22.5-1. Table 22.5-2 shows the initial timetable for the Water Supply Capacity Expansion of MCWD.

Table 22.5-1 Draft Implementation Plan of the West Diversion Road and Mindanao River Southside Road

Scope of work	2021							
	May	June	July	Aug	Sep	Oct	Nov	Dec
a. Traffic Study								
b. Study of Alternative Road Alignments								
c. Establishment of Design Criteria and Standard								
d. Design Requirements for Tsunami and Flood								
e. Road Design and Bridge Design								
f. Construction Method and Procurement								
g. Construction Cost Estimate and Project Cost								
h. Implementation Plan								
i. Initial Environmental Impact Assessment								
j. ROW Acquisition Study								

Table 22.5-2 Draft Implementation Plan of the Water Supply Capacity Expansion of Metro Cotabato Water District

Scope of work	2021							
	May	June	July	Aug	Sep	Oct	Nov	Dec
a. Study on Existing Facilities, Potential Expansion Area etc.								
b. Discussion and Identification on Scope of Potential Project								
c. Cost Estimation / Evaluation of Environmental Impact								

CHAPTER 23
ACTION PLAN OF THE WEST DIVERSION ROAD

23.1 Introduction

23.1.1 Project Background

Cotabato City is experiencing rapid economic growth. The city population is growing at an annual pace of 1.7% over the past five-year period (2015-2020). Similarly, bordering municipalities such as Sultan Kudarat in the north and Datu Odin Sinsuat in the south recorded even faster growths at 2.1% and 3.5% per year (2015-2020), respectively. The Greater Cotabato Area (GCA) collectively posted growth rates above the national average since 2000.

Cotabato City, which is the nucleus of the GCA, continues to function as center of trade and commerce, finance, and the leading provider of higher education and health services. In the last five (5) years or so, the City experienced the opening of more department stores and shopping malls (e.g., Mall of Al Nor, City Mall, etc.) coupled with the entry of new banks such as East-West Bank (EWB), Asia United Bank (AUB), and an additional branch of Banco de Oro (BDO). These new developments continue to attract and generate traffic which further put pressure to the already congested road network of Cotabato City.

Similarly, the BARMM Government, according to its 1st BDP (2020-2022), identified six (6) areas as economic zones. One of these is the Polloc Freeport in Parang Municipality. The location of this planned economic zone is just beside the Polloc Port. The realization of this plan requires, among others, the installation of support facilities/utilities (e.g., water supply, power supply, etc.) and infrastructure including roads to strengthen its link to the markets/consumers and to the sources of materials (Figure 23.1-1).

Inside Cotabato City, the City Government is planning to develop agro-industry along the Tamontaka-Bubong (Figure 23.1-1). This part of the city is witnessing rapid growth, with newly developed facilities such as schools, mosques, and residential areas. This area is along the proposed alignment of the West Diversion Road.

As Cotabato City and neighboring municipalities continue to expand, there is a growing need to invest in infrastructure development to cope up with the said expansion. In the GCA, one critical infrastructure where investment is severely needed is on road. One of the most important roads in the future road network prepared under this study is the West Diversion Road. This road will support both the agro-industry plan of the City Government and the economic zone plan of the BARMM Government by enhancing transportation access.

In addition, the West Diversion Road has been identified to address the geographical constraints along the western side of Greater Cotabato. Local government units find it difficult to expand westward due to the vulnerability of coastal communities to tsunami inundation. Once established, the West Diversion Road will serve as a tsunami barrier for Cotabato City and surrounding municipalities.

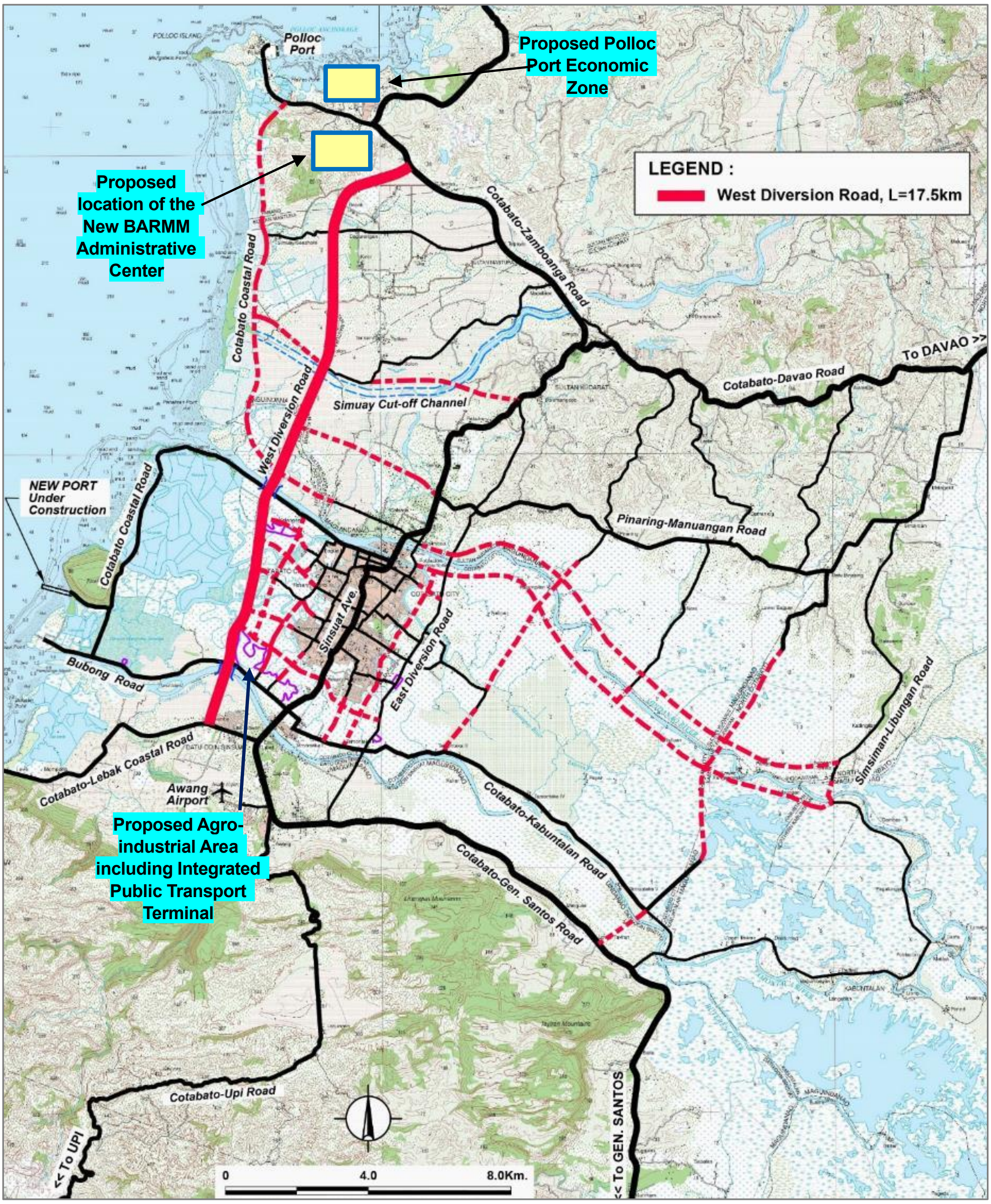


Figure 23.1-1 Location Map of West Diversion Road

23.1.2 Objectives of the Project

The objectives of the project are as follows:

- To protect Cotabato City and nearby municipalities from the possible damage caused by tsunami (Without WDR=245,000 people are affected by tsunami; With WDR=33,000)
- To construct an arterial road on the west side of Cotabato City to guide sound urbanization of the city
- To reduce traffic congestion by expanding the capacity of the road network by constructing another arterial road to divert a portion of the traffic away from the lone arterial road of Cotabato City (Sinsuat Avenue)
- To strengthen the link between Cotabato City and major facilities (e.g., Awang Airport and Polloc Port), new planned ecozone at Polloc Port, and the planned New BARMM Administrative Center in Barangay Landasan, Parang Municipality
- To contribute for peace building of the greater Cotabato area by providing easier and faster means of access.

23.1.3 Necessity of the Project

The following reasons justify the construction of the West Diversion Road:

(1) Protect Cotabato City and Neighboring Municipalities from The Impact of Tsunami and Storm Surge

Cotabato City and neighboring municipalities are vulnerable to both storm surges and tsunamis. The city and other coastal towns along the Illana Bay were devastated by tsunami waves in 1976. Simulation data from PHIVOLCS (Figure 23.1-2) revealed that in an event a tsunami occurs, about 190,000 inhabitants of Cotabato City will be affected (64% of the population). In addition, about 38,000 inhabitants of Sultan Kudarat Municipality (41% of the population) and 15,000 inhabitants of Sultan Mastura Municipality (70% of the population) will potentially be affected. In total, about 245,000 people from the three towns might be affected by a tsunami as shown in Table 23.1-1 below. The installation of the dike road (West Diversion Road), however, has the potential to reduce the possible affected inhabitants to just 33,262 or a reduction of about 211,737 potentially affected inhabitants. The WDR therefore is a necessary structure to protect the city and municipalities from the possible huge impact of a disaster.

Table 23.1-1 Estimated Number of People Affected by Tsunami with and without West Diversion Road (Tsunami barrier)

LGU	Total Population	A. Without West Diversion Road		B. With West Diversion Road		Difference (A-B)
		Affected Population	%	Affected Population	%	
Cotabato City	299,438	190,685	63.7%	26,826	9.0%	163,859
Sultan Kudarat	95,201	38,769	40.7%	1,674	1.8%	37,095
Sultan Mastura	22,261	15,581	70.0%	4,762	21.4%	10,819
Total	**416,900**	**245,035**	**58.8%**	**33,262**	**8.0%**	**211,773**

Source: Calculated by the JICA Study Team based on the tsunami inundation data from PHIVOLCS

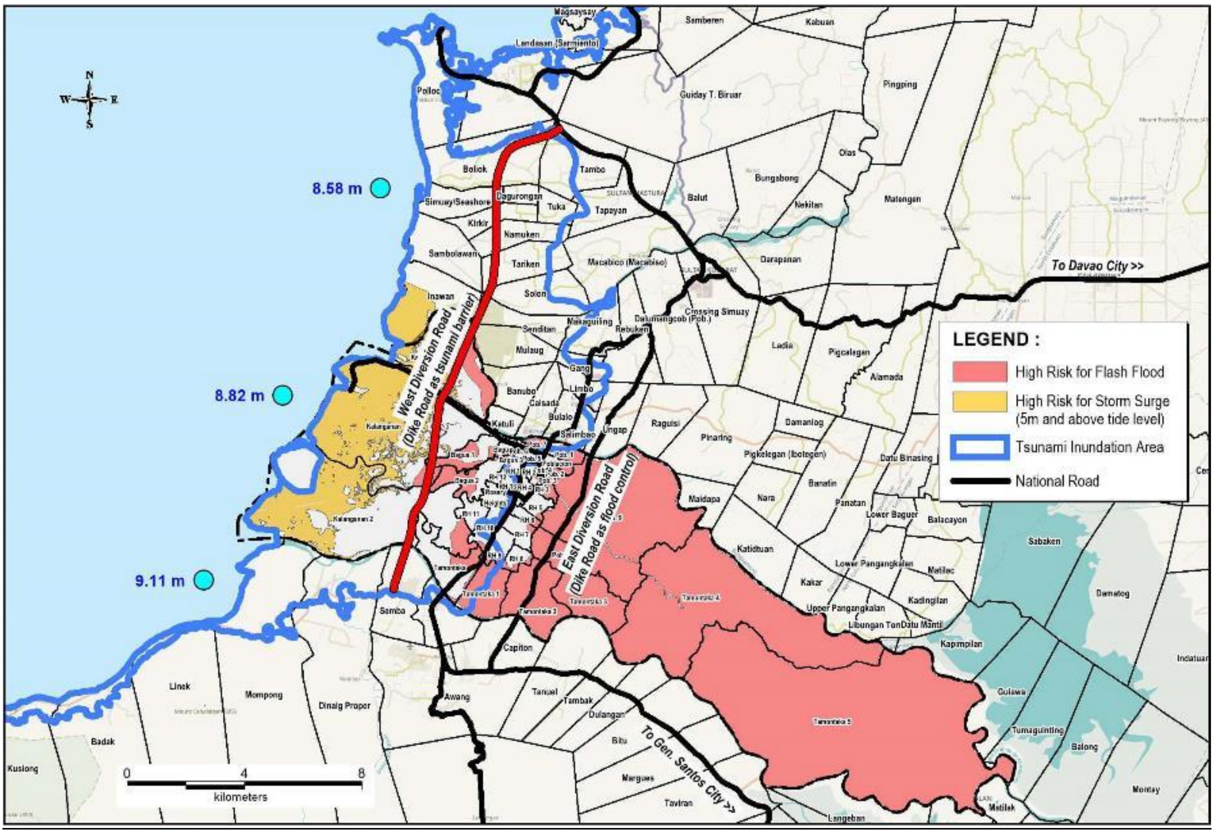


Figure 23.1-2 West Diversion Road will Expand the Network Capacity and Protect Cotabato City and Two Other LGUs from The Possible Impact of Tsunami

(2) Expand the Road Capacity for the North-South Traffic

The lone arterial road (Sinsuat Avenue) is currently handling about 3,000 PCU/hour for the north-south traffic which resulted to a level of service "F" (Figure 23.1-3). Level of service (LOS) "F" represents forced flow, indicating the road is carrying a volume above its capacity. Ideally, to maintain good flow of traffic, the said road should handle only about 2,000 PCU/hour, which corresponds to a LOS "D". The excess traffic of 1,000 PCU/hour therefore needs to be diverted. However, there is no existing alterative road which could absorb the excess traffic. As such, the construction of the West Diversion Road (WDR) is necessary to absorb the excess traffic.

In addition, the WDR will serve as well as one of the most important roads (along with the Sinsuat Avenue and East Diversion Road) to realize the future road network. In road network planning, low-capacity roads (i.e., local/city road) have to be linked to a high-capacity road (i.e., arterial road and collector road). However, Sinsuat Avenue serves as the sole high-capacity road for the north-south traffic in Cotabato City. This is the reason why traffic flow is concentrated in this road since majority of the traffic from local roads are channeled into this arterial road (Sinsuat Avenue). Figure 23.1-4 illustrates the important role of the WDR in the future road network. It is envisioned as one of the three (3) arterial roads serving north-south traffic. It is a critical trunk road in expanding the network capacity and in completing the future road network.

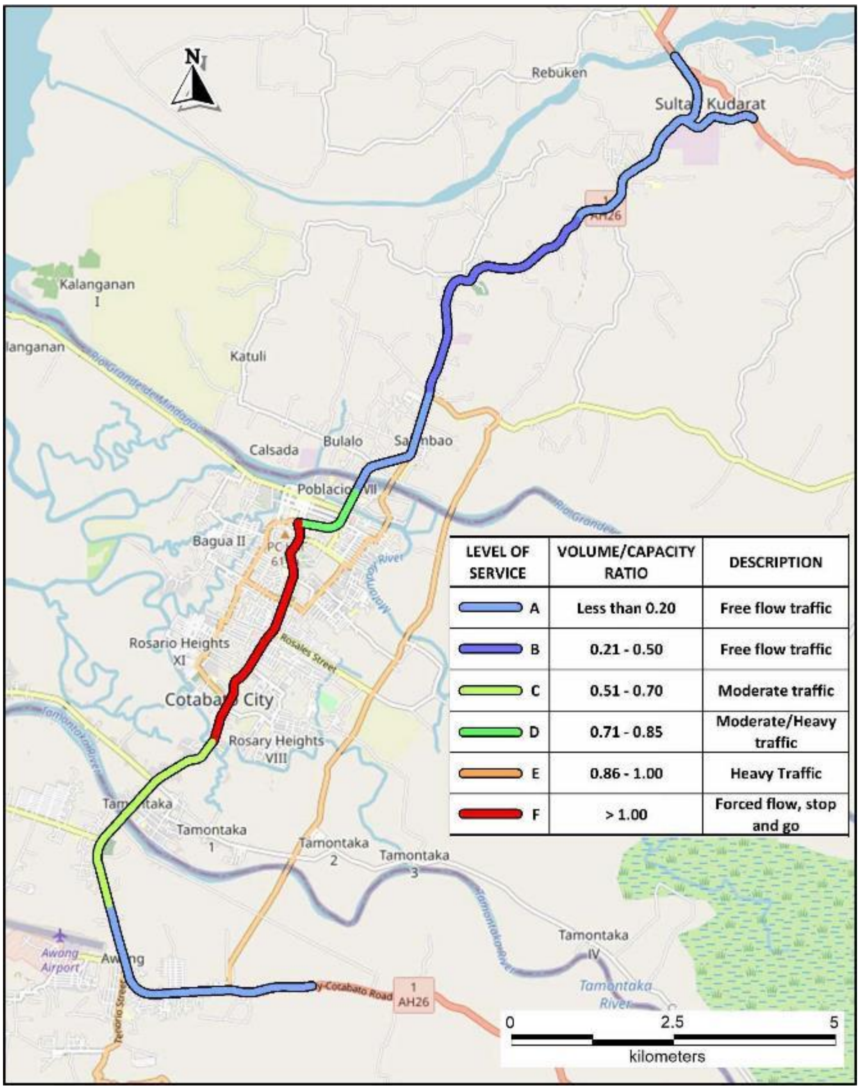


Figure 23.1-3 Map showing Current LOS along the National Road

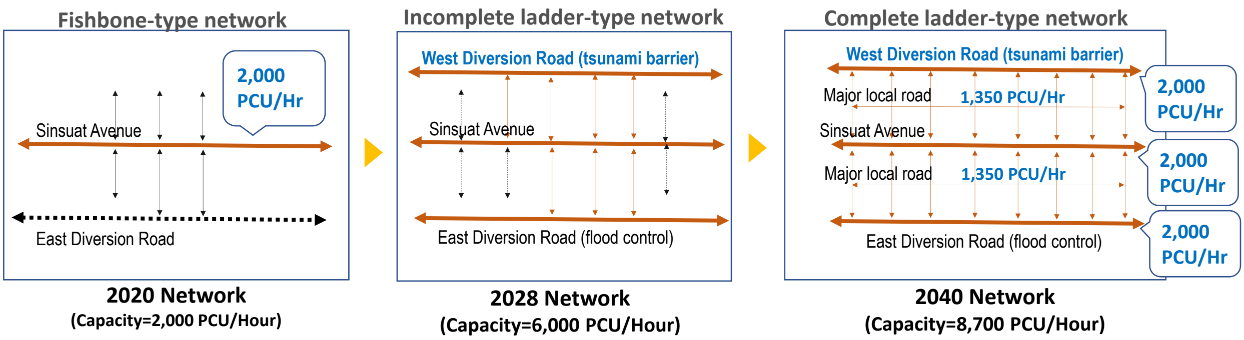


Figure 23.1-4 Role of the West Diversion Road in the Future Road Network

(3) Guide sound Urbanization of Cotabato City

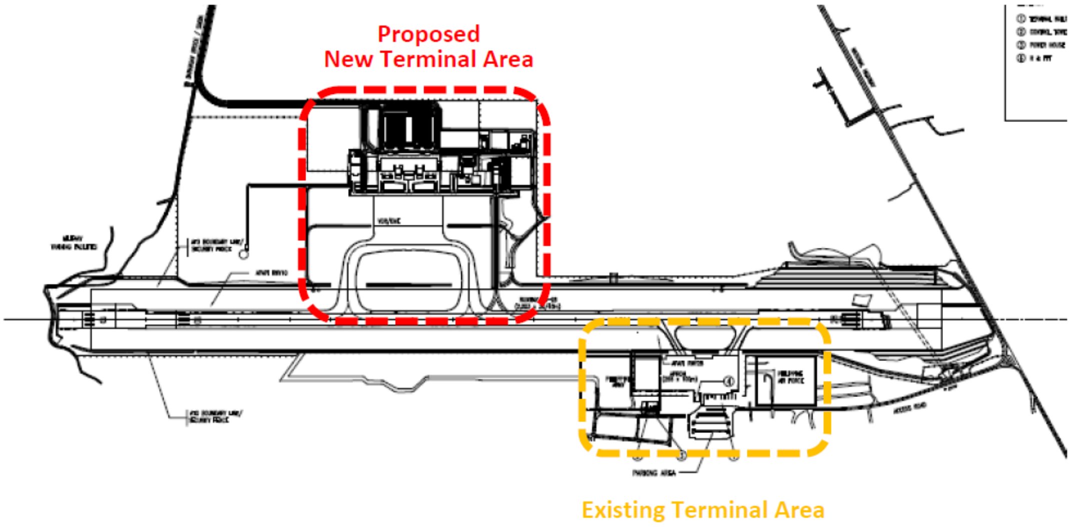
Another important contribution of the West Diversion Road is to guide the sound urban expansion of Cotabato City. The city is expanding westward through the development of planned new settlements (e.g., Malagapas Resettlement, Concerned Riverside, etc.) and expansion of existing settlements. Agro-industry and integrated public terminal are also planned by the City Government at the southwest portion of Cotabato City and are expected to generate and attract substantial volume of traffic. All these developments had been taking place without corresponding installation of roads with high capacity to handle the expected increase in the volume of passengers and freight traffic.

The West Diversion Road therefore will anchor the development along the western side of Cotabato City by absorbing the traffic volume that would be generated/attracted. Similarly, this facility will allow secondary and local roads to link with an arterial road (West Diversion Road), thus giving the new settlements and industries enhanced access.

(4) Enhanced connection to Awang Airport, Polloc Port and the planned Polloc Economic Zone and the planned new BARMM Administrative Center

Currently, the only link between Cotabato City and other municipalities on the northern side of Cotabato City to Awang Airport is the congested Sinsuat Avenue. Therefore, the WDR is an important road which can provide redundancy to ensure that in an event of a disaster/emergency, there remains an open road for people to get to/from the airport. Similarly, since the existing road to the airport is congested, the WDR will serve as an alternative link to the airport. Furthermore, there is a plan by the DOTr based on the 2006 study by the ADB to transfer the passenger terminal of Awang Airport to the southside of the runway. This is due to the lack of space to expand the existing passenger terminal at its current location. Once this plan is realized, the new terminal will be located at the end point of the WDR which makes the road even more important in terms of providing a direct access to the airport. On the other hand, Polloc Port serves as the primary seaport serving the Bangsamoro region, as shown in Figure 23.1-6. Currently, the Pan-Philippine Highway (national highway) serves as the sole major road connecting Cotabato City and Polloc Port. The BARMM government has identified the need to enhance road connectivity between the seaport and Maguindanao production and industrial sites, such as Cotabato City, Kabuntalan, Datu Piang, and Buluan[1]. The West Diversion Road will serve as an alternate road to/from Polloc Port, in line with the objectives of the BDP (2020-2022). In addition, the said plan (BDP 2020-2022) has identified Polloc Port as a major component in the impending integration with other member states of the BIMP-EAGA. As such, plans for the upgrading and expansion of the port[2], and the development of the Polloc Freeport and Ecozone as an agro-industrial ecozone are already in the pipeline[3].

[1] 1st Bangsamoro Development Plan, 2020-2022
[2] Master Plan and Feasibility Study for the Upgrading/Expansion of Polloc Port, Regional Economic Zone Authority (REZA), 2018
[3] 1st Bangsamoro Development Plan, 2020-2022



Source: The Master Plan Study on the Strategy for the Improvement of National Airports in the Republic of the Philippines, 2006, Asian Development Bank

Figure 23.1-5 New Terminal Development Plan in Awang (Cotabato City) Airport

It was also learned during meetings with BARMM officials that the government is planning to establish a new BARMM Administrative Center (BAC) in Barangay Landasan, Parang Municipality. Accordingly, the site has been identified and the negotiation to acquire the land is progressing. The new BAC is expected to commence operations by the last quarter of 2022 or by the beginning of 2023. The area is very close to Polloc Port (Figure 23.1-6). This means that there will be an expected shift of BARMM personnel from Cotabato City (current BARMM administrative center) to the new BAC. The number of employees at the current BARMM administrative center is about 8,000 to 10,000 (3,000 permanent and the rest are job orders/contractual employees) according to BARMM. Hiring of personnel to man the bureaucracy of the BARMM has not been completed, hence this number will further increase.

Once this number of staff is transferred to the new BAC, a strong road connection to/from Cotabato City will be indispensable since most of these personnel are living in Cotabato City. The WDR will be necessary to support movement of people between Cotabato City and the new BARMM Administrative Center.

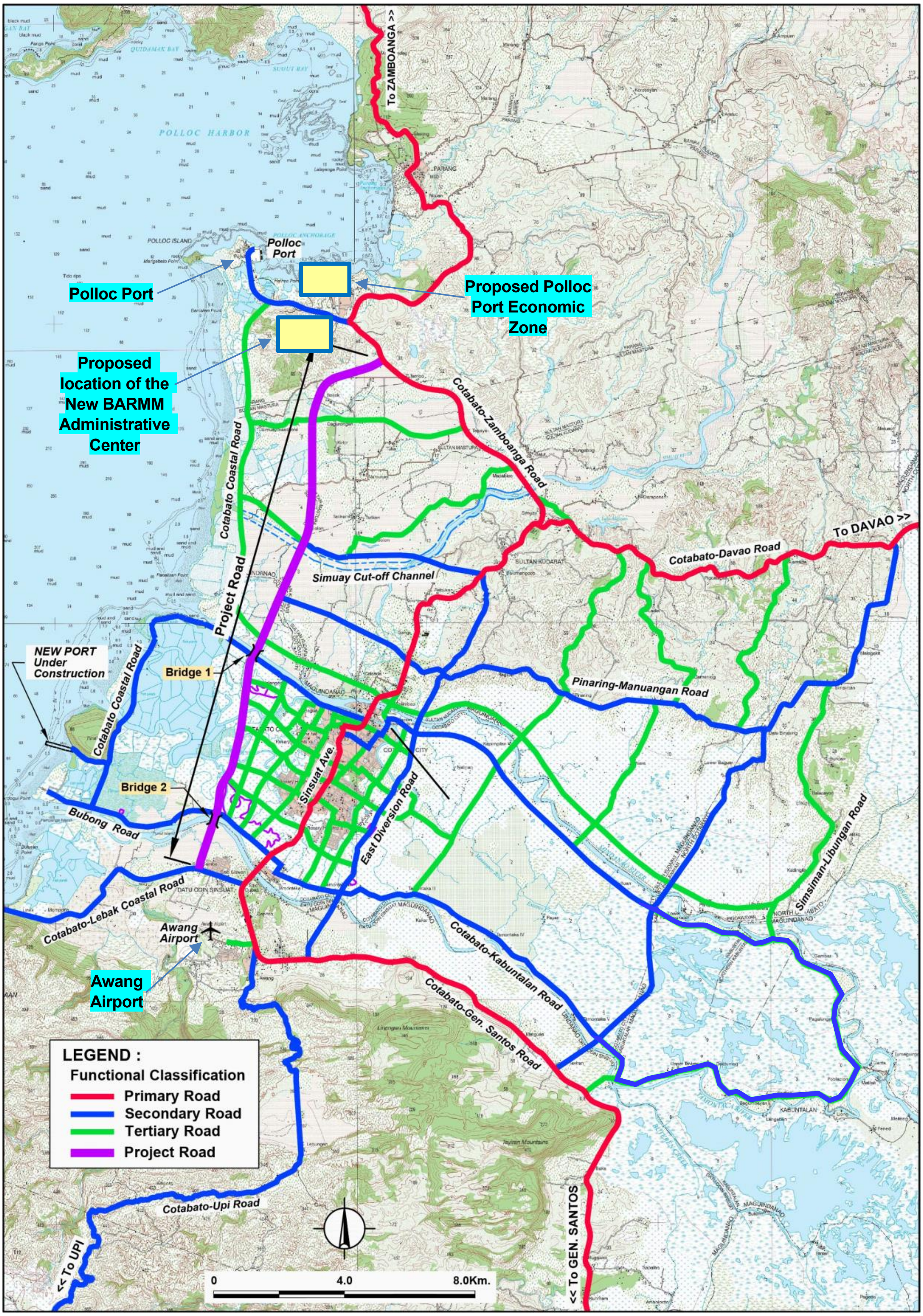


Figure 23.1-6 Position of the West Diversion Road in the overall Future Road Network of the Greater Cotabato City

23.1.4 Outline of Project

West Diversion Road is a new road to be developed to support sound urban development of Cotabato City and its surrounding municipalities. It has a total road length of 17.5 km and passes at the border line of urbanization limit. The east area of the road is designated as areas for urbanization, on the other hand the west area is designated as non-development area due to swampy area. The road has a total stretch of 17.5km and involves construction of eight (8) bridges. It will be connected with six (6) existing roads and eight (8) access roads which are extended from the existing roads.

23.2 Existing Traffic Condition and Traffic Demand

23.2.1 Traffic Survey Undertaken

The traffic count survey and roadside Origin-Destination (OD) survey were carried out. The objectives and method of the four surveys are shown in Table 23.2-1.

To analyze how many vehicles will potentially use the action plan study project road (WDR: West Diversion Road), the two survey points for traffic count and roadside OD survey were chosen.

Table 23.2-1 Objectives of Traffic Survey and Method of Survey

No.	Type of Survey	Target	Objectives	Method
1	Traffic count survey	2 stations (Along Sinsuat Avenue)	To determine the traffic volume coming in and out of Cotabato City To use for expanding OD survey result	Manual count (14-hour survey)
2	Roadside OD survey	2 stations (Along Sinsuat Avenue)	To analyze how many vehicles will use the action plan study project roads	Interview of drivers by Vehicle type (e.g., origin and destination)

Source: JICA Study Team

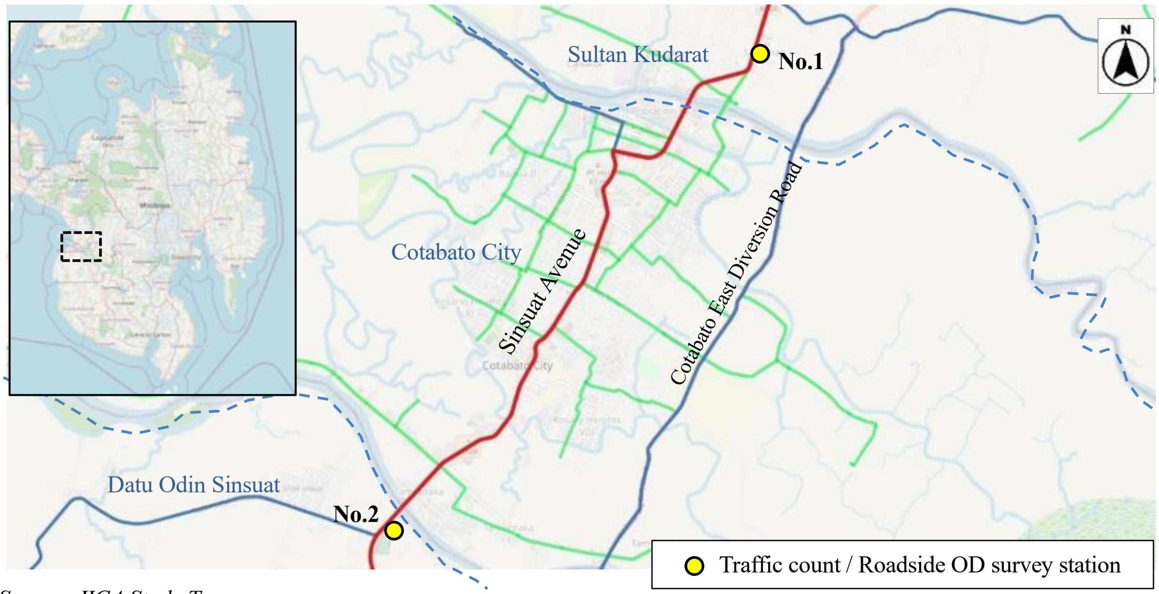
(1) Traffic Count Survey

A 14-hour traffic count survey was carried out, at two stations along Sinsuat Avenue. The survey was done manually, with surveyors positioned at the side of the road while recording the number of vehicles, per direction, per vehicle type (12 types of vehicles based on DPWH classification). The locations of the traffic count survey stations are shown in Figure 23.2-1. Traffic count data were used for expanding OD survey result.

Table 23.2-2 Traffic Count Survey Methodology

Survey day	Station1: July 13, 2021 (Tue) Station2: July 15, 2021 (Thu)
Survey time	14 hours (from 6:00 AM to 8:00 PM)
Survey items	Traffic volume per type of vehicle

Source: JICA Study Team



Source: JICA Study Team

Figure 23.2-1 Location of Traffic Count/ Roadside OD Survey Stations

(2) Roadside OD survey

A roadside Origin-Destination (OD) Survey was conducted to establish the present OD matrices for trips of passengers and commodities. The objective is to acquire the trip characteristics among traffic zones. The survey was conducted by stopping vehicles at roadsides and asking the drivers questions relating to their trips. The location map of roadside OD survey stations is shown in Figure 23.2-1.

Table 23.2-3 Roadside OD Survey Methodology

Survey day	Station1: July 13, 2021 (Tue) Station2: July 15, 2021 (Thu)
Survey time	12 hours (from 6:00 AM to 6:00 PM) *
Survey items	Passenger vehicle: origin, destination (province, city/municipality, barangay), trip purpose, number of passengers
	Freight vehicle: origin, destination (province, city/municipality, barangay), trip purpose, type of goods, loaded goods volume
Target Vehicle	Passenger car, Jeepney, Bus, Truck (excluding two wheels vehicles)
Sampling rate	Total sample number (Sampling rate (four wheels or more vehicle)) Station1: 2,125 (22%) Station2: 2,617 (22%)

* As per police advisory
Source: JICA Study Team

23.2.2 Traffic Characteristics

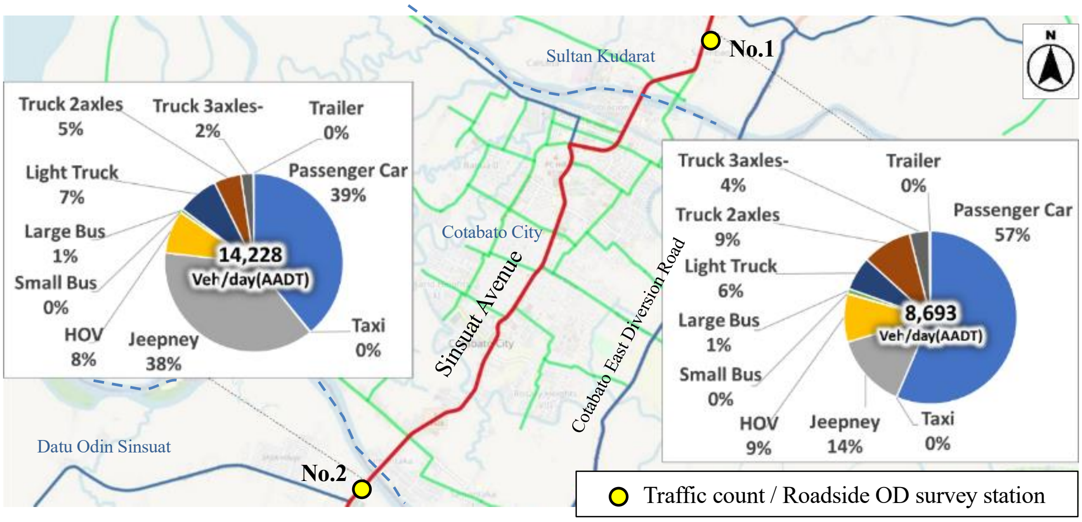
In this section, traffic characteristics are analyzed using the results of the traffic survey.

(1) Traffic Volume by Vehicle type

Traffic count results were converted to the annual average daily traffic (AADT) as shown in Figure 23.2-2. Passenger cars and jeepneys occupied more than 75% of total traffic (excluding motorcycles and tricycles).

At the northern portion of Cotabato City, passenger cars comprised more than 50% of total traffic (vehicles with four wheels or more).

At the southern portion of the city, there were many jeepneys observed. Jeepneys accounted for approximately 30% of the total traffic (vehicles with four wheels or more).

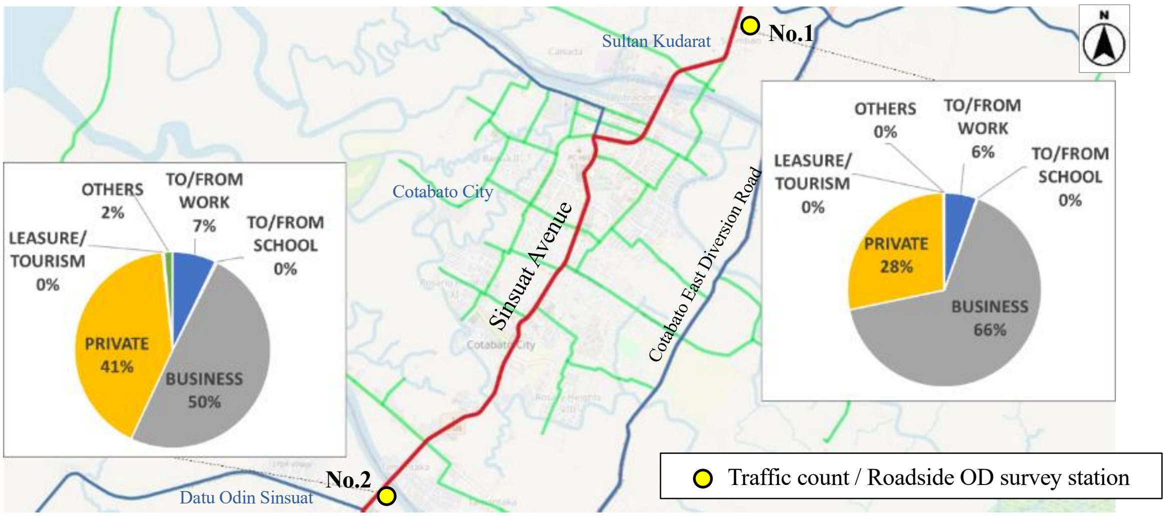


Source: JICA Study Team

Figure 23.2-2 Traffic volume (AADT) by Vehicle type (Four wheels or more vehicle)

(2) Traffic Purpose

Using the results of the roadside OD survey, the trip purpose at each station is shown in Figure 23.2-3. “business” served as the predominant trip purpose at both Station1 and Station2. In the northern side of Cotabato City (Station2), business trips accounted for two-thirds of total trips. On the other hand, “private” trips comprised 40% of all total trips at the southern side (Station1). This value is greater than the percentage of private trips at the northern side.



Source: JICA Study Team

Figure 23.2-3 Trip Purpose

(3) Average Passenger number

From the results of the roadside OD survey, the average number of passengers per vehicle is shown in Figure 23.2-4. According to the survey, there were approximately 2-3 people within passenger cars, taxis and trucks. Large buses recorded the highest average passenger number, at approximately 22 passengers.

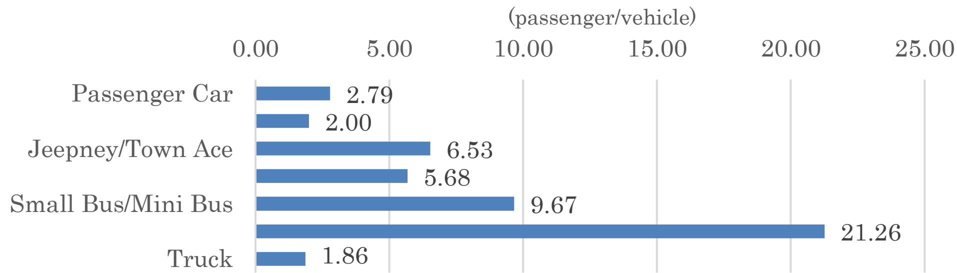


Figure 23.2-4 Average Passenger number

(4) Average Cargo Weight

From the roadside OD survey result, the cargo weight carried by a truck is shown in Figure 23.2-4. Trucks which carry less than 10t comprised approximately 90% of total truck trips. This suggests that there aren't too many heavy trucks operating within the vicinity of Cotabato City.

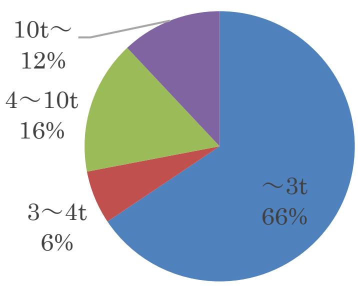


Figure 23.2-5 Cargo Weight of Truck

(5) Trip Origin and Destination

From the Roadside OD survey result, Trip Desire line map by Vehicle type is prepared and shown in Figure 23.2-6 to Figure 23.2-10. The results are shown below.

- For passenger cars, there is significant traffic demand between Cotabato City and Awang, Cotabato Province, Sultan Kudarat province and Parang (Figure 23.2-6).
- For jeepneys, almost all recorded traffic is between Cotabato City and Awang (Figure 23.2-7).
- For buses, almost all traffic is between Cotabato City and Davao, South Cotabato Province (Figure 23.2-8).
- For trucks, main traffic demand is between Cotabato City and Sultan Kudarat (Nuling) (Figure 23.2-9).
- For all vehicles, Cotabato City and Awang, Cotabato Province, Sultan Kudarat province, Parang. (Figure 23.2-10).

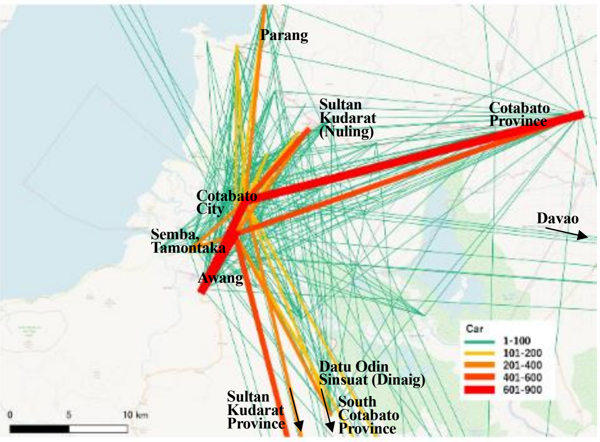


Figure 23.2-6 Passenger Car

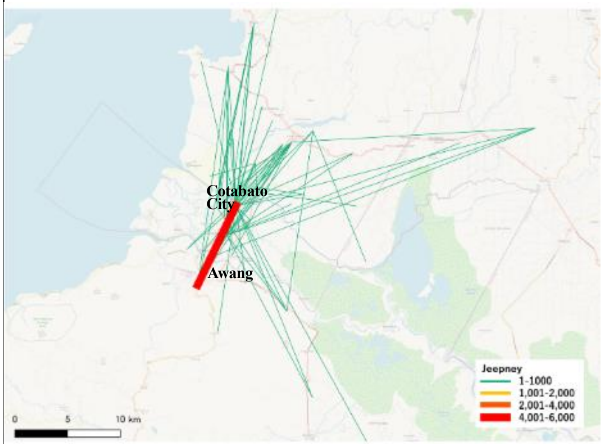


Figure 23.2-7 Jeepney

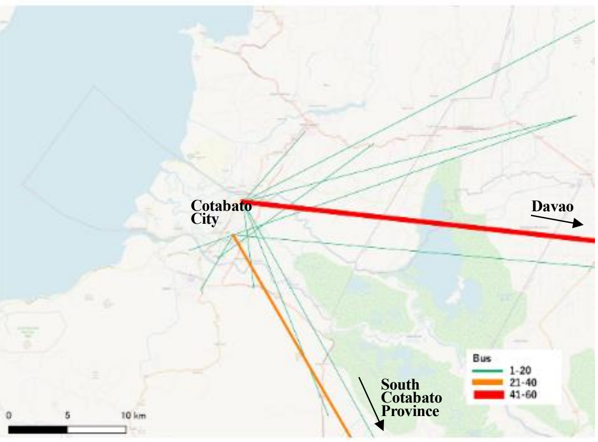


Figure 23.2-8 Bus

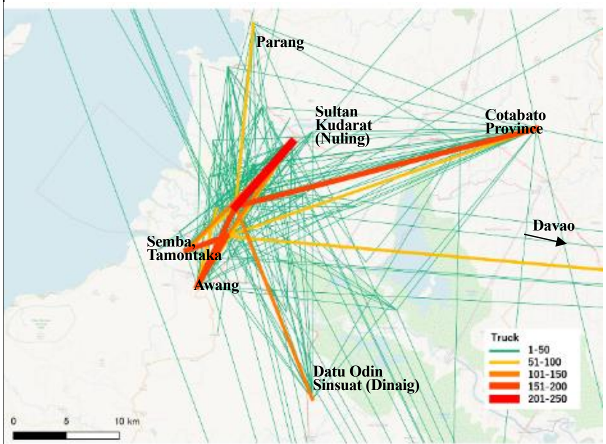
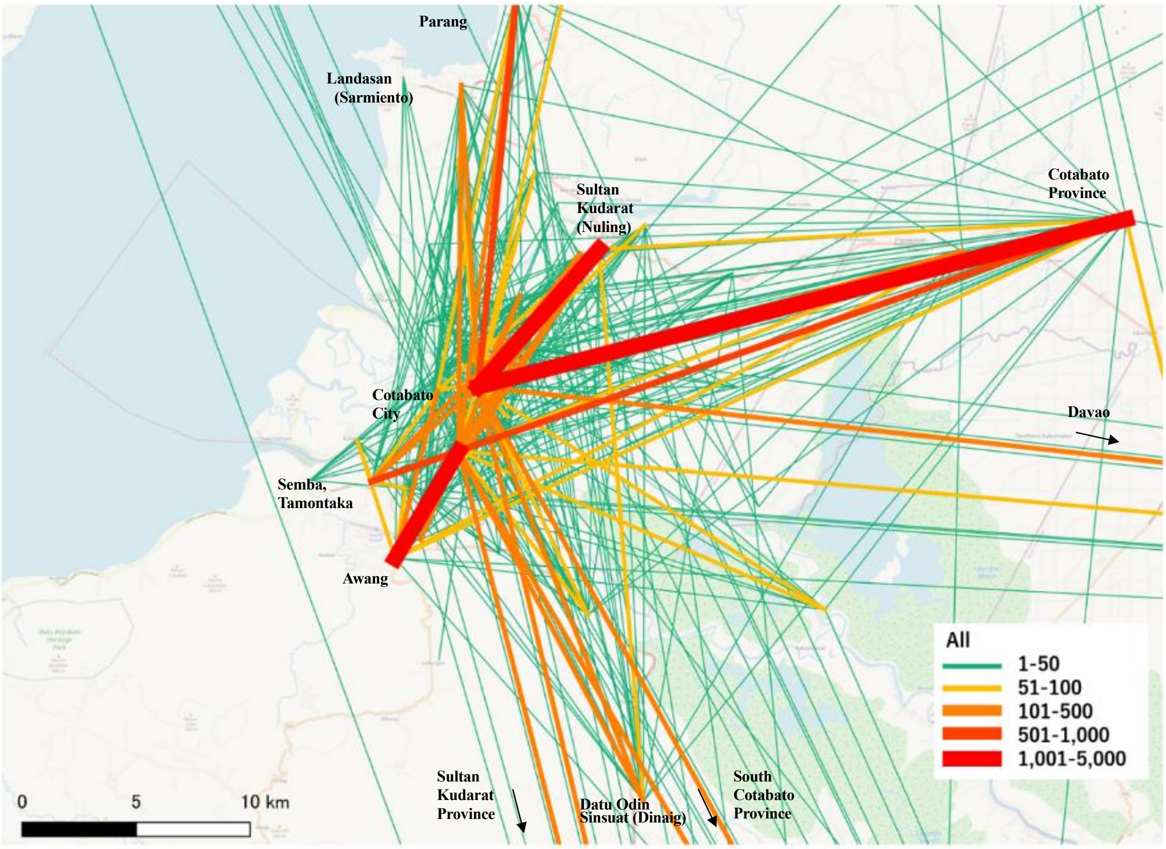


Figure 23.2-9 Truck

Source: JICA Study Team



Source: JICA Study Team

Figure 23.2-10 Desire Line (All Vehicles)

23.2.3 Traffic Issues

Currently, there is only one major north-south road in Cotabato City: Sinsuat Avenue (primary road). The East Diversion Road is operational along the city's east side, but its north section remains a missing link. As such, the traffic in the north-south direction is using Sinsuat Avenue.

From the results of the travel speed survey, Sinsuat Avenue in Cotabato City has many sections where the travel speed is less than 20 km/h during peak hours. The results of the travel speed survey are shown in Figure 23.2-11. The West Diversion Road is a road parallel to the west side of this Sinsuat Avenue, and it has the function of distributing traffic away from Sinsuat Avenue.

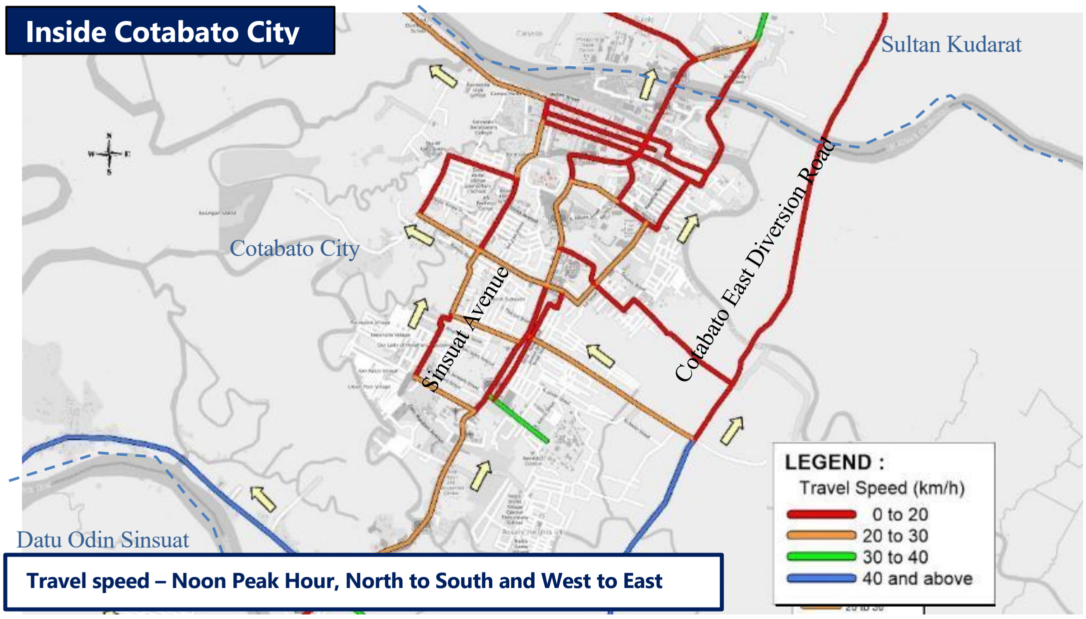


Figure 23.2-11 Travel Speed inside Cotabato City (Peak Hour)

23.2.4 Traffic Demand Forecast

(1) Approach

Traffic demand forecast is generally used to evaluate the efficiency of proposed transport infrastructure projects and their potential changes to an area's travel characteristics. In this project, future traffic demand will serve as a strong justification to the necessity of the West Diversion Road for the Greater Cotabato Area. The approach aims to determine the project's impact by comparing future traffic situation (target years: 2028 and 2040) with and without the project. The forecasted traffic demand will be used as basis for economic analysis.

Mathematical models were used to estimate future travel demand. Since transport demand closely interacts with the socioeconomic environment, future socioeconomic indexes (e.g., population and economic indicators) were first estimated. Concurrently, the existing and future road network and condition, traffic zones and traffic data were prepared. These were inputted to the traffic assignment model to determine the future interzonal transport demand. The overall demand flow of the methodology used in forecasting the traffic volumes on West diversion road is shown in Figure 23.2-12.

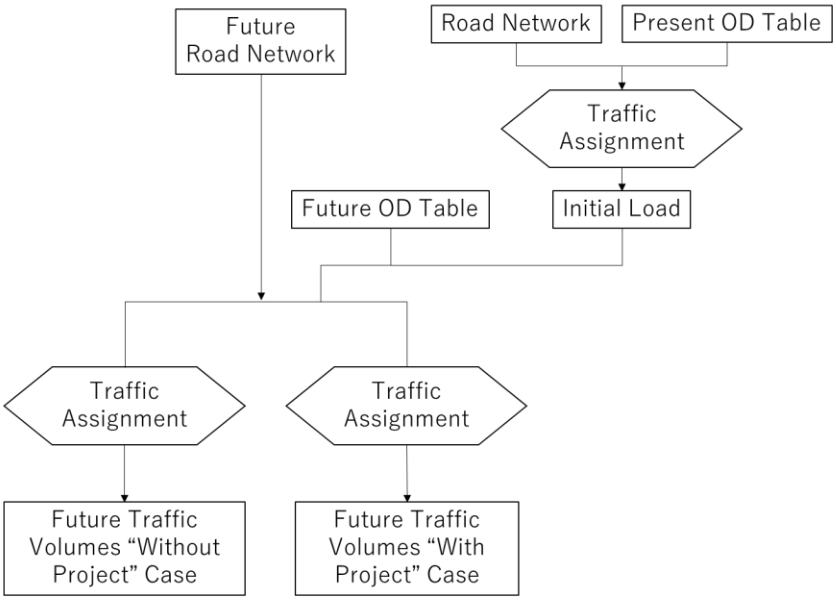


Figure 23.2-12 Forecast of Traffic Volumes on Road Network

(2) Outline of Analysis

The condition of traffic demand forecast is shown in Table 23.2-4.

Table 23.2-4 Condition of Traffic Demand Forecast

Items	Description
Target Area	Cotabato City and around area
Year of Forecast	Base year: 2021 Target year: 2028, 2040
Classification of vehicle	Motor Vehicle excluding two-wheel vehicle (total traffic is divided into four types) ✓ Car: individual car, taxi, HOV ✓ Jeepney ✓ Bus: Mini-Bus, Large Bus ✓ Truck: all types of trucks and trailers
Network	✓ All National Primary Roads ✓ All National Secondary Roads ✓ Selected National Tertiary roads
Zoning	Total number of traffic zones: 65 zones ✓ Cotabato City: 13 zones ✓ Outside of Cotabato City: 52 zones

Source: JICA Study Team

(3) Traffic zoning for traffic assignment

To calculate the traffic demand, traffic zones are determined based on configuration of Barangay and Municipality.

The Cotabato City and surrounding area is divided into 56 traffic zones.

Traffic zoning table and Traffic zoning map are shown in Table 23.2-5 to Table 23.2-6 and Figure 23.2-13.

Table 23.2-5 Traffic Zone Table (1/2)

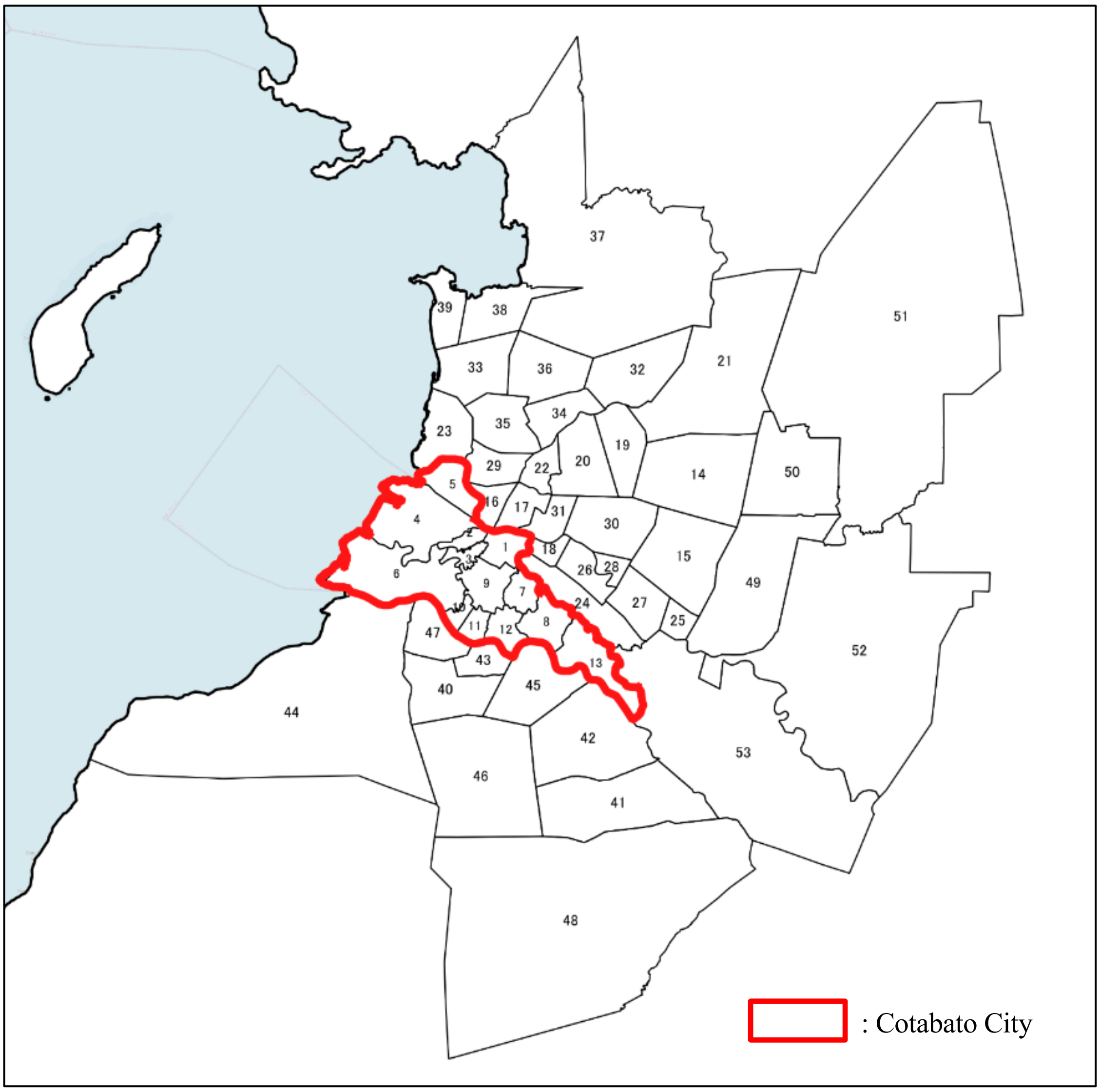
Zone	Province	City/Municipality	Barangay
1	Cotabato City	Cotabato City	Bagua,Bagua III,Poblacion,Poblacion I,Poblacion II,Poblacion III,Poblacion IV,Poblacion V,Poblacion VI,Poblacion VII,Rosary Heights I,Rosary Heights II,Rosary Heights III,Rosary Heights IV,Rosary Heights XII,Rosary Heights XIII
2	Cotabato City	Cotabato City	Bagua I
3	Cotabato City	Cotabato City	Bagua II
4	Cotabato City	Cotabato City	Kalanganan
5	Cotabato City	Cotabato City	Kalanganan I
6	Cotabato City	Cotabato City	Kalanganan II
7	Cotabato City	Cotabato City	Poblacion VIII
8	Cotabato City	Cotabato City	Poblacion IX
8	Cotabato City	Cotabato City	Tamontaka III
9	Cotabato City	Cotabato City	Rosary Heights,Rosary Heights V,Rosary Heights VI,Rosary Heights VII,Rosary Heights VIII,Rosary Heights IX,Rosary Heights X,Rosary Heights XI
10	Cotabato City	Cotabato City	Tamontaka
11	Cotabato City	Cotabato City	Tamontaka I
12	Cotabato City	Cotabato City	Tamontaka II
13	Cotabato City	Cotabato City	Tamontaka IV,Tamontaka V
14	Maguindanao	Sultan Kudarat (Nuling)	Alamada,Ladia,Pigcalagan
15	Maguindanao	Sultan Kudarat (Nuling)	Banatin,Damaniog,Nara,Panatan,Pigkelegan (Ibotegen)
16	Maguindanao	Sultan Kudarat (Nuling)	Banubo,Katuli
17	Maguindanao	Sultan Kudarat (Nuling)	Bulalo,Calsada,Limbo
18	Maguindanao	Sultan Kudarat (Nuling)	Bulibod
19	Maguindanao	Sultan Kudarat (Nuling)	Crossing Simuay
20	Maguindanao	Sultan Kudarat (Nuling)	Dalumangcob (Pob.),Rebuken
21	Maguindanao	Sultan Kudarat (Nuling)	Darapanan,Matengen,Nekitan,Olas,Pingping
22	Maguindanao	Sultan Kudarat (Nuling)	Gang,Makaguiling
23	Maguindanao	Sultan Kudarat (Nuling)	Inawan,Sambolawan
24	Maguindanao	Sultan Kudarat (Nuling)	Kabuntalan,Katamlangan (Matampay),Nalinan
25	Maguindanao	Sultan Kudarat (Nuling)	Kakar
26	Maguindanao	Sultan Kudarat (Nuling)	Kapimpilan
27	Maguindanao	Sultan Kudarat (Nuling)	Katidtuan
28	Maguindanao	Sultan Kudarat (Nuling)	Maidapa
29	Maguindanao	Sultan Kudarat (Nuling)	Mulaug,Senditan
30	Maguindanao	Sultan Kudarat (Nuling)	Pinaring,Raguisi
31	Maguindanao	Sultan Kudarat (Nuling)	Salimbao,Ungap
32	Maguindanao	Sultan Mastura	Balut,Bungabong
33	Maguindanao	Sultan Mastura	Boliok,Dagurongan,Kirkir,Simuay/Seashore
34	Maguindanao	Sultan Mastura	Macabico (Macabiso)
35	Maguindanao	Sultan Mastura	Namuken,Solon,Tariken
36	Maguindanao	Sultan Mastura	Tambo,Tapayan,Tuka
37	Maguindanao	Parang	Guiday T. Biruar,Bongo Island (Litayen),Campo Islam,Cotongan,Datu Macarimbang Biruar,Gadungan,Gadunganpedpandaran,Gumagadong Calawag,Kabuan,Limbayan,Macasandag,Magsaysay,Making,Manion,Moro Point,Nituan,Orandang,Pinantao,Poblacion I,Poblacion II,Samberen,Tagudtongan,Tuca-Maror
38	Maguindanao	Parang	Landasan (Sarmiento)
39	Maguindanao	Parang	Polloc
40	Maguindanao	Datu Odin Sinsuat (Dinaig)	Awang
41	Maguindanao	Datu Odin Sinsuat (Dinaig)	Baka
42	Maguindanao	Datu Odin Sinsuat (Dinaig)	Bitu,Margues,Taviran
43	Maguindanao	Datu Odin Sinsuat (Dinaig)	Capiton
44	Maguindanao	Datu Odin Sinsuat (Dinaig)	Dinaig Proper,Linek,Mompong
45	Maguindanao	Datu Odin Sinsuat (Dinaig)	Dulangan,Tambak,Tanuel
46	Maguindanao	Datu Odin Sinsuat (Dinaig)	Labungan
47	Maguindanao	Datu Odin Sinsuat (Dinaig)	Semba,Tamontaka

Source: JICA Study Team

Table 23.2-6 Traffic Zone Table (2/2)

Zone	Province	City/Municipality	Barangay
48	Maguindanao	Datu Odin Sinsuat (Dinaig)	Ambolodto,Badak,Bagoenged,Benolen,Bongued,Bugawas,Dados,Dalican Poblacion,Kakar,Kenebeka,Kurintem,Kusiong,Makir,Nekitan,Sapalan,Sibuto,Sifaren (Sifaran),Tapian,Tenonggos
49	Cotabato (North Cotabato)	Pigcawayan	Balacayon,Buricain,Datu Binasing,Datu Mantil,Kadingilan,Libungan Torreta,Lower Baguer,Lower Pangangkalan,Matilac,Simsiman,Upper Pangangkalan
50	Cotabato (North Cotabato)	Pigcawayan	Banucagon,Central Panatan,Malagakit
51	Cotabato (North Cotabato)	Pigcawayan	Anick (Upper Balogo),Balogo,Buluan,Bulucaon,Cabpangi,Capayuran,Kimarayang,Maluao,Midpapan I,Midpapan II,Mulok,New Culasi,New Igbaras,New Panay,North Manuangan,Patot,Payong-payong,Poblacion I,Poblacion II,Poblacion III,Presbitero,Renibon,Tigbawan,Tubon,Upper Baguer (Baguer)
52	Maguindanao	Northern Kabuntalan	Balong,Damatog,Gayonga,Guiawa,Indatuan,Kapimpilan,Libungan,Montay,Paulino Labio,Sabaken,Tumaguinting
53	Maguindanao	Kabuntalan (Tumbao)	Bagumbayan,Buterin,Dadtumog (Dadtumeg),Gambar,Ganta,Katidtuan,Langeban,Liong,Lower Taviran,Maitong,Matilak,Pagalungan,Payan,Pedtad,Pened,Poblacion,Upper Taviran
54	Agusan del Sur		
55	Bukidnon		
56	Cotabato Province (those not covered in the above zone)		
57	Davao del Sur		
58	Lanao del Norte		
59	Lanao del Sur		
60	Misamis Oriental		
61	Sarangani		
62	South Cotabato		
63	Sultan Kudarat		
64	Zamboanga del Norte		
65	Zamboanga del Sur		

Source: JICA Study Team

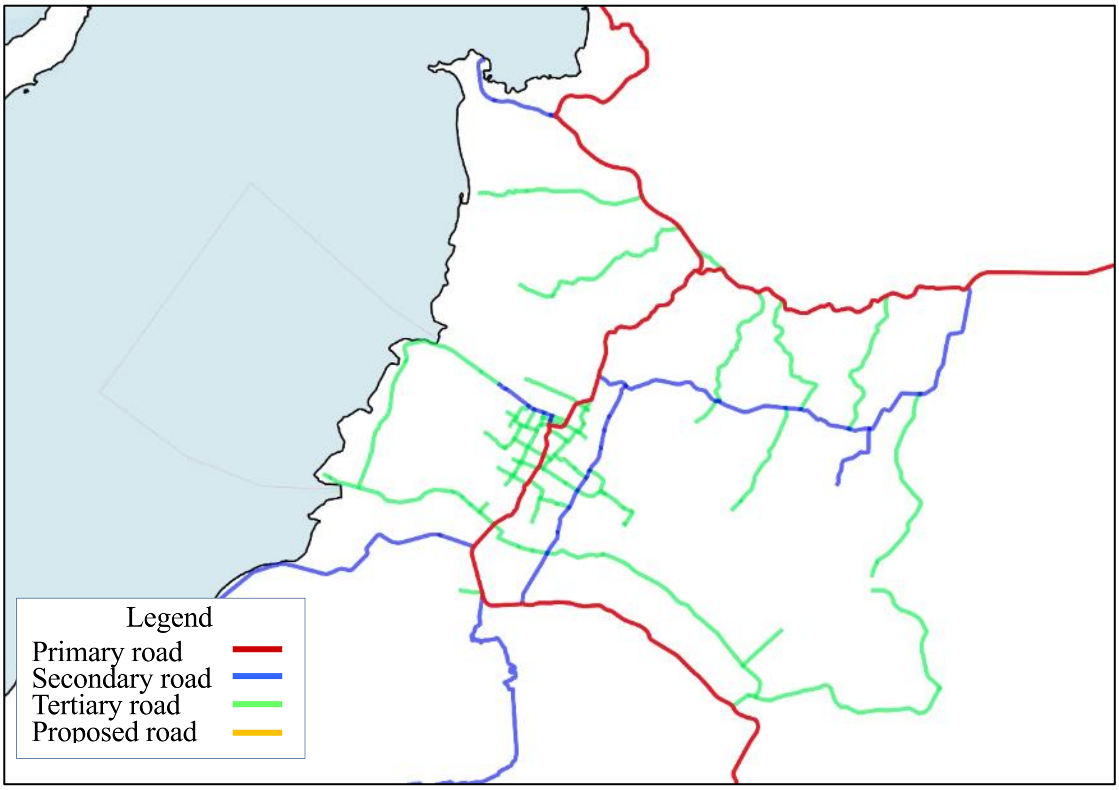


Source: JICA Study Team

Figure 23.2-13 Traffic Zone Map

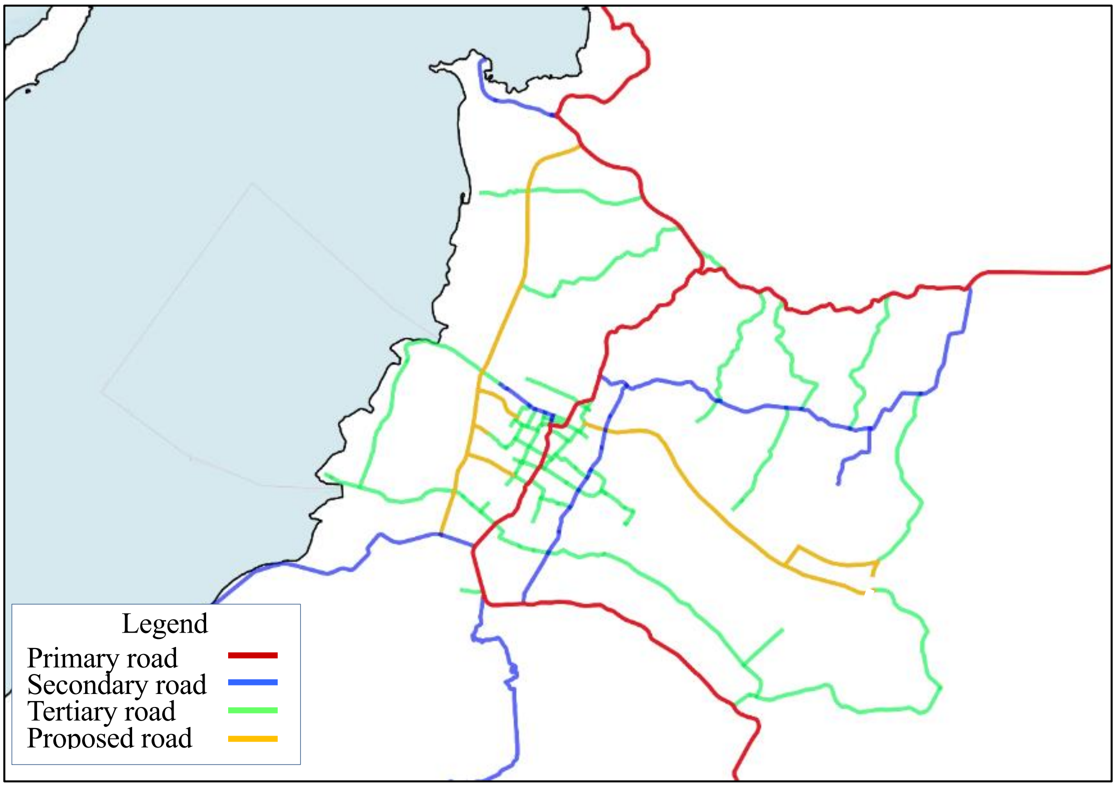
(4) Road Network for traffic assignment

The road network for traffic assignment is shown in Figure 23.2-14 to Figure 23.2-16. The road network includes all primary roads and secondary roads, and major tertiary roads. The road condition of each road class is shown in Table 23.2-7.



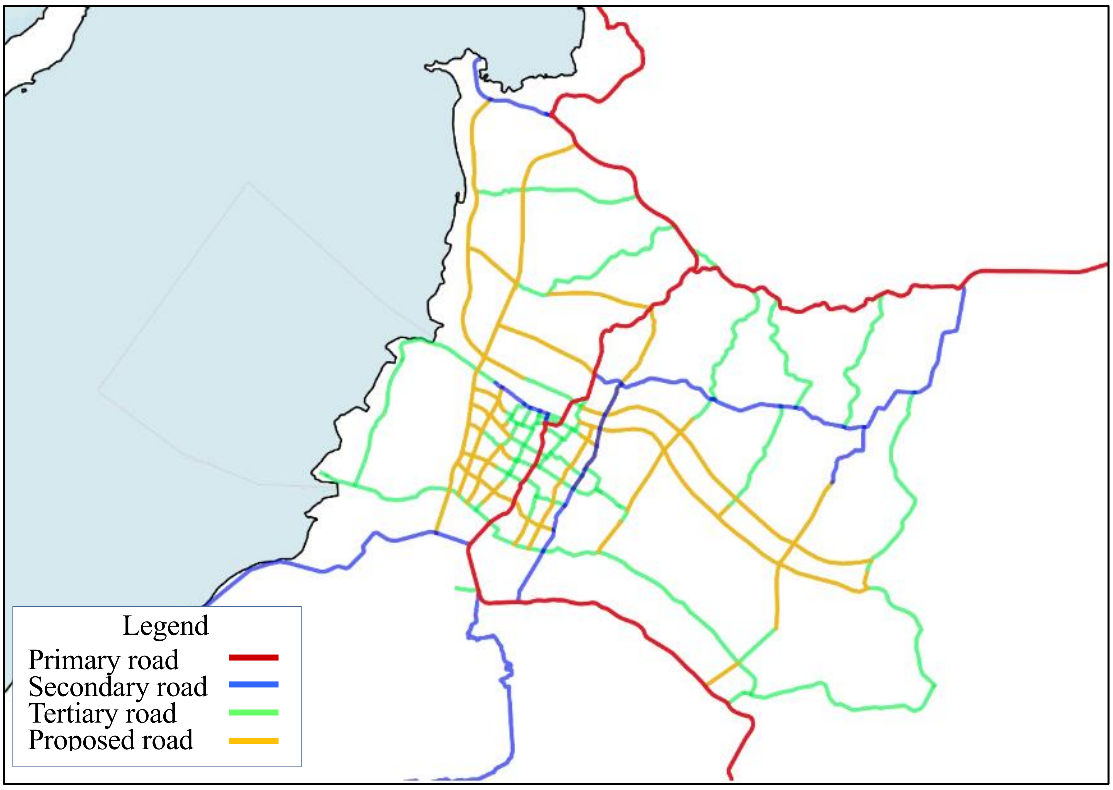
Source: JICA Study Team

Figure 23.2-14　Existing Road Network



Source: JICA Study Team

Figure 23.2-15　Road Network (2028)



Source: JICA Study Team

Figure 23.2-16　Road Network (2040)

Table 23.2-7　Free Flow Speed and Road Capacity Table

Road surface condition	QV Type	Road Class	Lane	Free flow Speed (km/h)	Road Capacity (PCU/day)
				Plain	
paved	1	National Road (Primary)※1	4	50	48,000
	2		2	40	10,000
	3	National Road (Secondary)	2	30	8,000
	4	National Road (Tertiary)	2	30	6,000
	5	West diversion road※2	2	40	8,000
Unpaved	6	National Road (Secondary)	2	20	6,000
	7	National Road (Tertiary)	2	20	6,000

※1：The capacity of Sinsuat avenue inside Cotabato City is adjusted by situation of road side parking.
※2：Even though, West diversion road is planned as a secondary road, but it is planned as a dike road and it is kind of access control road, so that Free Flow Speed is 40km/h.

Source: JICA Study Team

(5) Future Socio-Economic Framework

To assume the future traffic demand, the Population projection and GRDP projection were used. The future traffic demand of each kind of vehicles were projected using the indicators below.

・Passenger car, Jeepney, Bus: Population Projection (Projection of MP and past trend)

・Truck: GRDP Projection (past trend)

The socio-economic profile is summarized below.

a) Population projection

The future population of traffic demand target area is shown in Table 23.2-8. The population of MP target area (Cotabato City, Maguindanao province (Sultan Kudarat, Sultan Mastura, Parang, Datu Odin Sinsuat), Cotabato province (Pigcawayan)) is projected in this survey. The growth rate of population used for the other area is the past trend for Years 2015 to 2020.

Table 23.2-8 Future Population

Province	City/Municipality	Population			AAGR	
		POP_2020	POP_2028	POP_2040	20-28(%)	29-40(%)
Cotabato City	Cotabato City	325,079	380,500	474,700	2.0%	2.0%
Maguindanao	Sultan Kudarat	105,121	146,546	202,128	4.2%	3.0%
Maguindanao	Sultan Mastura	25,331	35,313	48,707	4.2%	3.0%
Maguindanao	Parang	102,914	143,469	197,885	4.2%	3.0%
Maguindanao	Datu Odin Sinsuat	116,768	162,782	224,524	4.2%	3.0%
Cotabato (North Cotabato)	Pigcawayan	72,371	100,890	139,156	4.2%	3.0%
Maguindanao	Northern Kabuntalan	26,277	28,175	31,394	0.9%	0.9%
Maguindanao	Kabuntalan (Tumbao)	25,439	52,908	195,207	11.1%	11.1%
Agusan del Sur		739,367	809,413	927,118	1.2%	1.2%
Bukidnon		1,541,308	1,779,375	2,207,163	1.9%	1.9%
Cotabato Province (those not covered in the above zone)		1,418,247	1,615,023	1,962,541	1.7%	1.7%
Davao del Sur		680,481	769,412	925,066	1.6%	1.6%
Lanao del Norte		722,902	808,505	956,286	1.5%	1.5%
Lanao del Sur		1,195,518	1,498,339	2,102,283	3.0%	3.0%
Misamis Oriental		956,900	1,084,094	1,307,277	1.6%	1.6%
Sarangani		558,946	584,561	625,201	0.6%	0.6%
South Cotabato		975,476	1,085,839	1,275,231	1.4%	1.4%
Sultan Kudarat		854,052	929,617	1,055,683	1.1%	1.1%
Zamboanga del Norte		1,047,455	1,111,074	1,213,820	0.8%	0.8%
Zamboanga del Sur		1,050,668	1,121,583	1,237,030	0.9%	0.9%

Source: JICA Study team

b) GRDP projection

The GRDP annual Growth rate of Region XII is shown in Table 23.2-9. The GRDP Growth rate used for traffic demand is 3.5% from 2020-2040.

Table 23.2-9 GRDP Growth rate

GRDP		2018-2019
Phillipine		6.9%
XII	SOCCSKSARGEN	3.5%

Source: JICA Study Team

(6) Preparation of Future OD matrix

The future OD table was created from the socio-economic framework and current OD table. The distribution model is present pattern model. Estimated Generation Trip is shown in Table 23.2-10. Future OD was prepared for Year 2028 and 2040. Year 2028 is the opening year of East Diversion Road. Year 2040 is the target year of this survey. The overall flow of the methodology used in creation for Future OD matrix is shown in Figure 23.2-17.

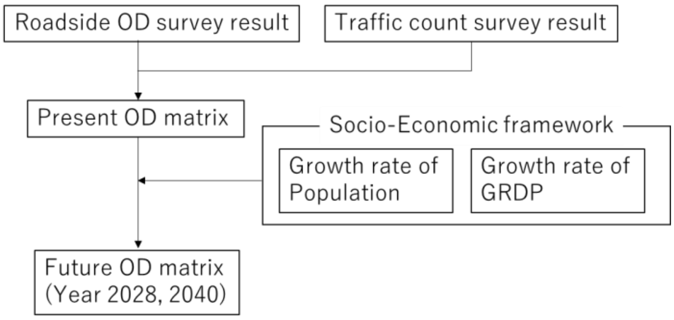


Figure 23.2-17 Creation of Future OD matrix

The purpose of this traffic demand forecast is for projection of demand for West Diversion Road, so that the OD data used for traffic demand is the traffic passing through the survey points of Roadside OD survey in this study. So, it is not included the traffic whose OD is inside Cotabato City. The generation trip of each province, city and municipality are shown in Table 23.2-10. The other conditions for demand forecast and detail OD matrix is described in annex 22.

Table 23.2-10 Estimation Generation Trip and Annual Growth Rate

Province	City/Municipality	Generation Trip(Vehicle/day)			Annual Growth Rate	
		2021	2028	2040	2021-2028	2029-2040
Cotabato City	Cotabato City	9,659	11,506	14,814	2.5%	2.3%
Maguindanao	Sultan Kudarat	3,137	4,316	6,087	4.7%	3.2%
Maguindanao	Sultan Mastura	324	441	634	4.5%	3.4%
Maguindanao	Parang	724	999	1,401	4.7%	3.1%
Maguindanao	Datu Odin Sinsuat	5,577	7,715	10,776	4.7%	3.1%
Cotabato (North Cotabato)	Pigcawayan	203	277	395	4.5%	3.3%
Maguindanao	Northern Kabuntalan	148	168	207	1.8%	1.9%
Maguindanao	Kabuntalan (Tumbao)	0	0	0	0.0%	0.0%
Agusan del Sur		3	4	6	4.2%	3.8%
Bukidnon		0	0	0	0.0%	0.0%
Cotabato Province (those not covered in the above zone)		1,128	1,330	1,718	2.4%	2.4%
Davao del Sur		177	217	300	3.0%	3.0%
Lanao del Norte		10	11	13	1.4%	1.5%
Lanao del Sur		96	121	171	3.4%	3.2%
Misamis Oriental		3	3	4	0.0%	2.6%
Sarangani		6	7	9	2.2%	2.3%
South Cotabato		198	235	308	2.5%	2.5%
Sultan Kudarat		143	162	199	1.8%	1.9%
Zamboanga del Norte		3	4	6	4.2%	3.8%
Zamboanga del Sur		16	18	22	1.7%	1.8%

Source: JICA Study Team

(7) Assignment Method

The traffic assignment procedure allocates vehicle traffic into individual road links. The Incremental Assignment is adopted. The incremental assignment divides the input OD traffic data into user-specified increments and assigns each increment to the minimum route wherein the generalized cost in the least. The OD data was divided 20% for each in this time.

The detail traffic assignment conditions like a Speed flow relationship, Passenger Car unit is descried in the Annex 22.

(8) Assignment Validation

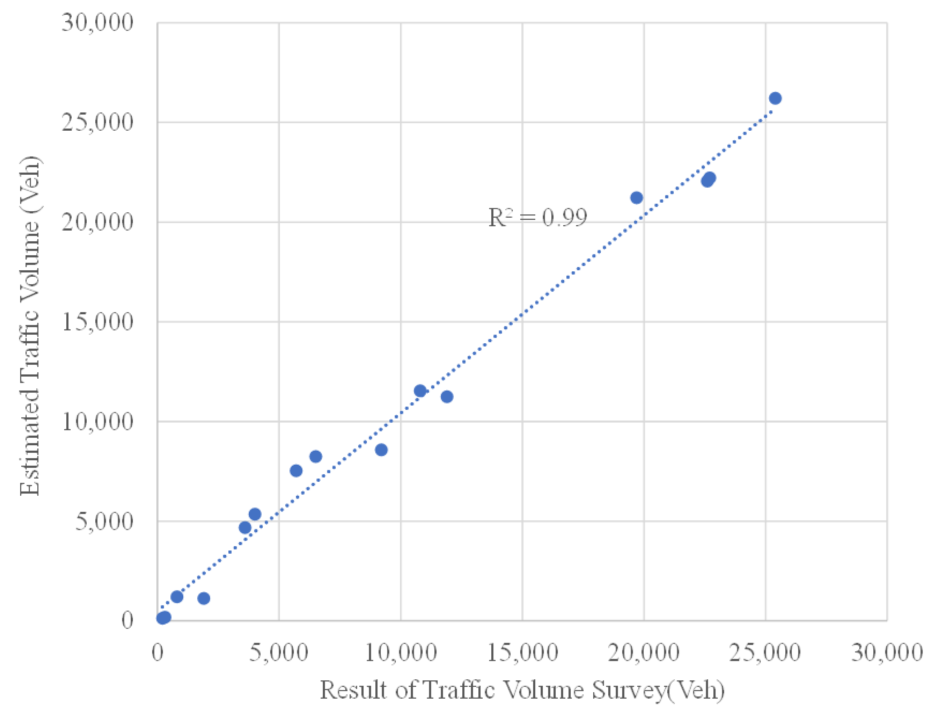
The procedure of model validation entails two steps: first, the current OD matrix is assigned on an existing network. Second, the assigned traffic volume is compared with the result of the traffic count surveys at each corresponding location. This verification aims to check the accuracy of both the current OD matrix and an existing network model representing the existing transport situation.

In this study, the OD data is without internal trip. In order to approximate the congestion situation in Cotabato City, the roads that differ from the survey results were given the initial traffic volume. Table 23.2-11 shows observed traffic volume by traffic count survey and Assignment traffic volume. Figure 23.2-18 shows the result of comparison between observed traffic volume and assignment traffic volume. The value of R^2 (Coefficient of determination) = 0.99 which is considered to reflect a good calibration.

Table 23.2-11 Comparison of Observed and Assigned Traffic Volume

Road name, Site	Observed Traffic Volume	Assigned Traffic Volume	Difference	Rate
North gate bridges① of Cotabato city (Quirino Bridge, Delta Bridge, East diversion road)	11,247	11,900	-653	-6%
North gate bridges② of Cotabato city (Matampay Bridge, Delta Bridge)	11,551	10,800	751	-7%
Quezon Avenue, Cotabato City	8,590	9,200	-610	-7%
Badoy St, Anacleto	7,542	5,700	1,842	24%
East Diversion Road north side of the City	145	200	-55	-38%
Don Teodoro V Juliano Ave nothside	5,362	4,000	1,362	25%
Sinusaat Ave north side of the City	22,227	22,700	-473	-2%
Don Teodoro V Juliano Ave southside	4,691	3,600	1,091	23%
Sinsuat Ave, middle of the City	22,071	22,600	-529	-2%
De Mazenod Ave	8,259	6,500	1,759	21%
East divesion road middle of the City	200	300	-100	-50%
Sinusuat Ave, middle of the City	26,224	25,400	824	3%
East diversion road middle of the City	1,221	800	421	35%
Sinsuat Ave,southside of the City	21,232	19,700	1,532	7%
East diversion road southside of the City	1,141	1,900	-759	-67%

Source: JICA Study Team



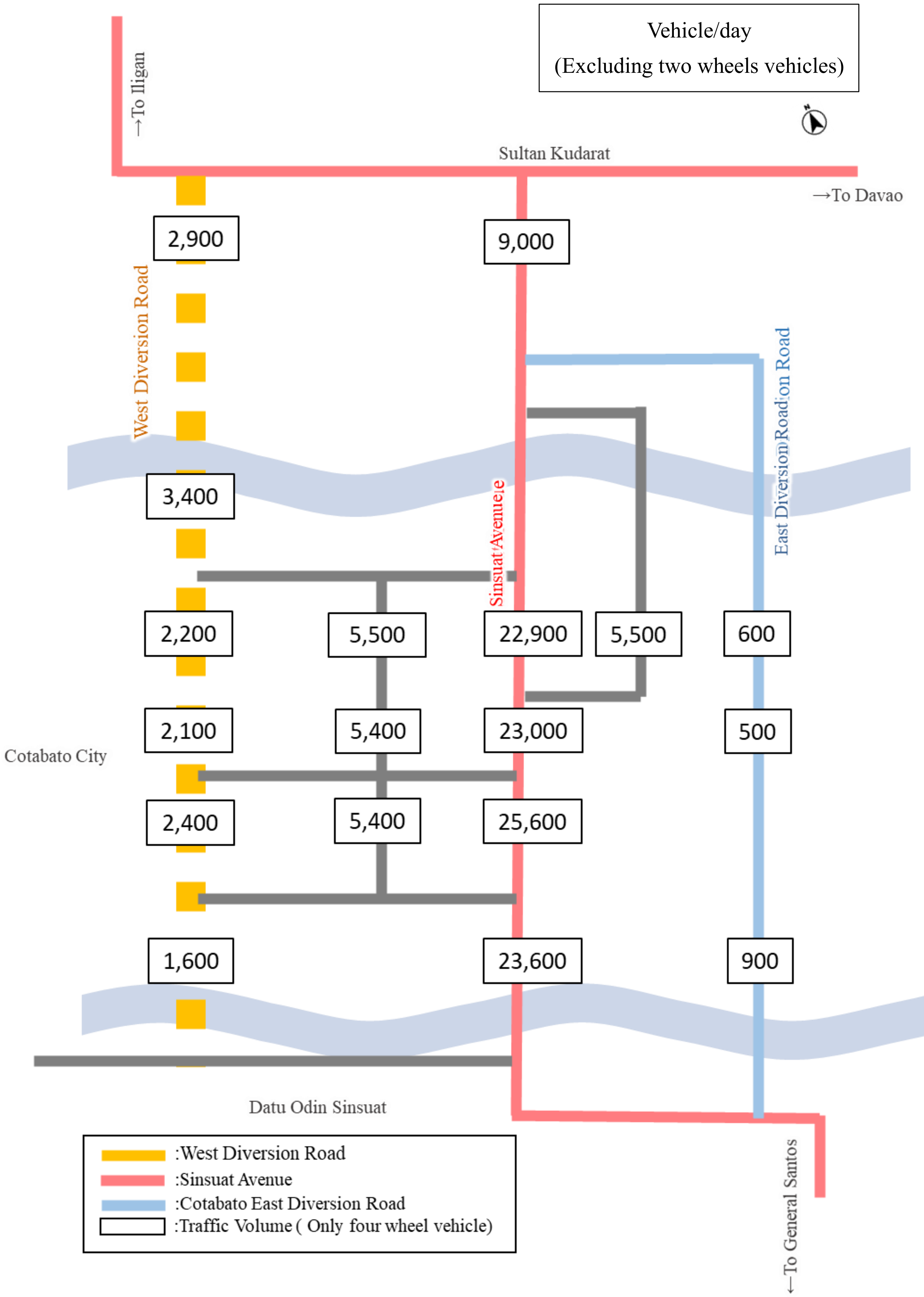
Source: JICA Study Team

Figure 23.2-18 Comparison of Observed and Assigned Traffic Volume

23.2.5 Future Traffic Volume

Figure 23.2-19 shows the estimated traffic volume along the West Diversion Road in 2028. The traffic volume along West Diversion Road is between 1,600-3,400 vehicle/day. Majority of the traffic which is expected to shift to the West Diversion Road will come from the north-south traffic to/from bordering municipalities.

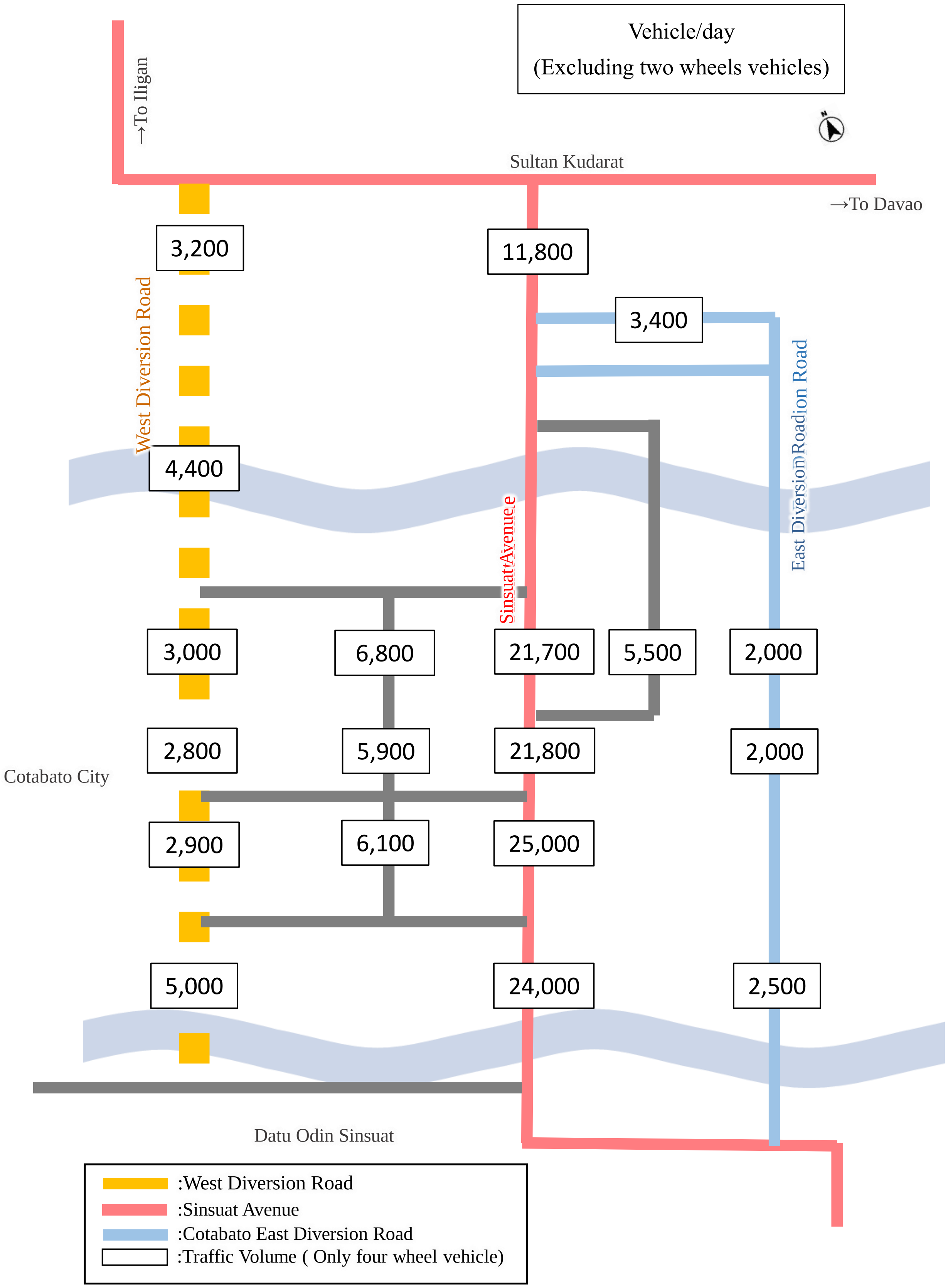
Figure 23.2-20 shows the estimated traffic volume of West Diversion Road in 2040. The traffic volume of West Diversion Road is between 2,800-5,000 Vehicle/day.



Note: Tricycles and motorcycles are not reflected in the above data

Source: JICA Study Team

Figure 23.2-19　Traffic Projection of West Diversion Road (Year 2028)



Note: Tricycles and motorcycles are not reflected in the above data

Source: JICA Study Team

Figure 23.2-20 Traffic Projection of West Diversion Road (Year 2040)

23.2.6 Project Impact

Table 23.2-12 summarizes the traffic assignment results for both cases: (1) without project case and (2) with project case. In 2040, the total travel time will be reduced by 2,770 PCU*hr and the total vehicle-km will be reduced by 40,699 PCU*km.

Table 23.2-12 Traffic Indicators of Without Case and With Case

Year	Case	Total Travel Time (PCU*hr)	Total Vehicle Km (PCU*km)
2028	With	21,536	781,579
	Without	23,186	811,676
	With-Without	-1,649	-30,096
2040	With	27,683	956,660
	Without	30,453	997,359
	With-Without	-2,770	-40,699

Source: JICA Study Team

The Benefit from these Impact is mentioned in Section 23.9 Economic Evaluation of the Project.

23.3 Effects of Tsunami and Countermeasures

23.3.1 Past Tsunami Records

(1) Historical Great Earthquakes Beneath the Moro Gulf Area

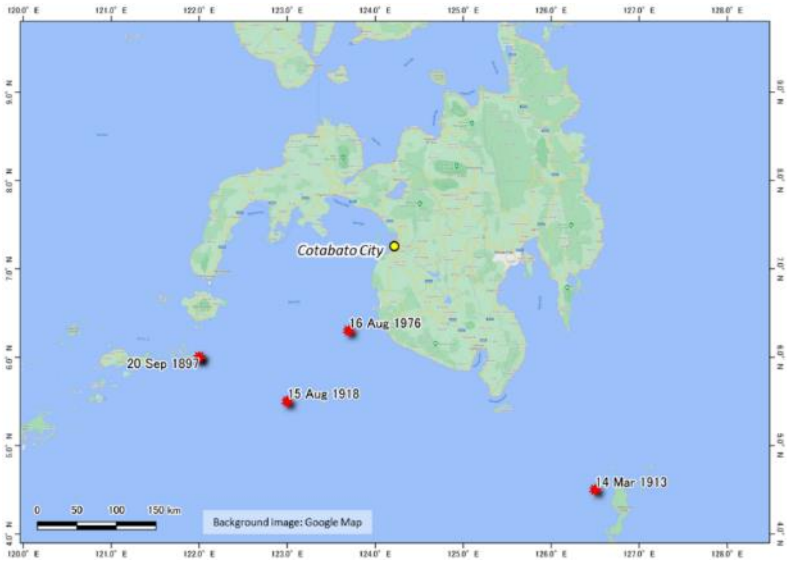
Many submarines shallow earthquakes of great magnitude (7.9 or greater) occurred in the Mindanao area[4]. Beneath the Moro Gulf area or the immediately neighboring Celebes Sea alone five great earthquakes have occurred since 1897 as shown in Table 23.3-1. In a statistical study of tsunamis in the Philippines, Nakamura (1977)[5] reported that the Moro Gulf area is the most tsunami prone, followed by Eastern Mindanao, then by Western Luzon.

Table 23.3-1 (Repost) Historical Great Earthquakes Beneath the Moro Gulf Area or the Immediately Neighboring Celebes Sea since 1897

Date	Magnitude	North	East	Reference
20 Sep 1897	8.6	6.	122.	S
21 Sep 1897	8.7	6.	122.	I, S
14 Mar 1913	8.3	4.5	126.5	I
15 Aug 1918	8.3	5.5	123.	I, S
16 Aug 1976	8.2	6.3	123.7	

(References: I-Iida et al, 1967; R-Repetti, 1948; S-Soloviev and Go, 1969, 1974)
Source: "Moro Gulf Tsunami of 17 August 1976", Victor L. B. et al, 1978

[4] Tichter, C.F., Elementary Seismology, San Francisco: W.H. Freeman, 1958
[5] Nakamura, S., On Statistical Tsunami Risk in the Philippines, Kyoto: Kyoto University, 1977



Source: Created by JICA Study Team based on Table 23.3-1

Figure 23.3-1 (Repost) Estimated Epicenters of Historical Large Tsunamigenic Earthquakes

(2) Tsunami Records of 17 August 1976 Earthquake

The Moro Gulf tsunami of 17 August 1976 was the most disastrous tsunami experienced by the Philippines. There had been more severe tsunamis, but areas hit were less populated and had less manmade structures. According to the PHIVOLCS website[6], there were three destructive tsunami events in 1990, 1992 and 1994 after the tsunami in 1976, but the Moro Gulf tsunami is still recognized as the most destructive tsunami event in the Philippines.

Victor L. B. and Zinnia C. A. (1978)[7] reported that the measured and estimated values of wave heights by PAGASA/ITIC **never exceeded 4.3 meters**. As expected, these values are less than those given by survivors, considering their state of mind at the time. Estimates of wave heights had to be based on qualitative descriptions of the waves being as tall as a coconut tree, a two-story house, twice a man's height or had to be deduced from photographs of damaged structures. A listing of wave heights at various localities is given in Table 23.3-2. Places where waves were reported to be **higher than 5 meters** are: Linek (Maguindanao), Kalanganan (Cotabato City), Pagadian City, Sacol Island (Zamboanga City) and Lebak (Sultan Kudarat). In Lebak waves may have been as high as nine meters. At the time of the tsunami, the water level was almost exactly between high and low tide. The normal water level would have been 0.9 meter above mean lower low water level. If the tsunami had occurred three hours earlier (later) the resulting wave heights would have been greater (less). Theoretical isochronal travel times at five-minute intervals based on a bathymetric map of Moro Gulf (Figure 23.3-2) are illustrated in Figure 23.3-3.

[6] https://www.phivolcs.dost.gov.ph/index.php/tsunami/historical-tsunamis
[7] Victor L. Badillo and Zinnia C. Astilla, Moro Gulf Tsunami of 17 August 1976, Quezon City: Manila Observatory, 1978

Table 23.3-2 Wave Heights, Delay Time, Number of Waves and Extent of Water Penetration

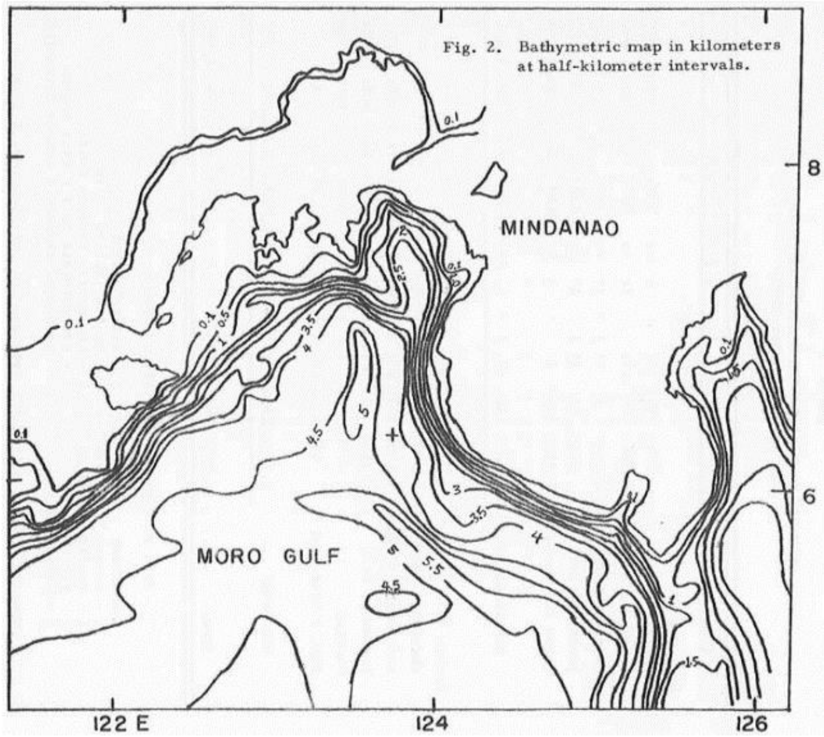
Place	Source	Wave Hts. (Meters)	Delay Time (Minutes) @	Delay Time (Minutes) #	No. of Waves	How Far Inland (Km)
South Cotabato:						
Lake Sebu, Surallah	b	1-1.5		2-3		.5
Sultan Kudarat:						
Lebak	a	*3.4	5			
	d	4.6-9.0			3	1
Maguindanao:						
Resa	a	4.3				
	c	3.7	11	2-9	4	1-2
Kinimi	a	4.3	11			
Cusiong	c	3.7	15	10-20	3	1-2
Linek	a	4.3				
	c		15	5		
	d	6.1				.25
Pinansaran	a	4.3	12			
Upi	c	3.7	15	5-10	3	1-2
Parang	b	3.7	25	10		
	c	3.7		5-10	3	1-2
Magsaysay	c	3.7		5-10	3	1-2
Bongo Island	a	4.3				
	b	4.6		10		
	c	4.6	10	2-9	3	1
Cotabato City:						
Kalanganan	c	5.5-6.1	23	2-9	3	1-2
Buaya-buaya	b	3.7		2		2
	c	3.7		2-9	2	1-2
Lanao del Sur:						
Malabang	d	4.5	25			
Pagadian City	c	5.4		15	3	.8
	d	4.5-5.5	25	3-10	3	.5

* - Measured
@ - Computed delay time
# - Estimated delay time

a - PAGASA/ITIC
b - Questionnaire
c - Interviews
d - Published articles

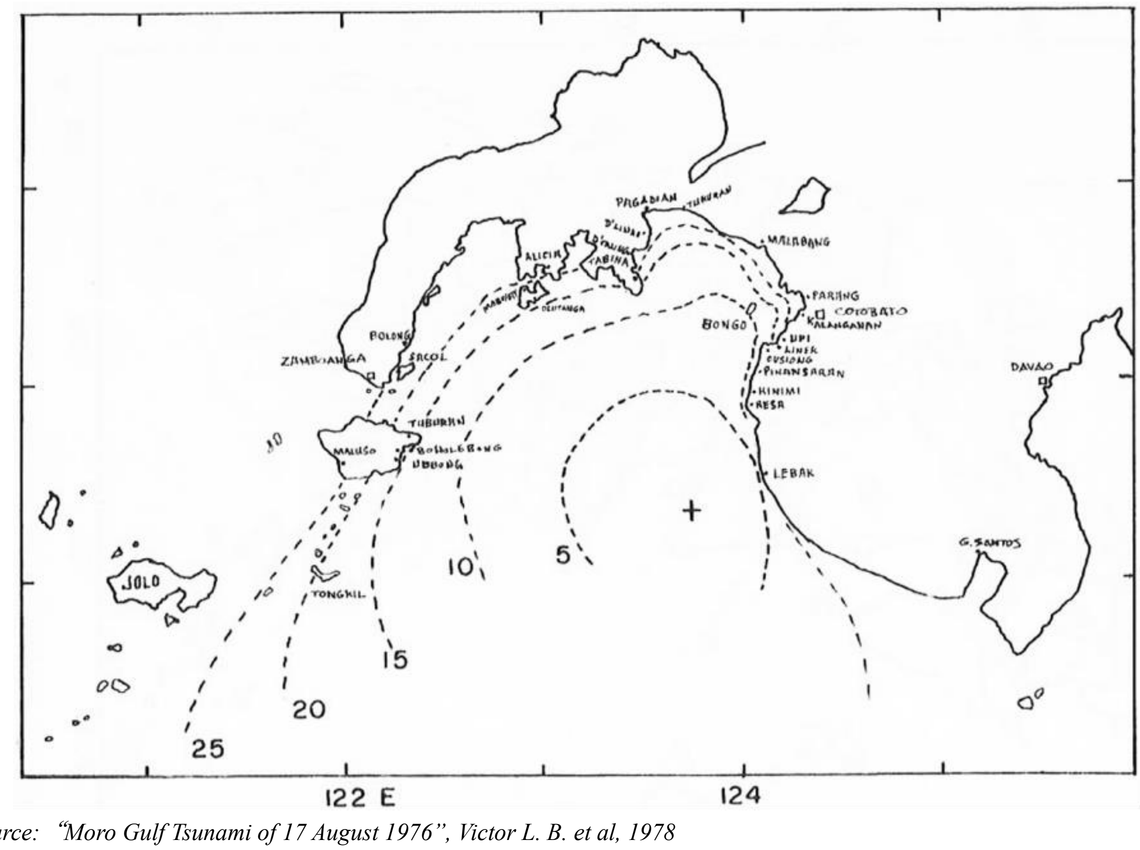
*Kalanganan is located around the Rio Grande de Mindanao estuary, and Buaya-buaya is located around the Tamontaka River estuary

Source: "Moro Gulf Tsunami of 17 August 1976", Victor L. B. et al, 1978



Source: "Moro Gulf Tsunami of 17 August 1976", Victor L. B. et al, 1978

Figure 23.3-2 Bathymetric Map in Kilometers at Half-kilometer Intervals



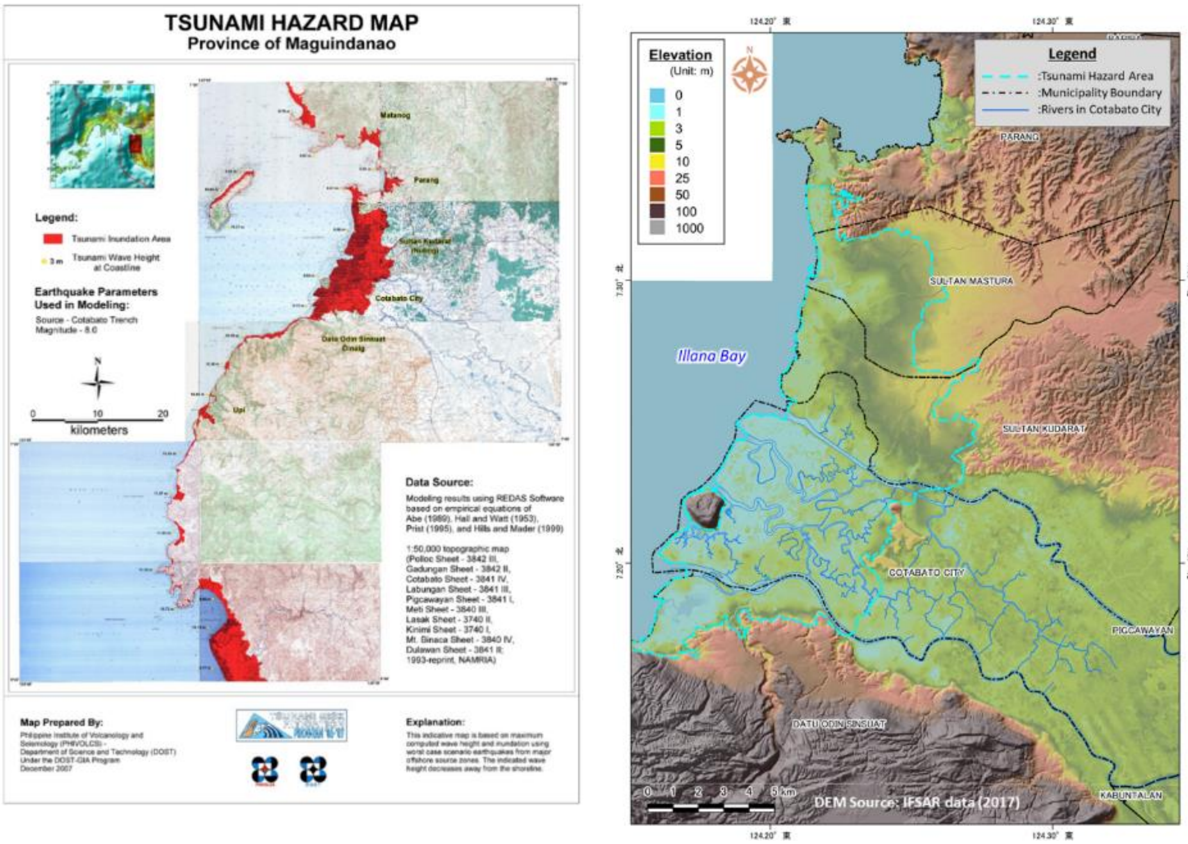
Source: "Moro Gulf Tsunami of 17 August 1976", Victor L. B. et al, 1978

Figure 23.3-3 Theoretical Isochronal Travel Times in Minutes at Five-Minute Intervals of 17 August 1976 Tsunami

(3) Tsunami Simulation

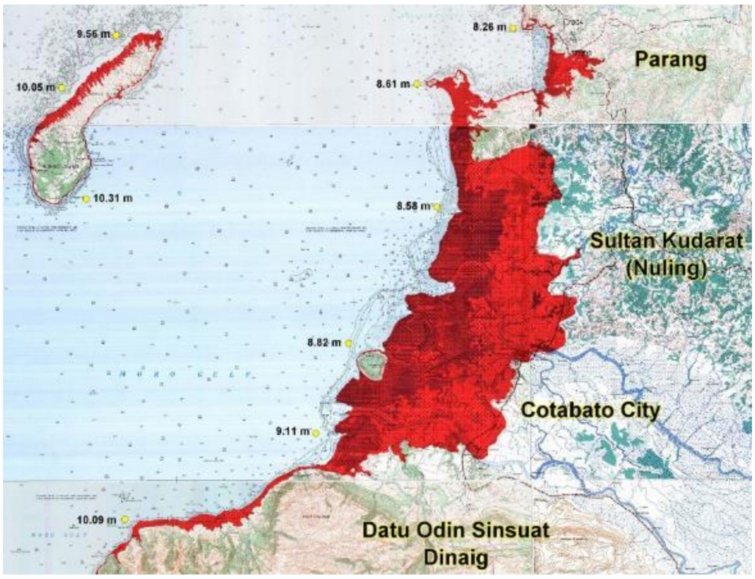
A tsunami hazard map for Maguindanao Province was prepared by PHIVOLCS-DOST under the DOST-GIA Program in 2007 based on tsunami numerical simulation results using REDAS software as shown in Figure 23.3-4. This hazard map is based on maximum computed wave height and inundation using worst case scenario earthquakes from major offshore source zones. The target earthquake for simulation is an earthquake generated in Cotabato Trench with the magnitude of 8.0. Computed maximum wave heights around Cotabato City coastline are 8.58 m, 8.82 m and 9.11 m. Considering the tsunami inundation area and the topography of the lowland under 5 meter above mean sea level largely lying along the Mindanao River, the simulated tsunami wave heights decrease with the increasing distance from coastal line.

The magnitude of the target earthquake is smaller than historic giant earthquakes in Celebes Sea as shown in Table 23.3-1, but the simulated wave heights along the coast of Cotabato City will be not less than the actual wave heights in the 1976 tsunami based on the record shown in Table 23.3-2.



Source: (Left) PHIVOLCS, (Right) JICA Survey Team (the tsunami hazard area was traced based on the hazard map)

Figure 23.3-4 Tsunami Hazard Map (Left) and Tsunami Hazard Area and Topographic Map (Right)



Source: PHIVOLCS

Figure 23.3-5 Tsunami Hazard Map Zoomed in Cotabato City Coastal Area

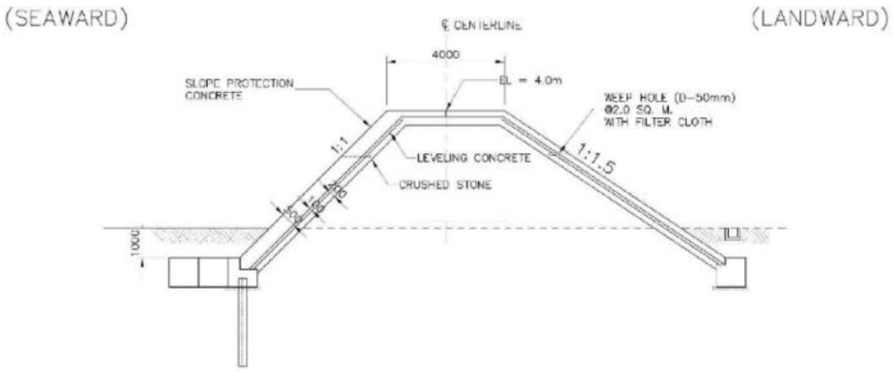
23.3.2 Information Collection on Tsunami Countermeasures

In this section, information on tsunami countermeasures was collected especially on how to design the West Diversion Road (WDR) as a road dike against tsunamis.

(1) Information Collection on Tsunami Road Dike in the Philippines

The DPWH Design Guidelines, Criteria and Standards (DGCS) 2015 Edition is the official guide for designs carried out within the Department of Public Works and Highways (DPWH). To study design guidelines, criteria and standards for tsunami countermeasures in the Philippines, the DGCS was reviewed. As a result, no standard was found on dike or road dike to prevent or mitigate tsunami disasters. On the other hand, there are some descriptions on coastal structures to prevent storm surge disasters.

As an example of tide embankment to prevent or mitigate storm surge and tsunami disasters, the Road Heightening and Tide Embankment (RHTE) Project also known as the "Great Wall of Leyte" is introduced. The 7.95 billion PhP RHTE is a 27.3 kilometer stretch, four-meter-high seawall structure under construction by DPWH. It is part of government's program on Rehabilitation and Recovery from Super Typhoon Yolanda. Figure 23.3-6 and Table 23.3-3 show standard structure and specifications of the tide embankment in the basic design stage. The crest and slopes are covered with concrete and the foot is protected with concrete blocks. These specifications were decided to be resilient to 50-year storm surge. The typical alignment of the tide embankment locates approximately 30 meter inside from the coastal line. Figure 23.3-7 shows a landscape of the completed tide embankment.



Source: JICA, "The Urgent Development Study on the Project on Rehabilitation and Recovery from Typhoon Yolanda in the Philippines", Final Report (II) Main Report Vol.1, Feb 2017

Figure 23.3-6 Proposed Standard Structure for Tide Embankment

Table 23.3-3 Structural Specifications of Tide Embankment

Items	specifications	explanation
Seaward slope gradient	1 : 1.0	Steepest case-based gradient for concrete-protected embankment. Lowering the gradient facilitates overtopping, thus unsafe.
Landward slope gradient	1 : 1.5	Typical case-based gradient for concrete-protected embankment.
Seaward slope protection	Concrete (50cm) Lean concrete (10cm) Crushed stone (20cm)	Typical case-based protection for tide embankment.
Landward slope protection	Concrete (20cm) Lean concrete (10cm) Crushed stone (20cm)	Typical case-based protection for tide embankment.
Crest protection	Concrete (20cm) Lean concrete (10cm) Crushed stone (20cm)	Typical case-based protection for tide embankment.
Sheet pile (seaward)	L=3.0m	Standard length needed for water cutoff and soil draw-out prevention. The length shall be determined by seepage analysis
Base concrete (seaward)	1m x 1m (1 unit)	Typical case-based protection for tide embankment.
Embedded depth (seaward)	D=1.0m	Standard length needed for erosion protection
Embedded depth (landward)	D=1.0m	Standard length needed for erosion protection
Foot protection	2 lines of base concrete (1m x 1m)	Typical case-based protection for tide embankment.

Source: JICA, "The Urgent Development Study on the Project on Rehabilitation and Recovery from Typhoon Yolanda in the Philippines", Final Report (II) Main Report Vol.1, Feb 2017

Source: YouTube (https://www.youtube.com/watch?v=5beVN16B4io)

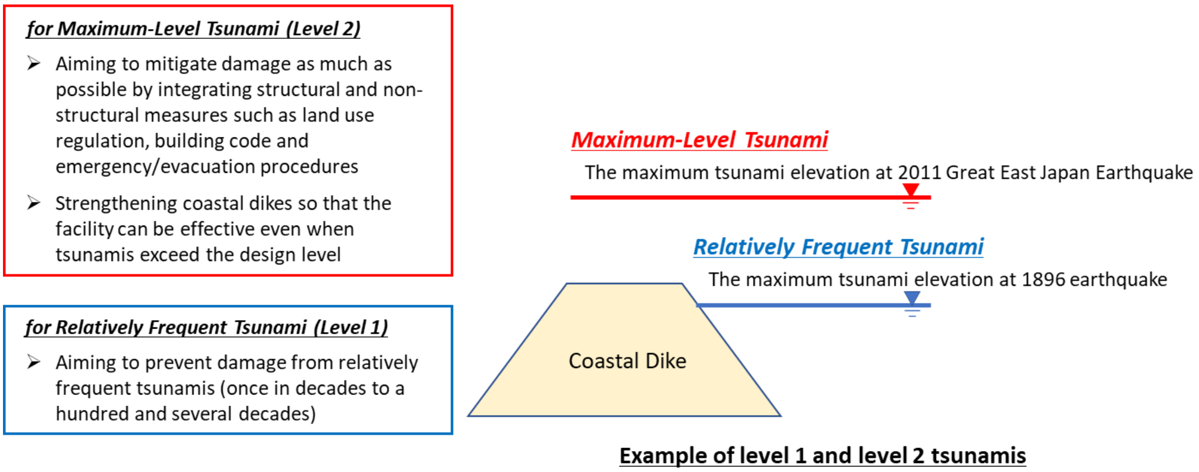
Figure 23.3-7 Completed section of the RHTE Project

(2) Information Collection on Tsunami Road Dike in Japan

1) Basic Concept of Tsunami Defense and Role of Tsunami Road Dike in Japan

The Great East Japan Earthquake in 2011 (GEJE) revealed the limitations of DRM strategy that largely depend on structural measures against tsunamis. Coastal dikes and breakwaters constructed before the GEJE were designed to protect against relatively frequent tsunamis, and they were effective in preventing damage from the tsunamis of limited heights. However, the heights of tsunamis in the GEJE far exceeded the designed tsunami heights for structural measures. Although the structures still contributed to reduce inundation depth, to delay tsunami arrivals, and to mitigate tsunami damage, lots of the structures were destroyed, resulting in serious inland damage.

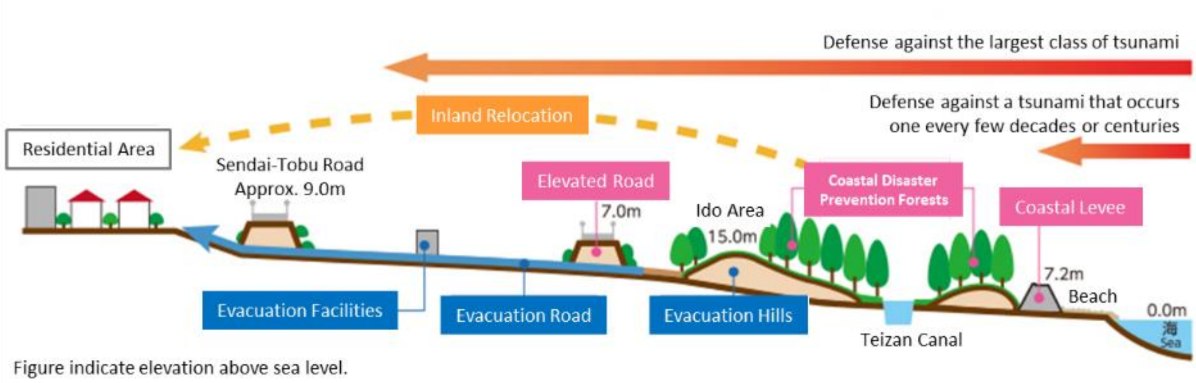
Planning for the possible maximum tsunamis is a significant paradigm shift in Japan's disaster risk management (DRM) policy. Since the GEJE, the Japanese government has set two- level targets against tsunamis. Level 1 tsunami includes the tsunamis that occur as frequently as every few decades or a hundred and several decades and that cause significant damage, whereas level 2 tsunami means the possible maximum scale tsunami that has an extremely low probability of occurrence (lower than once every 200 years) but has the power to cause devastating destruction (Figure 23.3-8). In planning for tsunami defense, conventional structural measures such as coastal dikes and breakwaters are designed to prevent level 1 tsunamis from overflowing. On the other hand, level 2 tsunamis, assumed to overflow the structures, must be tackled with all possible countermeasures to save human lives and to reduce damages.



Source: Prepared by JICA Survey Team based on the reference material at the 2nd meeting of the working group for Nankai Trough megaquake on 28 May 2012

Figure 23.3-8 New Approach Setting Two Level Targets Against Tsunamis

One of key concepts to address the level 2 tsunamis is multilayered approaches that combine structural and nonstructural measures to ensure residents safe evacuation and to minimize damage. Figure 23.3-9 illustrates an example of multi-layered approach against tsunamis in Sendai City. This example shows four types of structural measures, namely (i) coastal levee, (ii) coastal forests, (iii) artificial canal and (iv) elevated road dike and nonstructural measures such as safer city spatial planning including resettlement from high-risk area and better evacuation including evacuation planning, road and facility. Road dike takes an important role as second or third levee against tsunamis to prevent or mitigate inland inundation.



Source: Great East Japan Earthquake Memorial Sites Improvement Project (https://infra-archive311.jp/sp_sign/infra.html)

Figure 23.3-9 Example of Multi-layered Approach against Tsunamis in Sendai City

2) Effects of Road Dike in the Great East Japan Earthquake (GEJE)

Effects of road dikes against tsunami were focused after the GEJE, 2011. Since the tsunamis far exceeded the designed protection level of coastal dikes, tsunami invaded the land widely and inundated various structures. Among the structures, some embankment of road and railways contributed to prevent or mitigate tsunami intrusion and also served as evacuation space. Representative two cases are introduced in the following boxes.

Box. 1 Comprehensive Tsunami Protection Built on Lessons from Sendai-Tobu Road's Effectiveness as Bulwark against Tohoku Tsunami

At 2:48 p.m. on March 11, 2011, a gigantic earthquake with a magnitude of 9.0 struck. It spawned a monster tsunami that caused devastating destruction along the Pacific coastline, especially in the Tohoku region but also in Hokkaido and the Kanto region. Over 20,000 people ended up dead or missing.

The tsunami inundated an area of approximately 535 km^2, causing extensive flood damage on the plains stretching from southern Miyagi Prefecture to northern Fukushima Prefecture. The terrain on the coastal lowlands of Miyagi Prefecture, which include the city of Sendai, compounded the destruction by allowing the tsunami to reach about four kilometers inland. The Sendai-Tobu Road that runs north and south through the eastern part of Sendai is built on an embankment that varies in height from seven to ten meters. This structure served as a bulwark to halt the progress of the tsunami and rubble toward the city, while also providing high ground that 230 or so evacuees fled to.

The lessons from these events informed tsunami preparation effects after the Great East Japan Earthquake. Comprehensive Tsunami Protection, a combination of infrastructure, systems, awareness and knowledge, is reshaping the land to make it more resilient against the destruction of a tsunami. Under this program, the Shiogama Watari Prefectural Road, a coastal route east of the Sendai-Tobu Road, is being raised six meters. The program is also constructing coastal and river levees as protection against the power of even the strongest of tsunamis. Although the multiple defenses may not prevent all damage, an array of tsunami readiness measures are under implementation with a focus on maximum mitigation of damage. These efforts include building facilities for evacuation use and relocating residences from areas where safety cannot be guaranteed.

The Sendai-Tobu Road blocked the tsunami and rubble from reaching farther inland

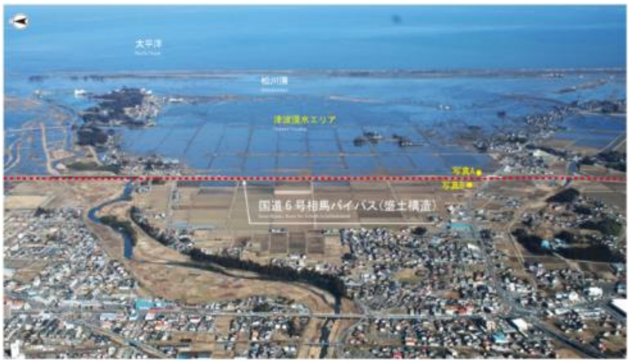
Evacuations to Sendai-Tobu Road (near the Sendai Port North Interchange)

Source: Great East Japan Earthquake Memorial Sites Improvement Project (https://infra-archive311.jp/sp_sign/infra.html)

Box. 2 Soma Bypass Shielded a Community from the Tsunami

At 2:48 p.m. on March 11, 2011, a gigantic earthquake with a magnitude of 9.0 struck. It spawned a monster tsunami that caused devastating destruction along the Pacific coastline, especially in the Tohoku region but also in Hokkaido and the Kanto region. Over 20,000 people ended up dead or missing.

The tsunami inundated an area of approximately 535 km^2, causing extensive flood damage on the plains stretching from southern Miyagi Prefecture to northern Fukushima Prefecture. In the City of Soma, Fukushima Prefecture, the tsunami reached 3.7 km inland from the Osu Coast to the Soma Bypass on National Route No. 6. Since the road was built on an embankment about 5 meters high, it served as a flood barrier that significantly mitigated the damage from the tsunami's inundation. The Soma Bypass was recovered soon after the disaster, on March 18. As an effective route for rescue operations and cleaning rubble from the disaster zone, the road made a major contribution to preventing further damage and effecting a prompt restoration. This case provides a source of reference for responding to future tsunamis. Now, work is underway to build communities that have multi-layered defenses against tsunami damage.



The Soma Bypass on National Route No. 6 halted the tsunami's advance toward the city of Soma, Fukushima Prefecture, thus preventing further flood damage. Meanwhile, the prompt temporary restoration of the road facilitated rescue operations and the disaster zone's rebuilding.

This photo was taken on May 26, 2011, about two months after the earthquake. Signs of the tsunami damage still remained on the Soma Bypass east side, which faces the sea.

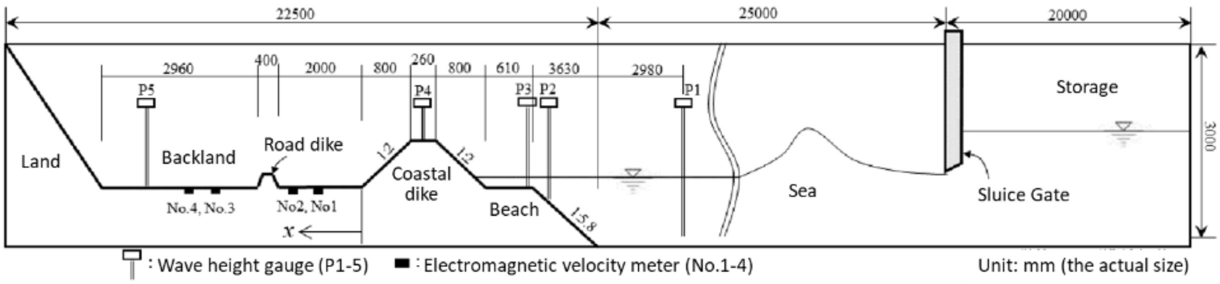
This photo was taken on May 26, 2011, about two months after the earthquake. Rice paddies on the west side of the bypass, toward the interior, were planted as normal.

Source: Great East Japan Earthquake Memorial Sites Improvement Project (https://infra-archive311.jp/sp_sign/infra.html)

3) Literature review on the effects of road dike against tsunami

Pakoksung et al. (2018)[8] conducted a systematic evaluation study to assess the performances of different infrastructures as structural tsunami countermeasures in Sendai City, Japan based on a 2D tsunami numerical analysis. The results of the tsunami modeling demonstrate significant differences in tsunami inundations when evaluating several combinations of structures. The elevated road provides the highest performance of the single scheme, whereas the highest performance of the 2-layer schemes is the combination of an existing seawall and an elevated road. This study assessed the performance of multilayer structural countermeasures for future tsunami mitigation and revealed the effectiveness of elevated road, i.e., road dike.

Sekijima et al. (2019)[9] conducted a hydraulic model experiment using a two-dimensional cross-section model with a road embankment parallel to the coastline as illustrated in Figure 23.3-10. As a result, they reported that the effect of reducing tsunami inundation by 10 to 20 percent by arranging a two-line levee, namely road dike, in parallel with the coastal levee.



Source: Translated by JICA Survey Team based on the thesis

Figure 23.3-10 Experimental Model in the Study

23.3.3 Proposed Tsunami Countermeasures for West Diversion Road (WDR)

(1) Expected role of West Diversion Road as tsunami defense

The magnitude of damage is determined by the level of tsunami risk reduction achieved by means of structural measures such as seawalls, vulnerability of the land and local capacity to cope with tsunami. To minimize damage, therefore, it is necessary to take appropriate and reliable structural measures so that tsunami risk can be reduced and to take nonstructural measures so that the safety level, disaster resistance and disaster tolerance can be enhanced. As studied in the chapter of disaster risk reduction plan, there is still no master plan for tsunami defense in the coastal area of Illana Bay and no structural measures in Cotabato City and the neighboring municipalities. West Diversion Road (WDR) will be the first structural measure as a road dike against tsunami. As described in the subsection 23.3.1(3), the simulated wave heights around Cotabato City coast are approximately 9 meters. However, the wave heights decrease with the increasing distance from coastal line considering the simulated inundation boundary and the topography. It suggests that if coastal dike is planned to protect from tsunamis, the

[8] Pakoksung, K., Suppasri, A. and Imamura, F. (2018) Systematic evaluation of multilayered infrastructure systems for tsunami disaster mitigation in Sendai City, Geosciences, 8 (5), 173. Available at: https://www.mdpi.com/2076-3263/8/5/173

[9] Sekijima K., Kiri H., Azechi I., Kimura N. and Khogo Y. (2019) On Energy Dissipation Effects of Tsunami by using Secondary Levee. Available at: http://soil.en.a.u-tokyo.ac.jp/jsidre/search/PDFs/19/10-28.pdf

structure should be large with the top, for example, 8 - 10 meters high. On the other hand, if dike is planned several kilometers inside from the coast, the height of structure can be lower a few meters than the dike near the coast. Large scale coastal dike is difficult to be feasible in terms of cost efficiency and big impacts on local environment and communities. In addition, heavy structure has disadvantage in terms of land subsidence by consolidation action because Cotabato City locates on weak ground made of fluvial deposits from the Mindanao River. Therefore, the proposed road dike has advantages in economic feasibility and less social and environmental impact. The expected functions for WDR are as follows:

(i) **Decrease inundation area and tsunami damage**
The structure of WDR as road dike will decrease tsunami energy and the inside inundation depth, which contributes to save human lives and decrease damage.

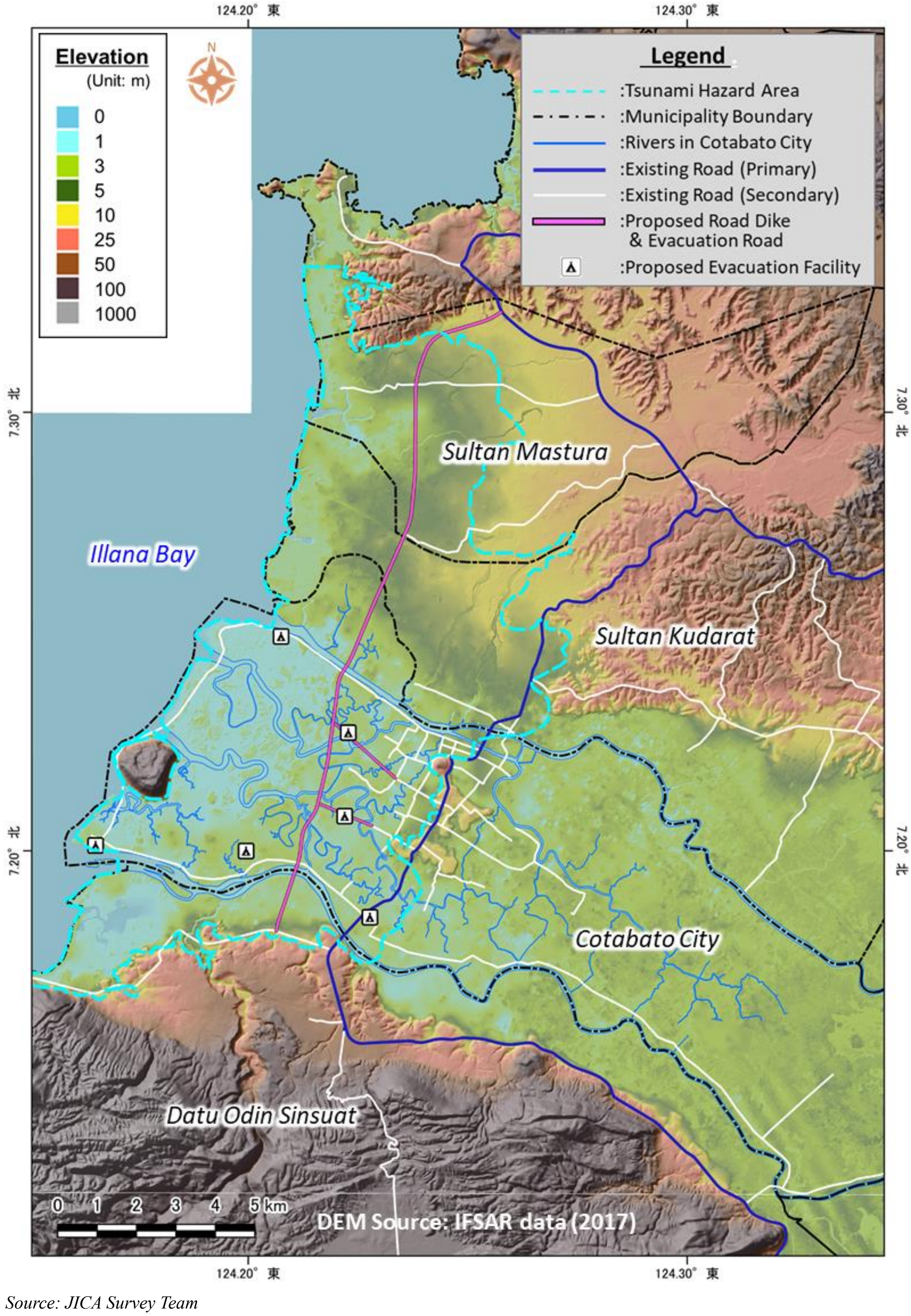
(ii) **Increase time for evacuation**
WDR will delay the tsunami arrival time inside the structure, which increase evacuation time and decrease number of casualties who fail to escape.

(iii) **Provide efficient evacuation route**
WDR can provide efficient evacuation route for the people living there and the people in cars.

(iv) **Accommodate temporary evacuation space**
If the crest of WDR is high enough to the coming tsunami level, the road can accommodate temporary evacuation space for fleeing individuals during tsunami event.

(v) **Enhance rescue operation and restoration work**
If WDR survives from tsunami without serious damage, the road serves as an effective route for rescue operations and prompt restoration works.

In the initial stage of the WDR project, barrage or sluice gate to prevent tsunami run up through the rivers or the culvers of WDR are not planned. Therefore, WDR will contribute to mitigate tsunami damage by decreasing the tsunami energy and the inside inundation depth and delaying the inside arrival time, however, it cannot completely prevent tsunami intrusion. Therefore, evacuation facility such as tsunami tower should be also constructed. Figure 23.3-11 illustrates an example of tsunami protection by WDR and evacuation facility.



Source: JICA Survey Team

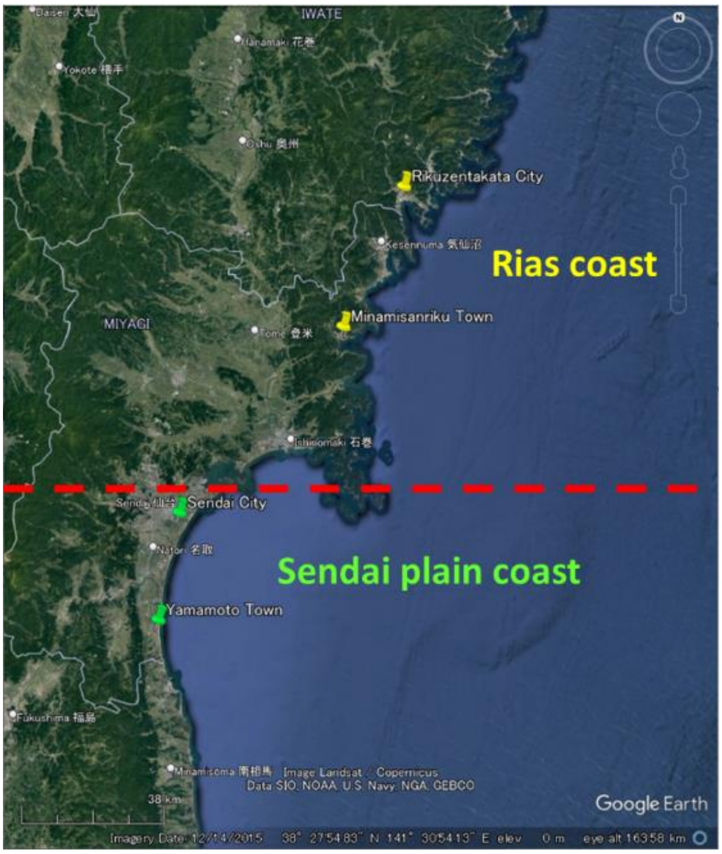
Figure 23.3-11 Example of Tsunami Protection by WDR and Evacuation Facility

(2) Assumed tsunami level at WDR

As described in the subsection 23.3.1(3), PHIVOLCS conducted a tsunami simulation with the magnitude 8.0 earthquake in Cotabato Trench as worst-case scenario and illustrated the maximum inundation area in the published hazard map. As a result, the simulated tsunami with approximately 9 meters of the maximum wave heights around Cotabato City coastline ran up the land 7 to 8 km and stopped at the land with the elevation of approximately 5 meters. Since the lowland under 5 m largely exists more than 20 km along the Mindanao River, the results indicate that the simulated tsunami wave heights decrease with the increasing distance from coastal line.

In the case of Great East Japan Earthquake (GEJE) in 2011, the distance decay effect in tsunami inundation depth was significantly different by the coast type, rias coast and Sendai plain coast (see Figure 23.3-12). Tsimopoulou (2012)[10] explained the difference in coastal tsunami behavior between the two coasts as follows. The rias coasts are extremely irregular and indented in places, forming narrow and steep bays. At this type of coast, due to bathymetry focusing effects, the tsunami height increases. The narrow bays are surrounded by high grounds that face the ocean with steep cliffs, and relatively deep sea in the front. The basin created by the high grounds obstructs the intrusion of seawater far inland, which, combined with the increased tsunami height, resulted in large inundation and run-up heights. On the other hand, Sendai plain coast, large low-lying areas fronted by mild-sloped sandy beaches, characterize the southern half of Tohoku. Unlike the case in the rias, the tsunami intrusion is not obstructed by high grounds in the flat plains. At this type of coast, the tsunami broke near the shore and propagated inland, inundating large areas of flat land, while much lower inundation heights were recorded. Central Disaster Management Council of Japan published a report on the lessons learned from the GEJE in September 2011. In the reference annex for figures and tables of the report, several examples of recorded tsunami inundation depth in different coastal types are included. Figure 23.3-13 and Figure 23.3-14 show two examples of recorded distance decay effect in inundation depth in rias coast and plain coast, respectively. As shown in the figures, Obvious distance decay effect in inundation depth can be observed in Sendai plain coast. On the other hand, tsunami inundation depth did not clearly attenuate with the increasing distance from coastal line in rias coast.

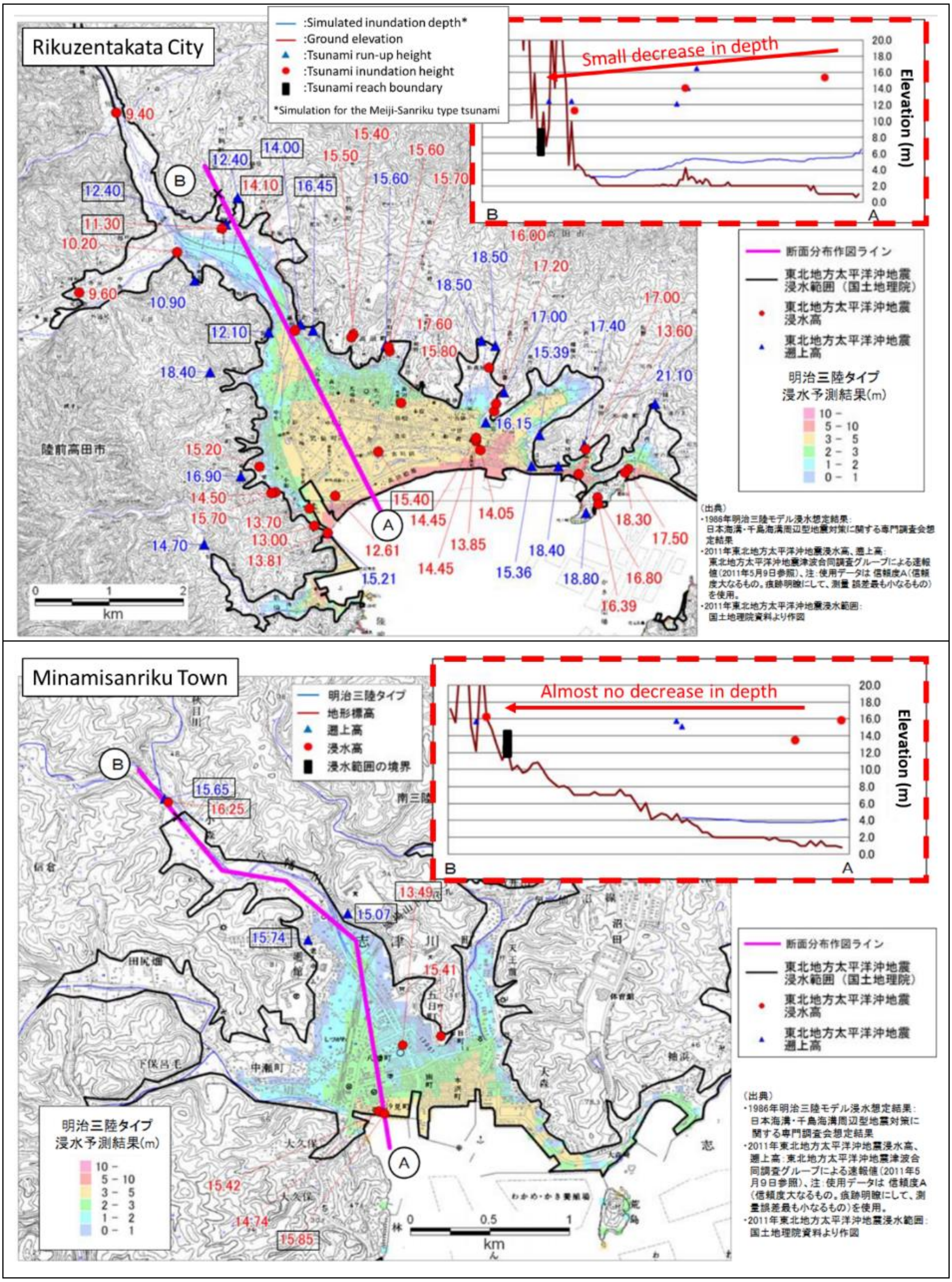
[10] Tsimopoulou et al., 2012. A multi-layered safety perspective on the tsunami disaster in Tohoku, Japan. Available at: https://www.researchgate.net/publication/263417283_A_multi-layered_safety_perspective_on_the_tsunami_disaster_in_Tohoku_Japan



*The location of 4 examples in Figure 23.3-13 and Figure 23.3-14 is indicated in the figure.

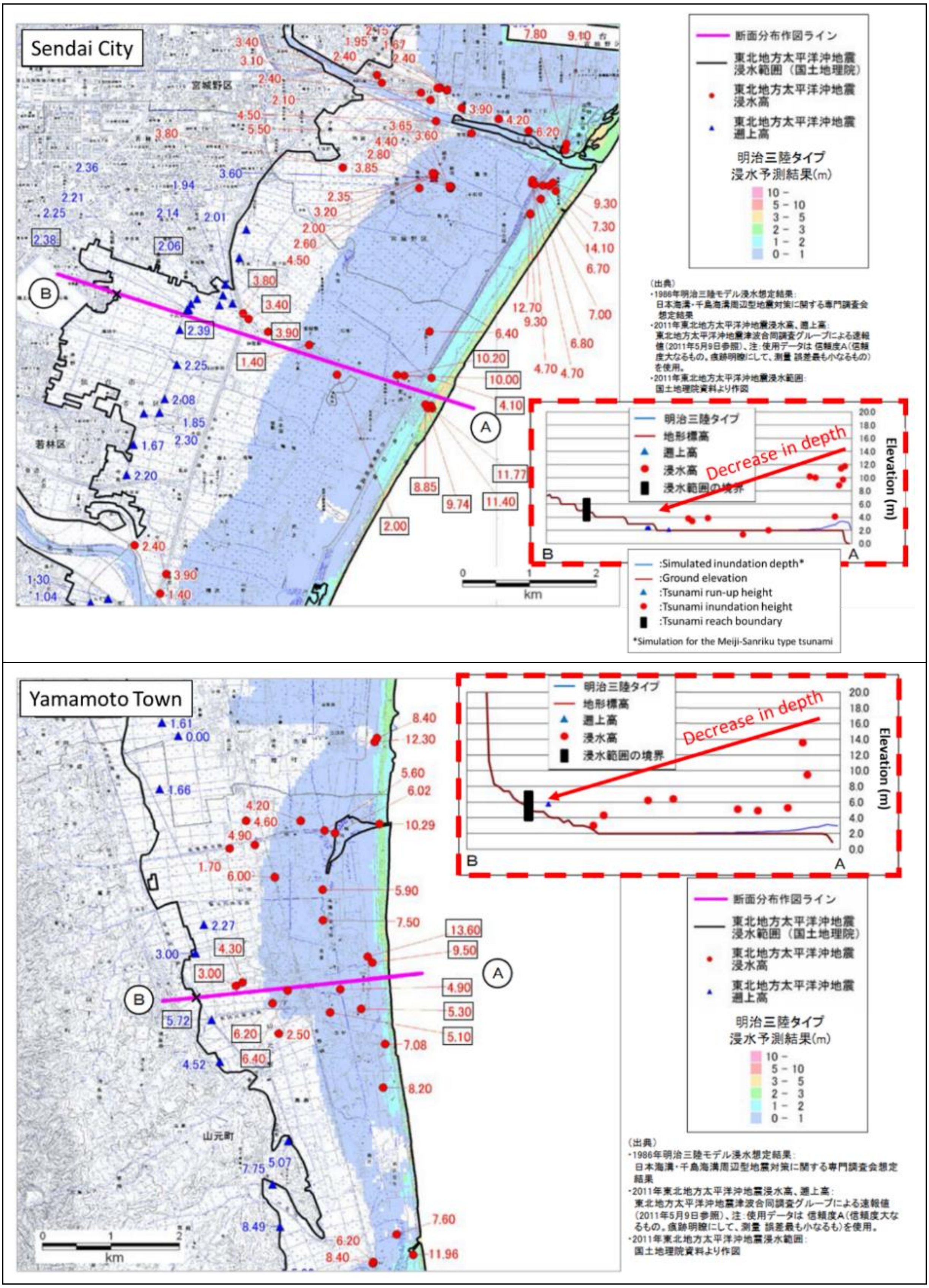
Source: JICA Survey Team

Figure 23.3-12　Two Coast Types in Tohoku Region



Source: partially revised by JICA Survey Team based on the reference materials of the Report of the Committee for Technical Investigation on Countermeasures for Earthquakes and Tsunamis Based on the Lessons Learned from the "2011 off the Pacific coast of Tohoku Earthquake"

Figure 23.3-13 Example of Distance Decay Effect in Inundation Depth (Rias Coast Type)

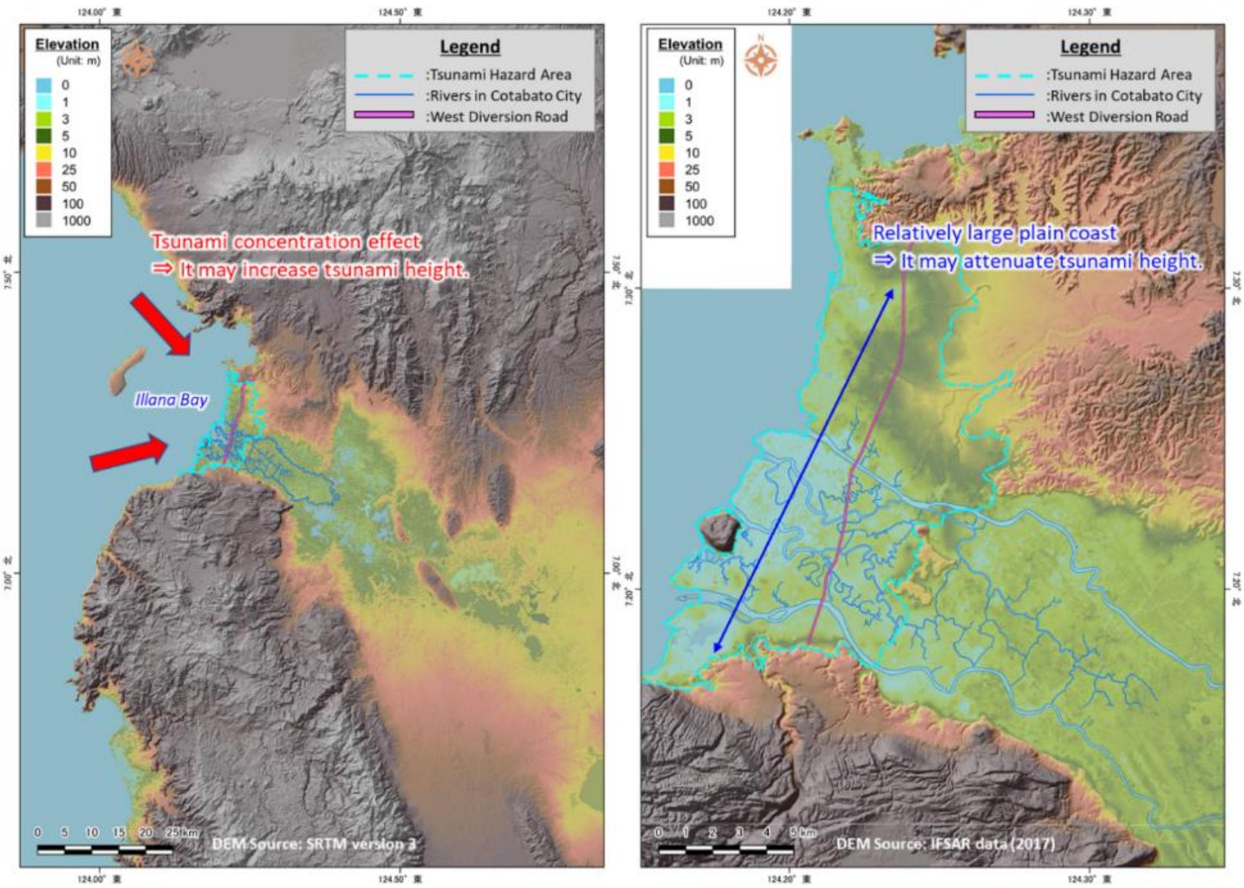


Source: partially revised by JICA Survey Team based on the reference materials of the Report of the Committee for Technical Investigation on Countermeasures for Earthquakes and Tsunamis Based on the Lessons Learned from the "2011 off the Pacific coast of Tohoku Earthquake"

Figure 23.3-14 Example of Distance Decay Effect in Inundation Depth (Plain Coast Type)

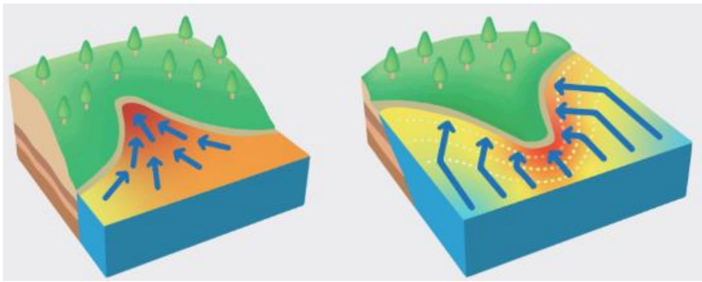
Coastal topography around Cotabato City may have both aspects of rias coast and plain coast in terms of tsunami coastal behavior. As illustrated in Figure 23.3-15, Illana bay locates at the Mindanao River mouth and is surrounded by mountains. The V-shape bay may increase the wave height, and the narrow valley may enhance tsunami run-up. On the other hand, Illana bay has relatively large plain coast, which may decrease wave height with the increasing distance from coastal line as well as the case of GEJE in Sendai plain coast. As referring the results of tsunami simulation by PHIVOLCS, the simulated tsunamis with approximately 9 meters of the maximum wave heights around Cotabato City coastline ran up to 7 to 8 km and stopped at the land with the elevation of approximately 5 meters. It indicates the existence of distance decay effect in inundation depth.

Therefore, distance decay effect in inundation depth is assumed in this study. The tsunami inundation depth along the West Diversion Road which locates 3-4 km inland is roughly estimated as 3-4 m in a worst-case scenario same as the tsunami hazard map by PHIVOLCS. As the record of the 1976 tsunami shown in Table 23.3-2, the wave height at Kalanganan which locates 1-2 km inland around the Rio Grande de Mindanao estuary was 5.5-6.1 meters. The 1976 tsunami wave height would be not more than that of the simulated tsunami.



Source: JICA Survey Team

Figure 23.3-15 Coastal Topography of Illana Bay (Left: Zoom Out View, Right: Zoom in View)



Left: In a V-shaped bay, the energy of tsunami is likely to be concentrated at the closed-off section of bay, and the wave increases its height.

Right: At the tip of a cape, the energy of tsunami is likely to be concentrated as the tsunami tend to be parallel to the coastline, and the wave becomes higher.

Source: Japan Meteorological Agency website (http://www.data.jma.go.jp/svd/eqev/data/tsunami/generation.html)

Figure 23.3-16 Example of Tsunami Wave Amplification by Topography

(3) Proposed structure for WDR

The proposed structure of West Diversion Road is earth filling with the height of approximately 4 meters. As explained in the previous subsection, the inundation depth in a worst-case scenario same as the PHIVOLCS simulation is roughly estimated 3-4 m along the WDR. The 1976 tsunami wave height would also be not more than that of the simulated tsunami as explained in the subsection 23.3.1(3). The occurrence probability of the simulated tsunami can be considered 1/100 or less.

Tokida et al. (2013)[11] reported the 8 multiple functions of earth dike as follows:

1) Earth dike doesn't require air release pipe or drain hole and has toughness structure against tsunami
2) Earth dike has lower deterioration risk than concrete structures and the quality to last long
3) Easy to inspect the structure deformation and easy to repair
4) Capable to improve dissipating tsunami energy by implementing energy dissipator at the foot of the back slope
5) Less obstruction to the transportation between the sea and the land due to the easiness of constructing across roads
6) Earth dike has potential to be green infrastructure and improve landscape and the effect of tsunami dissipation by creating green zone.
7) Various spatial availability by implementing green zone, evacuation zone and road together
8) High economic efficiency in initial cost and operation and maintenance cost

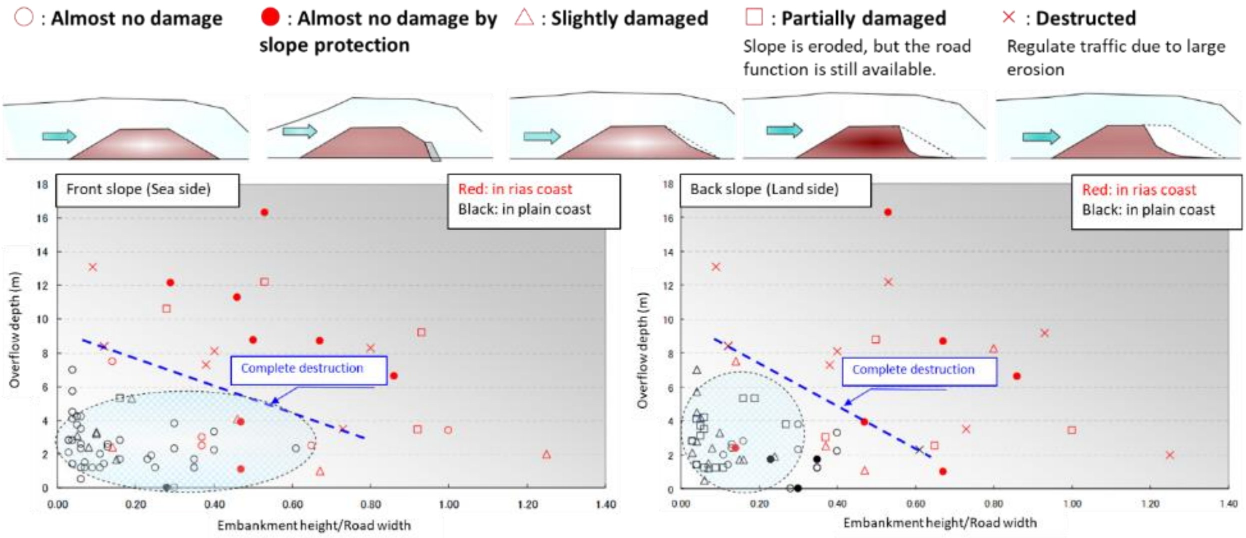
As reported the 8 multiple functions of earth dike, earth dike has many advantages. In addition, Tokida and Hata published the book[12] in 2016 and explained that road dike has toughness

[11] Tokida et al., "Performance-based Evaluation of Sea Wall and Improvement of Toughness of Earth Bank Against Tsunami", Japan Society of Civil Engineers collection of papers B2 (Coastal engineering) Vol. 69, No.2, 2013. Available at: https://www.jstage.jst.go.jp/article/kaigan/69/2/69_I_1016/_pdf/-char/ja

[12] Tokida K. and Hata Y. "Lessons learned from the tsunami in Great East Japan Earthquake -Disaster risk reduction by earth bank having toughness-", Riko Library, 2016

against tsunami overflows and its road pavement on the top has the effect of mitigating erosion. They also reported that the slopes of road dike can be strengthened against erosion by vegetation cover such as sodding or bamboo although back slope (land side) is more susceptible to erosion than front slope (seaside).

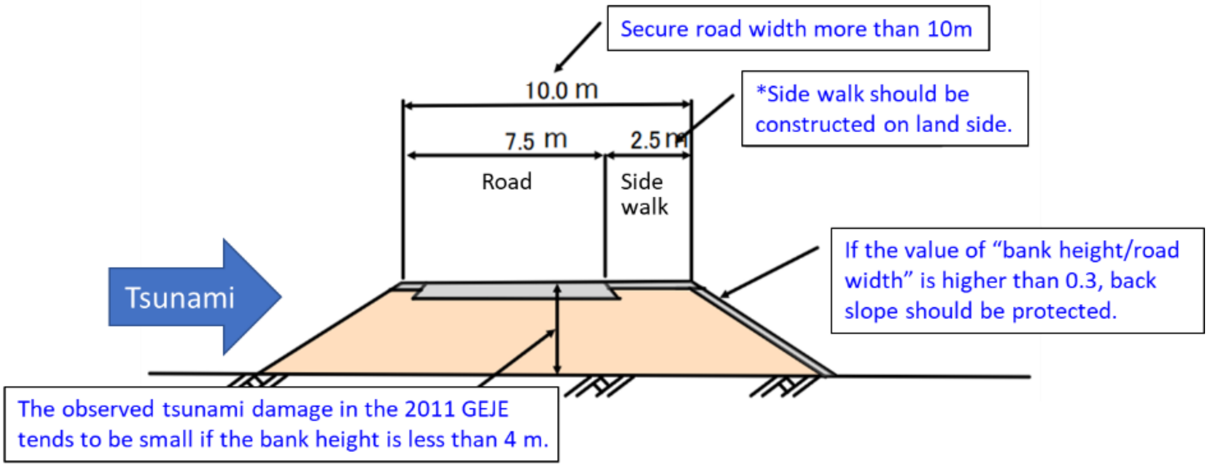
The report of the committee of Miyagi Prefecture Public Facility[13] analyzed the tsunami damage by the ratio of embankment height / road width as illustrated in Figure 23.3-17. As a result, if the ratio is high, the embankment is more likely destroyed with lower overflow depth. In other words, road embankments with lower bank height and wider roads can withstand higher overflow depths. The higher the embankment is, the better for tsunami defense and the securing of evacuation time. On the other hand, the higher the embankment is, the stronger abrasive action is worked on the land-side slope and the embankment is more likely to be eroded. Considering the study results, Miyagi Prefecture proposed the road dike structure as illustrated in Figure 23.3-18 for the purpose of mitigating tsunami energy, saving more people by serving as evacuation road and enhancing rescue operation and rehabilitation work.



Source: revised by JICA Survey Team based on the report of the committee of Miyagi Prefecture Public Facility, 13 March 2012[13]

Figure 23.3-17 Relation between Bank Height/Road Width Ratio and Overflow Depth

[13] The report of the committee of Miyagi Prefecture Public Facility, 13 March 2012. Available at: https://www.pref.miyagi.jp/uploaded/attachment/40137.pdf



Source: revised by JICA Survey Team based on the plan of building Miyagi Model for disaster resilient community, March 2017[14]

Figure 23.3-18 Characteristics of Proposed Road Dike Structure in Miyagi Prefecture

As conclusion, proposed structure for West Diversion Road is summarized in Table 23.3-4

Table 23.3-4 Proposed Structure for WDR

Item	Proposed Structure
Structure	Earth embankment with road pavement
Dike Height	Approximately 4 meters
Top Width	More than 10 meters
Slope Protection	Both sides of slopes are covered by sodding

23.4 Preliminary Design of West Diversion Road

23.4.1 Development Objectives of the Project

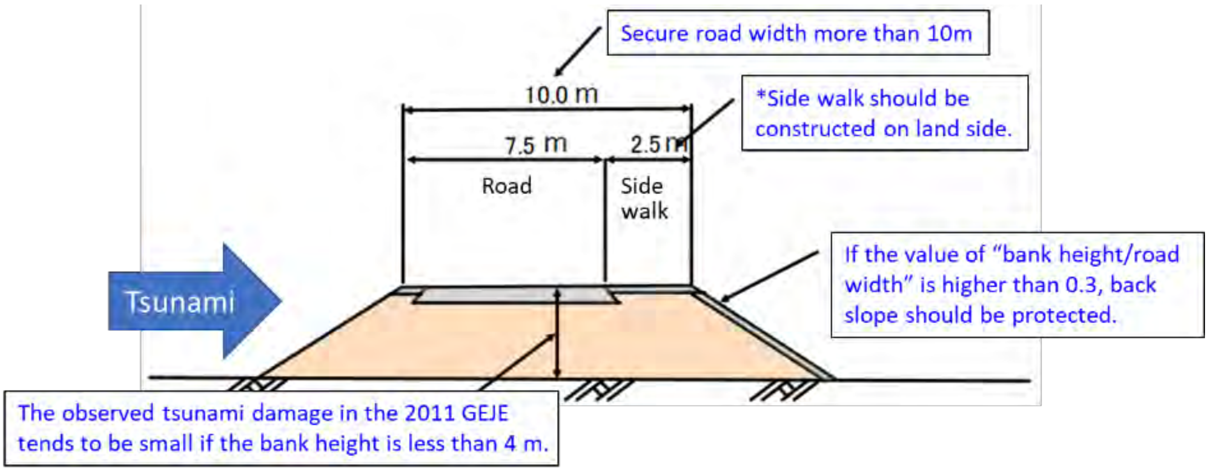
Development objectives of the project are as follows:

- Decrease traffic congestion of roads in the existing urban area
- Guide sound urbanization at the planned urban areas
- Function as a tsunami barrier

23.4.2 Flood Area by Tsunami/ or by Typhoon at Estimated 100-year Return Period

Figure 23.4-1 shows the flood hazard map along the major rivers and tributaries. This occurs at estimated 100-year return period for natural hazards such as typhoons or heavy monsoon rains.

[14] The plan of building Miyagi Model for disaster resilient community, March 2017. Available at: https://www.pref.miyagi.jp/soshiki/dobokusom/miyagi-model.html



Source: revised by JICA Survey Team based on the plan of building Miyagi Model for disaster resilient community, March 2017[14]

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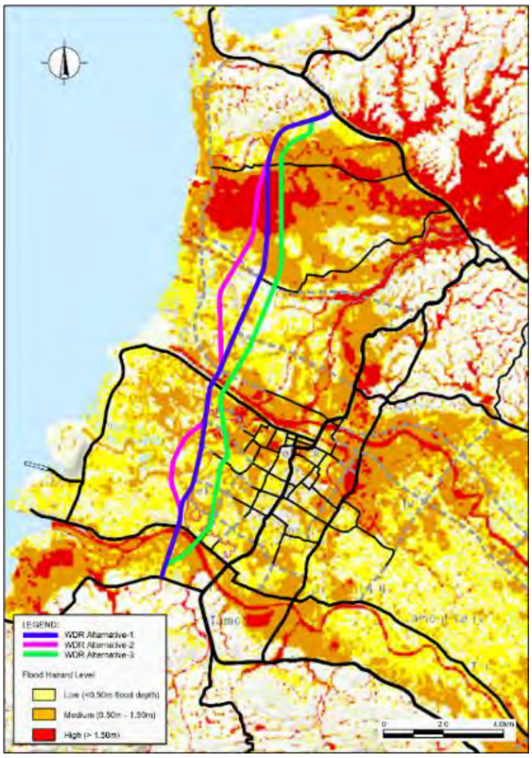


Source: Flood Hazard Map- http://noah.up.edu.ph

Figure 23.4-1 West Diversion Road Flood Hazard Map

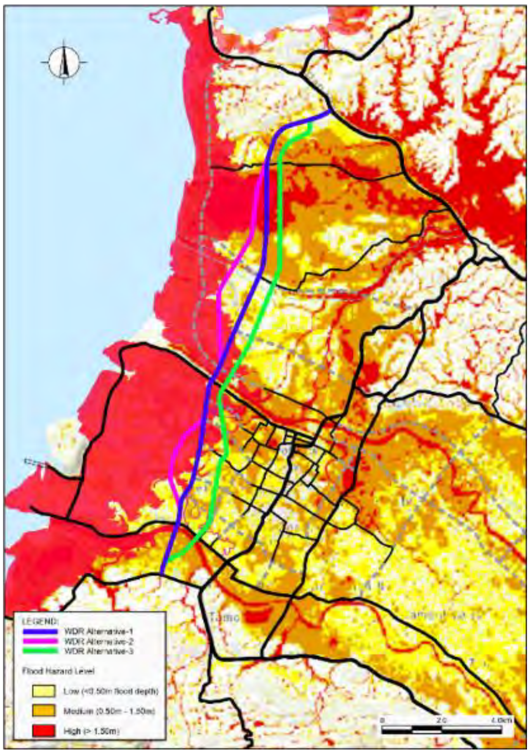
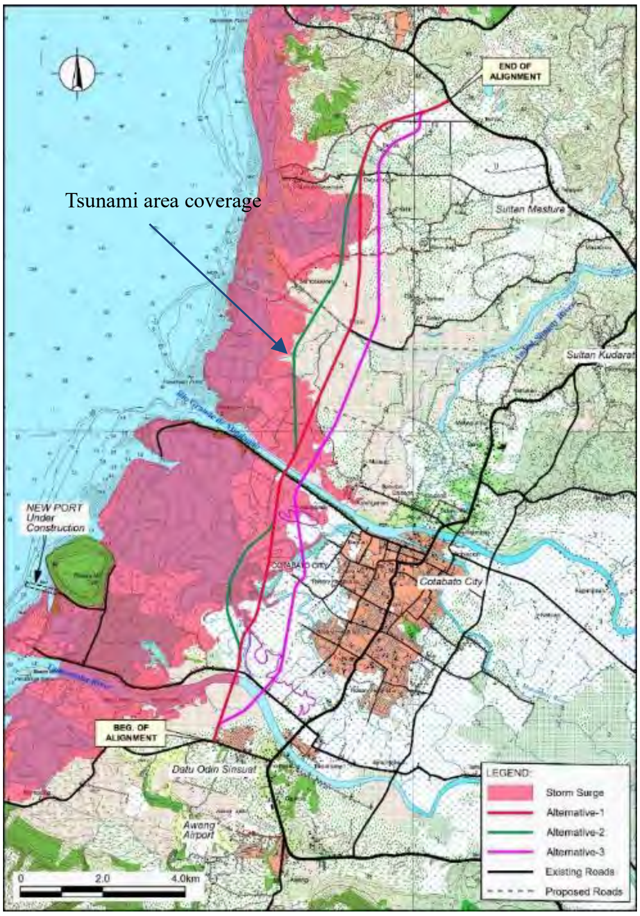


Figure 23.4-2 West Diversion Road Flood Hazard with Tsunami Map

Although a natural hazard that combines storm surges and/ or tsunami will occur during heavy monsoon rains and/or typhoons is unlikely to happen, but in such a case, engineering protection barriers is a must.

The alignment of the West Diversion Road project is to address improvement as a minimum where the location of large flooding area. The design of slope protections and by proper drainage system including relief culverts to make the flow of water on both side of the embankment highway remain balance are some of the mitigation factors to be considered.

In Figure 23.4-3**,** the hazard of a tsunami event of a higher wave height alone is a concern in this route study. The tsunami coverage area is therefore the main design factor in the determination of alignment route. There are also storm surges which are frequent during typhoon seasons, thus flooding due to these weather conditions affects the route alignment study and the design is needed for protection barriers. The social and environmental concerns are to be addressed in the design of the proposed roadway.



Source: JICA Study Team

Figure 23.4-3 West Diversion Road Alternatives with Tsunami Map

23.4.3 Design Policies

The West Diversion Road is proposed for the expansion of Cotabato City urban developments. In this regard, the following design policies are considered, to wit:

- Connection to existing roads shall be strategically made to achieve an effective road network and traffic distribution.
- River crossing at Tamontaka River and Rio Grande de Mindanao River shall consider navigational clearance for barges. There is no official navigational clearance for the river. Referencing the navigational clearance of existing bridge, it is to be assumed 1.5 meters.
- The roadway will function as a tsunami barrier.
- Future land use plan is fully considered for selection of a road alignment.
- Minimal social impact to be achieved.
- Compliance with the required parameters of the adopted design speed.
- Interconnected roads function to decongest Sinsuat Ave. which is currently the city's only main trunkline.
- The road shall be initially two-lane, two-way highway with provision of expansion to a 4-lane divided road in the future.

(1) Highway Classification

For designing a highway, it is commonly required that the type, function, area and system of the highway be identified according to some principle of road classification. The highways and roads are, typically, in most standards, classified by:

- Highway type: two-lane, four-lane undivided, or four -lane divided,
- Highway function: Access-controlled Expressway, or not,
- Highway area: Rural, or Urban,
- Highway system: National, Provincial, or City
- Terrain of the area: Level (Flat), Rolling, or Mountainous, and
- Traffic forecast in the target year.

By identifying such attributes, a highway is ranked to a class of the applied standard and usually a corresponding design speed is specified.

Based on the above studied attributes, the design speed is selected to be at 80 kph for West Diversion Road.

(2) Highway Design Reference

There are three (3) design standards that are applied for the design of highway, namely,

- Design Guidelines, Criteria & Standards, Highway Design, Vol 4, DPWH, 2015
- A Policy on Geometric Design of Highways and Streets, AASHTO, 2011
- Japan Road Association, Road Structure Ordinance, 2019

These standards are to be jointly applied to the geometric design of highway in reference to each other, consequently, the selection or adoption of a higher standard from each design guidelines are considered.

(3) Basic Route Study

Alternative routes are studied to select the optimum alignment by analyzing the physical features of the area and geometric design controls. The physical features include topography, ground (soil) conditions, and surrounding land use. Its environmental and social impacts are also considered. While the geometric design controls comprise straight sections and curves for both horizontal and vertical alignments. These are designed accordingly with the set standards and criteria.

Typically, several preliminary maps are drawn showing various alignments. Selection of an alignment is a systematic process involving numerical counts of design features and alignment controls as the proposed alignments are checked for compliance with the horizontal and vertical control criteria. The selection of the final alignment is based on a comparison of geometrics, costs, construction methods and environmental and social impacts.

23.4.4 Design Standard and Typical Cross Sections

(1) Design Standard

The DPWH's Design Guidelines, Criteria and Standards sets the minimum geometric design standards and other applicable international standards for the project as shown in Table 23.4-1.

Table 23.4-1 Road Geometric Design Standard, WEST DIVERSION ROAD: Initial Stage (2-lane) (Design Speed, 80kph)

Item		Unit	Standard	Remark
Design Speed		kph	80	
Design Vehicle		-	WB-19	
Stopping Sight Distance		m	130	Page 3-4, Table 3-1, AASHTO 2011
Passing Sight Distance		m	245	Page 3-9, Table 3-4, AASHTO 2011 (two-lane highways)
ROW		m	40 - 50	
Terrain Condition			Flat	
1. Cross Section Elements				
Pavement				Asphalt Concrete
Lane Width		m	3.50	Page 53, Table 16.1, DPWH Road Safety Design Manual
Median Width		m	0	Page 8-8, Figure 8-2D, AASHTO 2011
Inner shoulder Strip		m	0	
Outer shoulder Strip		m	3.0	
Number of Lanes		Nos	2	Initial Stage, 4-lanes Ultimate Stage
Normal Cross Slope		%	2	Page 4-6, Table 4-1, AASHTO 2011
Maximum Super elevation		%	6	Page 53, Table 16.1, DPWH Road Safety Design Standard
2. Horizontal Alignment				
Minimum Radius		m	252	Page 3-45, Table 3-9, AASHTO 2011, e=6%
Min. Transition Curve Length		m	70	JPN
Min. Radius not requiring Transition Curve		m	1000	JPN
Min. Radius not requiring Superelevation		m	3,500	JPN (cross slope, 2%)
		m	2,000	JPN (cross slope, 1.5%)/ AASHTO, 2011
Max. Relative Slope			1/200	Page 3-61, Table 3-15, AASHTO 2011
3. Vertical Alignment				
Maximum Vertical Gradient		%	4	Page 8-4, Table 8-1, AASHTO 2011
Minimum K value	Sag		30	Page 3-161, Table 3-36, AASHTO 2011
	Crest		26	Page 3-155, Table 3-34, AASHTO 2011
Minimum Radius	Sag	m	2,000	JPN
	Crest	m	3,000	
Min Vertical Curve Length		m	70	JPN
4. Vertical Clearance				
Road		m	5.2	DPWH Requirement, 4.9 m (16 feet) clearance + 0.3m(Figure AC Overlay) (when needed)
Farm		m	2.5-3.0	Tractor/ Cart Driven.
River		m	3.75	Philippine Coast Guard

(2) Typical Cross Sections

The lane width for West Diversion Road is to adopt a much wider carriageway of 3.50m to contain a higher operational speed similar to almost all rural arterial road that are planned for multilane highways. The shoulder width is 3.0m with verges to provide spaces for roadway safety facilities and devices.

A normal cross fall of 2.0% is used for the traveled way all throughout the PCC pavement and 4.0% shoulders. Superelevation is to be determined in the final feasibility study and in accordance with the design guidelines used for this project.

The angles of slopes are based on the stability requirements and used a slope 1.5:1 for embankment and for minor earth cut considering there is a limited space. The road Right-of-Way is set at 45m considering the future widening. Typical cross-sections are shown in Figure 23.4-4 to Figure 23.4-6.

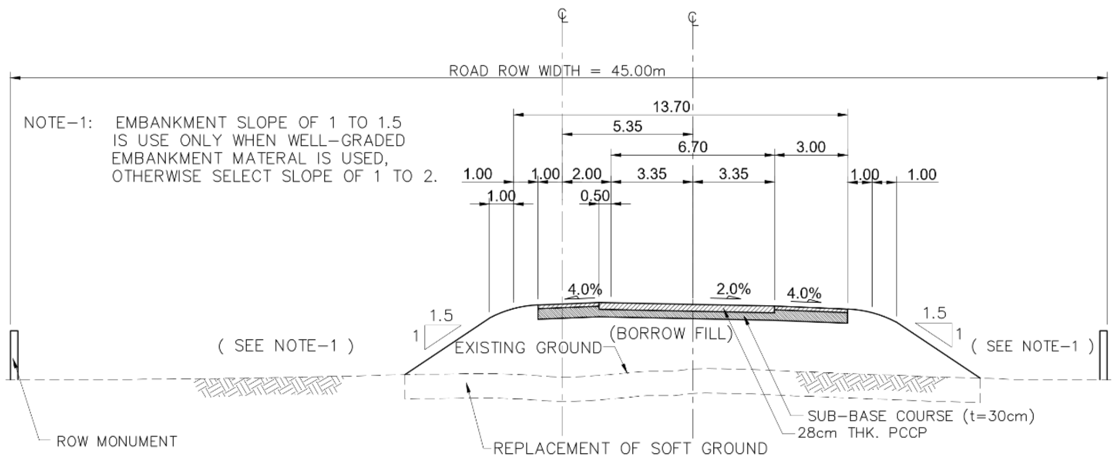


Figure 23.4-4 Typical Rodway Section for Lower Embankment at Initial Stage

The initial stage construction will consist first a two-lane, two-way highway. A typical section shown in Figure 23.4-5 is used where normal embankment height is applied especially at locations that have no road intersections and farm crossings.

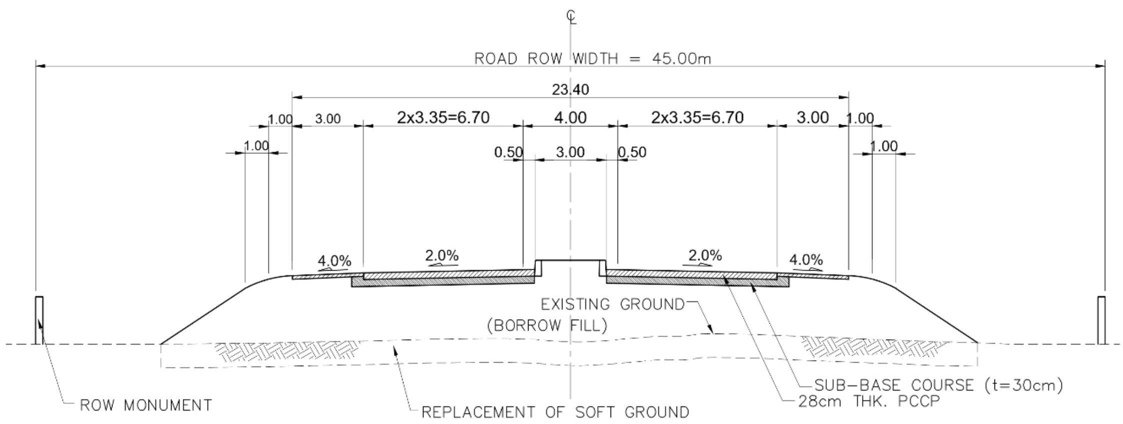


Figure 23.4-5 Typical Rodway Section for Lower Embankment At Ultimate (Permanent) Stage

The ultimate stage will be expanded into four-lanes, two-lanes each direction as shown in Figure 23.4-5. The normal crown indicated in the initial stage is set at 2.0% rotated at the proposed median of the ultimate stage.

Since the alignment cut through swampy area, there are soft grounds to be replaced with good embankment soil.

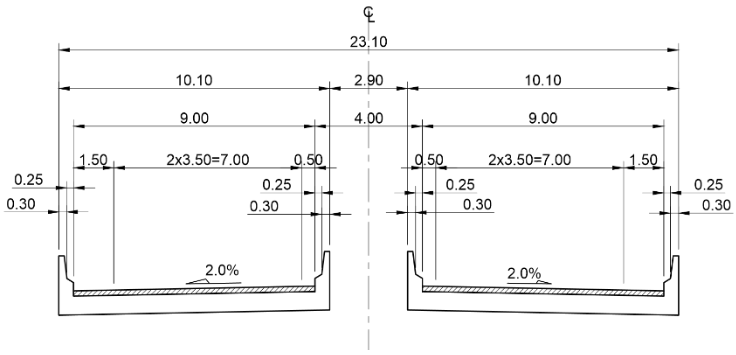


Figure 23.4-6 Typical Rodway Section at Bridge Section at Ultimate Stage

The bridge section as shown in Figure 23.4-6 is at ultimate stage. As typically done in Philippine highway that are classified as Arterial roads, the bridge shoulder width is reduced to 1.50m especially along long bridges. There is no planned sidewalk for this bridge due to safety of pedestrian on high-speed road.

23.4.5 Alternative Alignments and Selection of Optimum Alignment

(1) Alternative Routes Evaluation and Selection Criteria

Three (3) alternatives are selected for further comparison from several alignment routes initially laid out. These alternatives represent an alignment that will be closer to the city or closer to the coastal area. Much more, these alternative alignments laid out to avoid houses or structures as much as possible, just as its geometric layouts should be safe for driving motorists. The entire total length of the alignments and bridges to be constructed, together with its constructability is evaluated to determine the construction cost.

The final selection of these alternative alignments will be evaluated at a more detailed comparison. Selection of most suitable alignment will be determined based on the route selection evaluation criteria as shown in Table 23.4-2**.**

Table 23.4-2 Criteria for Route Evaluation And Selection

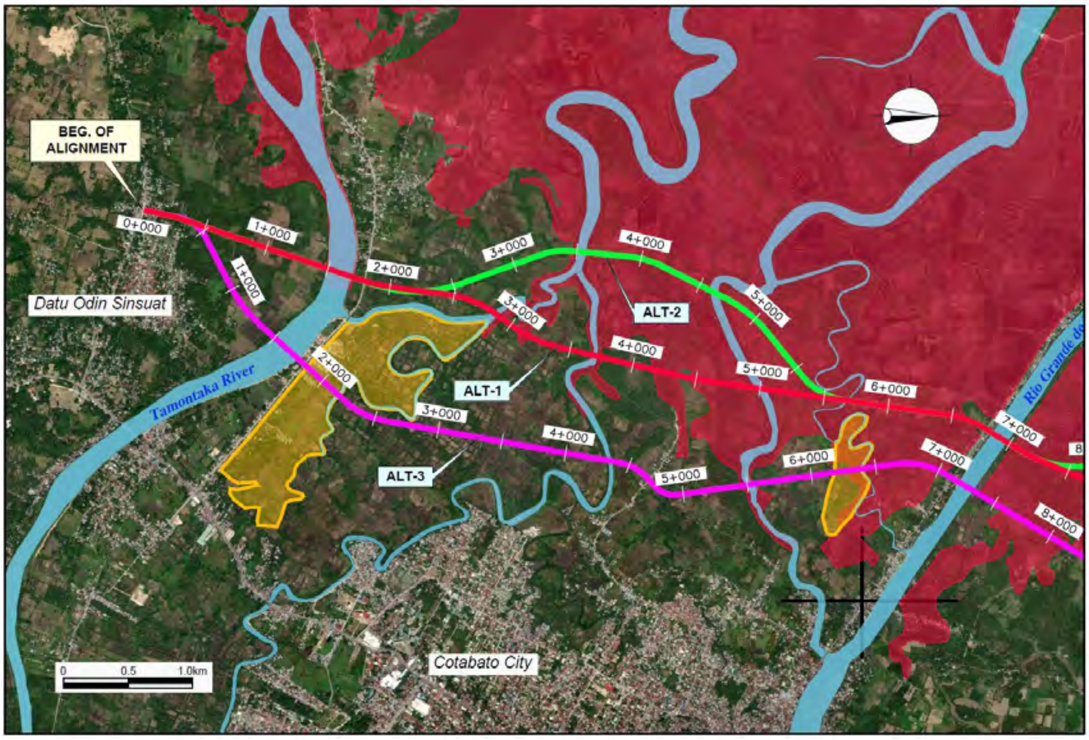
Item	Evaluation Weight	Assessment Points	Assessment Symbol
1) Horizontal and Vertical Alignment	5	・Good ··········· 5 ・Normal ··········· 3 ・Not Bad ··········· 1	◎ ● △
2) Project Cost	5	・Cheapest ··········· 5 ・Average ··········· 3 ・Expensive ··········· 1	◎ ● △
3) Construction Difficulty	5	・Easy ··········· 5 ・Average ··········· 3 ・Difficult ··········· 1	◎ ● △
4) Social Aspect	5	・Few ··········· 5 ・High ··········· 3 ・Very High ··········· 1	◎ ● △
5) Environmental Aspect	5	・Easy ··········· 5 ・Average ··········· 3 ・Difficult ··········· 1	◎ ● △
Total	25		◎ ● △

The comparison of alternatives is shown in Table 23.4-3. These are presented with evaluation items and assessed with a given points as analyzed.

(2) Description of the Alternative Alignments

a) STA. 0+000 to STA. 6+000

For the first six (6)- kilometer route alignment study as shown in Figure 23.4-7, Alternative 1 presents a more geometric alignment benefit in terms of least number of curves. Alternative 2 is located much more on the coverage of possible storm surge area to lessen the number of waterway crossing. Alternative 3 affects the proposed two (2) spot developments outside of the city proper, although it avoided the reach of possible storm surge area.



Source: JICA Study Team

Figure 23.4-7 West Diversion Road Alignment Alternatives STA. 0+000 – STA 6+000

All the alternatives in this section crosses several waterways including Tamontaka River and Rio Grande de Mindanao River. Number of bridges in Alternative 2 is the shortest among the three alternatives, although Alternative 1 presents the longest bridge lengths, however, crossing river tributaries are more on straight waterway course as compared to adjacent winding waterway course in other alternatives.

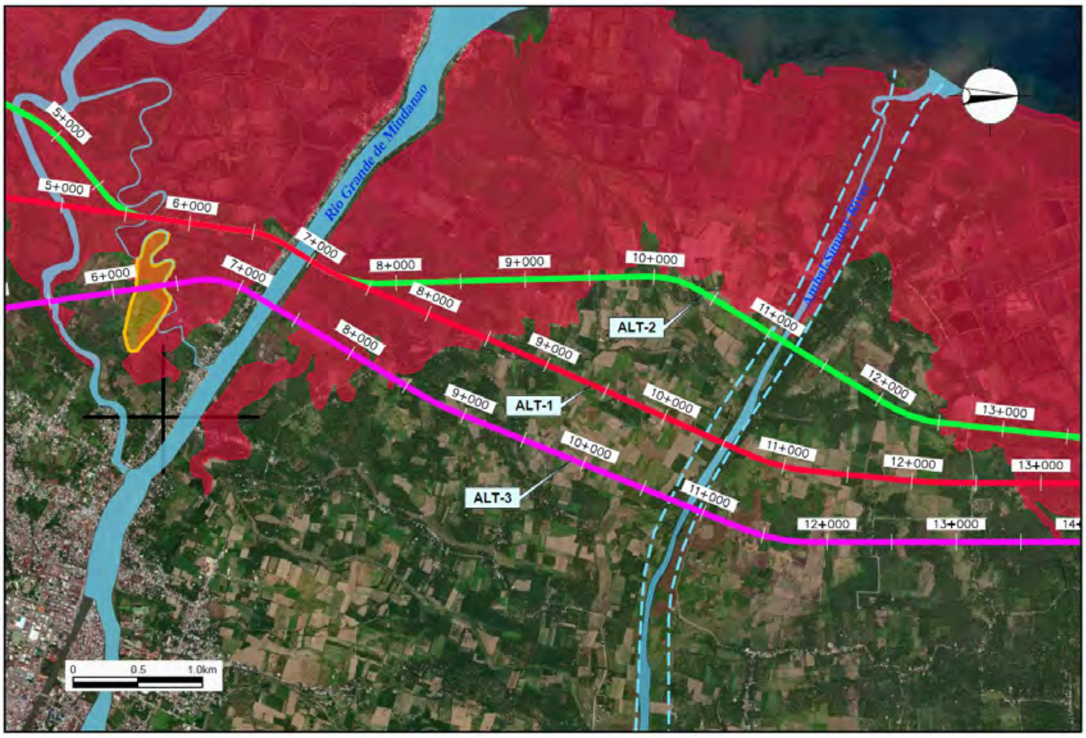
Alternative 1 has the least affected houses/structures. All alternatives affect farmlands and tree plantations. Since Alternative 1 is the least length, fewer lands in general will be affected.

b) STA. 6+000 to STA. 12+000

Figure 23.4-8 shows the next 6 kilometers. Alternative 1 provides best geometric alignment as much as Alternative 3. Alternative 2 transition toward the limit of the storm surge and also avoided cultivated agricultural lands but traverses on tree plantations. Alternative 1 and Alternative 2 share a common alignment in some parts in the entire length.

Another river will be crossed by all alternatives, this is the existing channel of the Simuay River. It is planned to be widened and dredged as part of the flood control project towards its river mouth at Illana Bay. The abutment of the proposed bridge crossing of the project will consider the proposed width of the proposed channel.

Alternative 2 avoided some agricultural lands to be cut by the roadway and diverted towards the boundary of swampy area and locations of fishponds. However, Alternative 1 and Alternative 2 consider the connecting roads that are also strategically planned for efficient traffic flow distribution.



Source: JICA Study Team

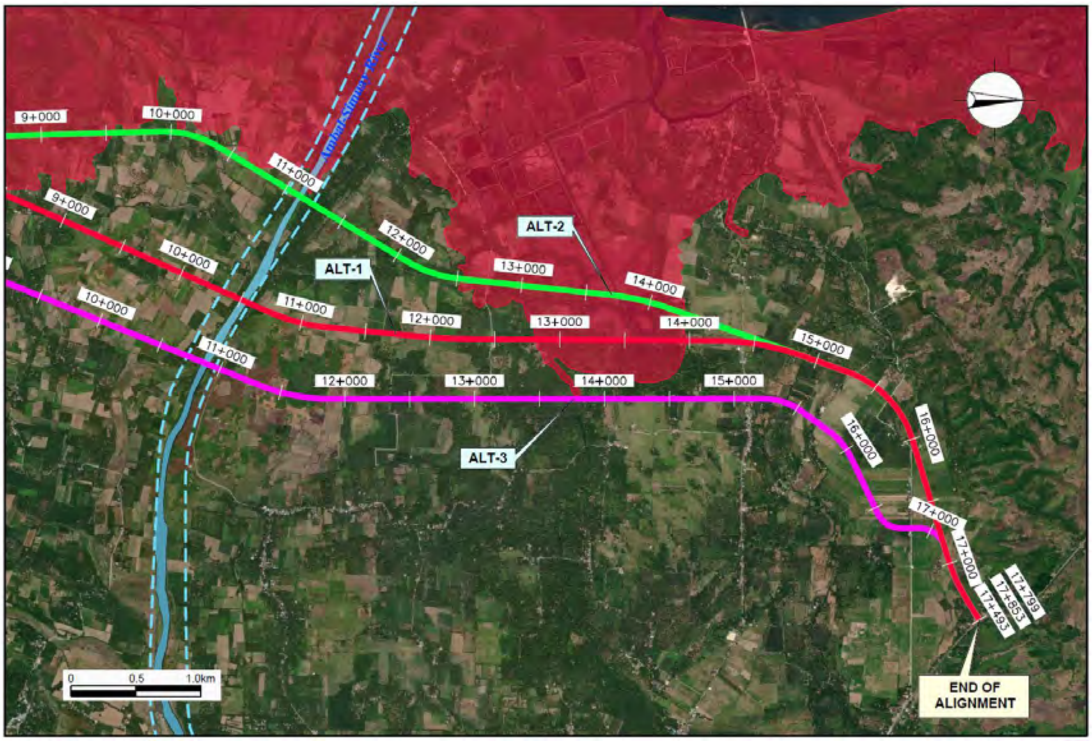
Figure 23.4-8 West Diversion Road Alignment Alternatives STA. 6+000 – STA 12+000

c) STA. 12+000 to END

For the last section as presented in Figure 23.4-9, Alternative 1 is generally the best in alignment because of least curves. The terrain gradually increasing to a higher ground at this section of the entire route corridor so that the storm surges coverage area is least. Alternative 2 passes through swampy and fishpond areas as it connects to Alternative 1.

Alternative 3 cuts through several existing roads more than other alternatives. Although, the vertical alignment tends to be much lower than Alternative 1 and Alternative 2, the presence of road intersections is considered for higher embankment in order for these road crossings to be underneath the proposed roadway to have a free flow of traffic.

Alternative 1 in this section presents least affected houses or structures, while Alternative 3 is highest due to much closer to scattered communities.



Source: JICA Study Team

Figure 23.4-9 West Diversion Road Alignment Alternatives STA. 12+000 – END

Table 23.4-3 Comparison Of Alternatives (West Diversion Road)

CRITERION		ALTERNATIVE 1		ALTERNATIVE 2		ALTERNATIVE 3	
ROUTE EVALUATION							
• Scope of Work		• Road Length = 16.543Km • No. of Bridges = 8 • Bridge Length = 950m • Total Length = 17.493Km		• Road Length = 17.003Km • No. of Bridges = 6 • Bridge Length = 850m • Total Length = 17.853Km		• Road Length = 16.879Km • No. of Bridges = 9 • Bridge Length = 920m • Total Length = 17.799Km	
EVALUATION ITEM	• Horizontal and Vertical Alignment	• Minimum radius of horizontal curve = 700m • Vertical alignment maximum gradient = 1.00%	◎	• Minimum radius of horizontal curve = 500m • Vertical alignment maximum gradient = 0.8%	◎	• Minimum radius of horizontal curve = 200m • Vertical alignment maximum gradient = 3.5%	◎
	• Project Cost	• Most expensive scheme due to required bridges.	△	• Least expensive scheme due to the shortest bridge length.	◎	• Second most expensive scheme.	●
	• Function as a Tsunami Barrier and Community Protection Function	• Effective as a Tsunami barrier. • Widest area protected from Tsunami.	◎	• Effective as a Tsunami barrier. • Widest area protected from Tsunami.	◎	• Not so effective as a Tsunami barrier. • Lesser area protected.	△
	• Construction Difficulty	• Higher embankment fill to address storm surge. • Several long and short bridges is needed. • Most number and longest bridge length required.	△	• Higher embankment fill to address storm surge. • Least bridge number and length required.	△	• Least embankment fill to address storm surge. • Fewer long and short bridges is needed.	△
	• Social Aspect	• No. of houses/buildings affected = 45 • Least impact.	◎	• No. of houses/buildings affected = 57 • Medium impact.	△	• No. of houses/buildings affected = 59 • Highest impact.	△
	• Environmental Aspect	• Affect few fishponds. • Affect several tree plantations.	● △	• Affect several fishponds. • Affect several tree plantations.	△ △	• Not affect fishponds. • Affect several tree plantations.	◎ △
OVERALL EVALUATION		RECOMMENDED	21 Points	NOT RECOMMENDED	19 Points	NOT RECOMMENDED	17 Points

Source: JICA Study Team

23.4.6 Proposed Layout of the West Diversion Road

(1) Plan and Profile

Based on the evaluation criteria, the selected alignment for the proposed West Diversion Road is Alternative 1.

The plan and profile are shown in Figure 23.4-14 and Figure 23.4-15 as studied. This will be presented in more basic design drawings.

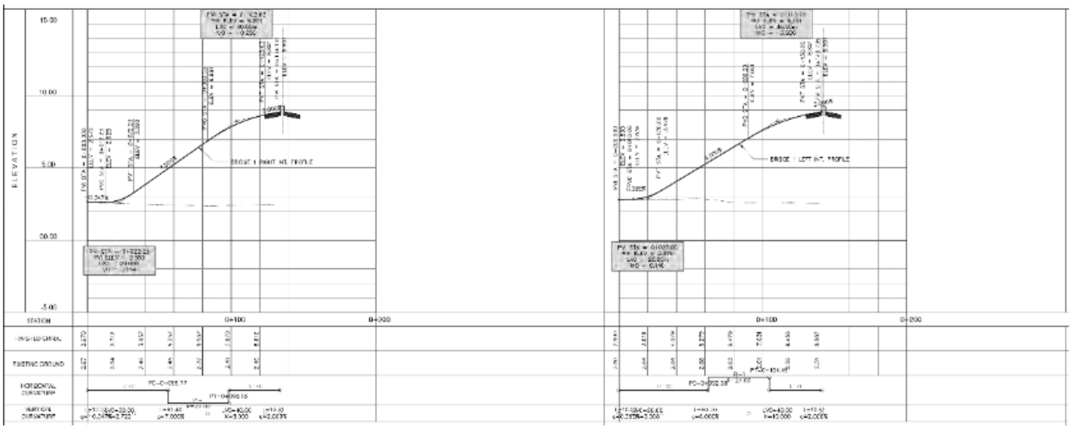
(2) Ramp Intersection Access

Figure 23.4-10 provides the concept for a service road to connect to existing road after crossing Tamontaka River.

The initial profile of this access road/ramp is shown in Figure 23.4-11**.** A maximum of 8% gradient is considered.

Source: JICA Study Team

Figure 23.4-10 Layout Plan of West Diversion Road Access Ramp To/ From Existing Road



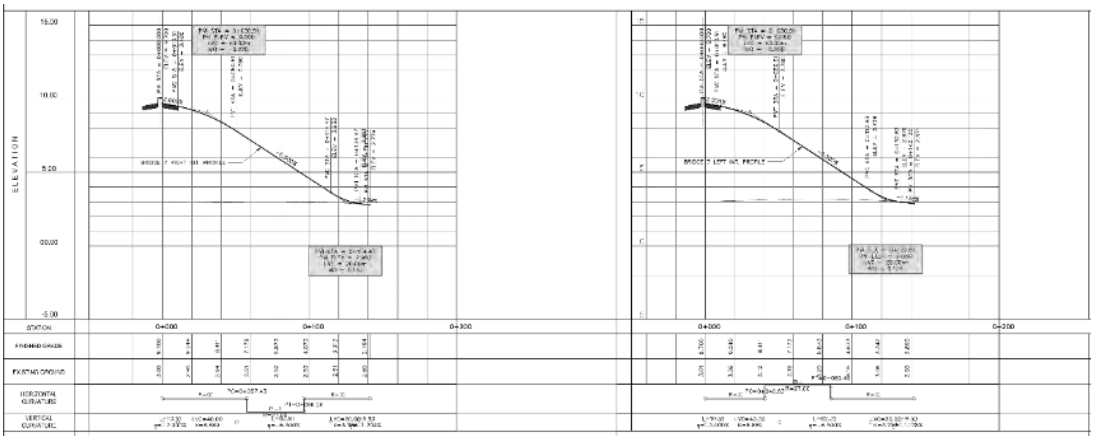
Source: JICA Study Team

Figure 23.4-11 Layout Profile of West Diversion Road Access Ramp to/from Existing Road

Figure 23.4-12 provides the concept for a service road to connect to existing road before river crossing at Rio Grande de Mindanao. Similarly, the profile would limit an 8% maximum gradient, but 6% to 7% is used as shown in Figure 23.4-13**.**

Source: JICA Study Team

Figure 23.4-12 Layout Plan of West Diversion Road Access Ramp To/ From Existing Road



Source: JICA Study Team

Figure 23.4-13 Layout Profile of West Diversion Road Access Ramp To/ From Existing Road

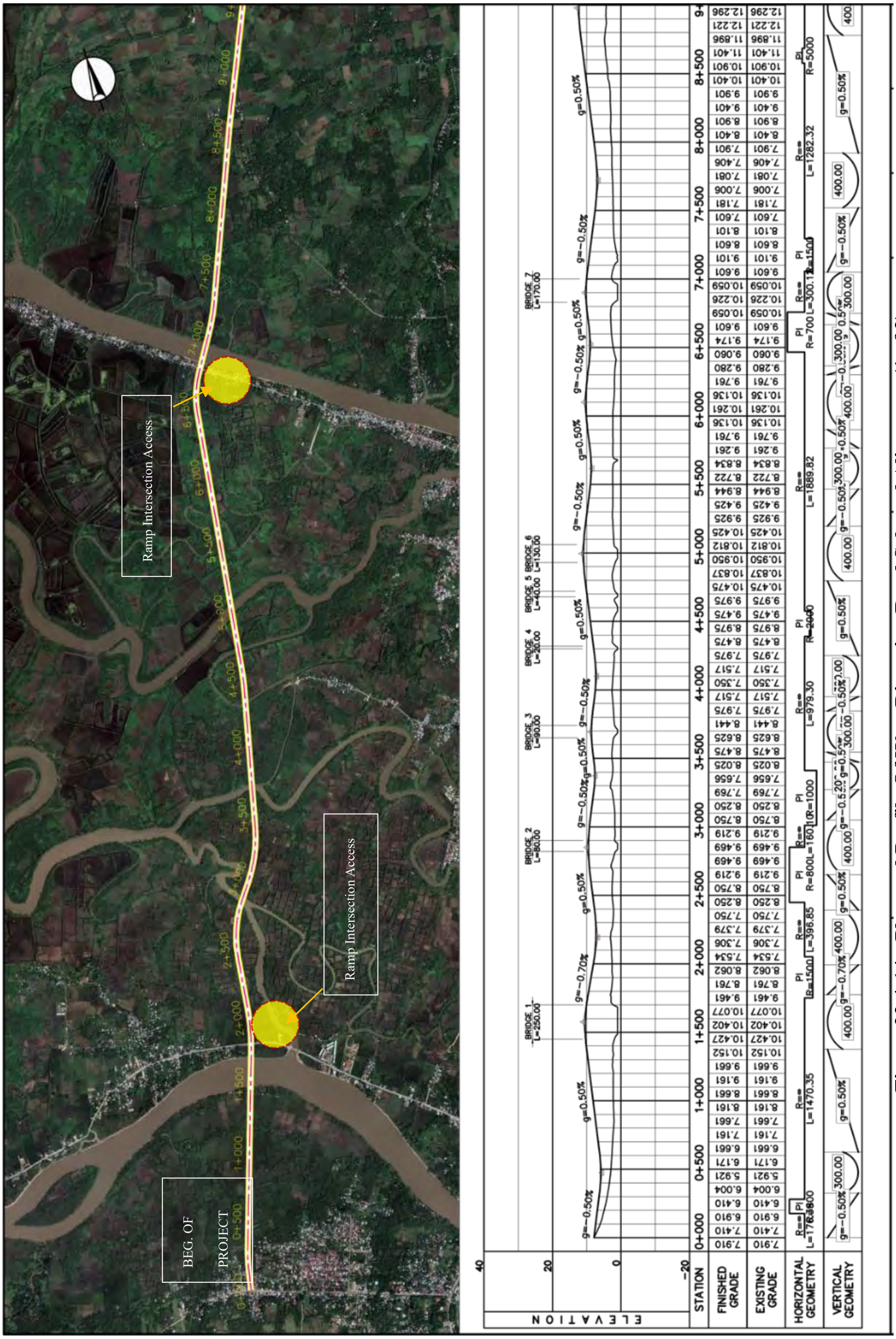


Figure 23.4-14 Plan and Profile Of West Diversion Road Selected Alignment (1 of 2)

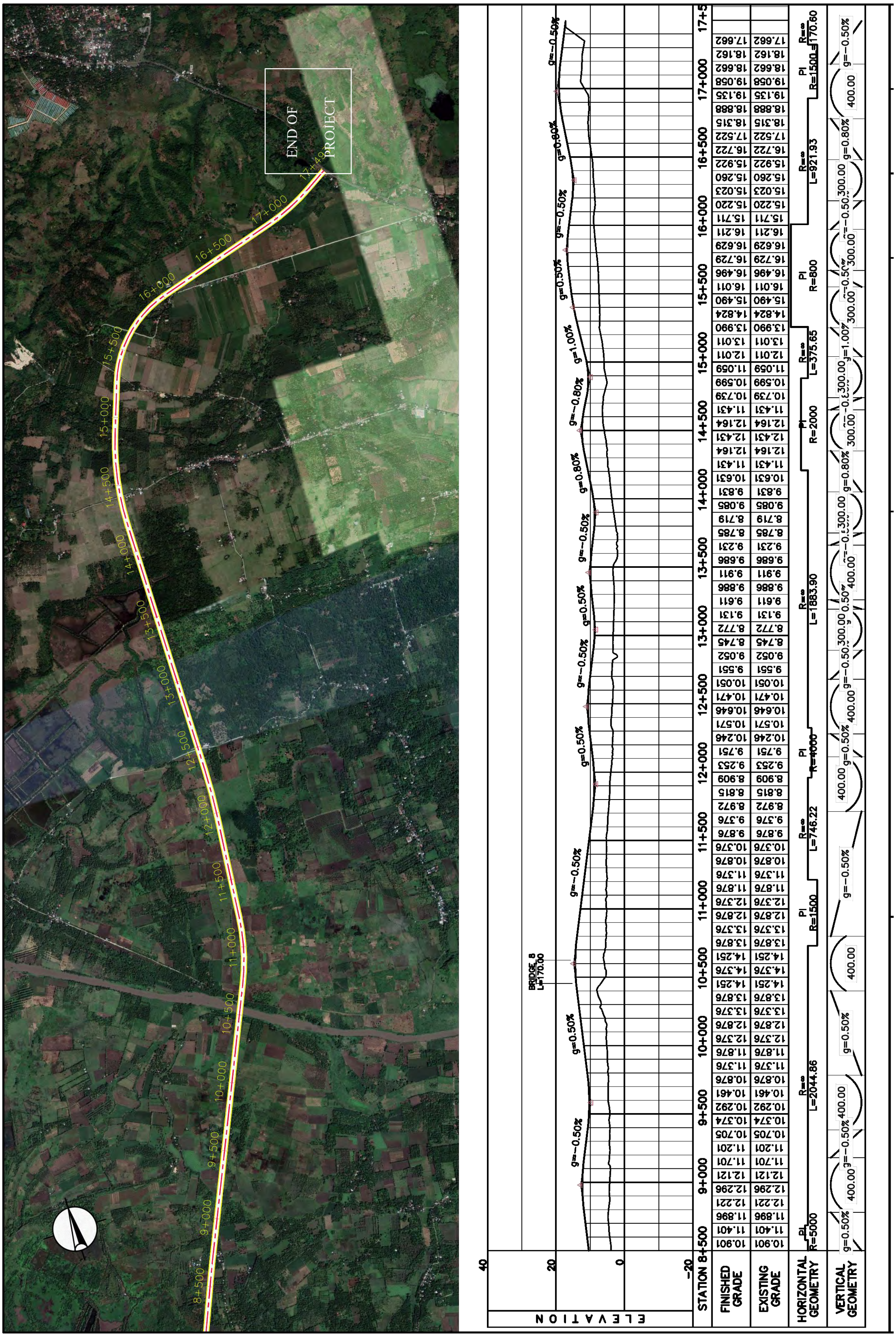


Figure 23.4-15 Plan and Profile of West Diversion Road Selected Alignment (2 of 2)

23.5 Preliminary Design of Bridges along West Diversion Road

23.5.1 Applied Design Standard and Criteria

The following Guidelines, Department Orders (DOs) and Specifications are applied for the bridge design:

1) DPWH Design Guidelines, Criteria and Standards, Volume V 2015 (DGCS)
2) DPWH LRFD Bridge Seismic Design Specifications, 1st Edition 2013 & Interim Revision 2019 (BSDS)
3) AASHTO LRFD Bridge Design Specifications, 8th Edition 2018
4) AASHTO LRFD Bridge Construction Specifications, 3rd Edition 2016
5) Japan Road Association, Specifications for Highway Bridges, Part 1 to Part 5, Nov 2017

23.5.2 Summary of Design Results

Table 23.5-1 shows the summary of bridges plans results.

Table 23.5-1 Summary of Bridge Plan

Classification	Type	Number	Length
		Total: 8	Total: 995m
Special Bridge	- Arch Bridge + AASHTO PC I-girder	1	170.0m (STA.6+830 - STA.7+0.0)
Standard Bridge	AASHTO PC I-girder	7	245.0m (STA.1+451.5-STA1+696.5) 90.0m (STA.2+810 - STA.2+900) 90.0m (STA.3+650 - STA.3+740) 40.0m (STA.4+285 - STA.4+325) 40.0m (STA.4+680 - SAT.4+720) 150.0m (STA.4+915 - STA5+65) 170.0m (STA.10+460 - STA.10+630)

Source: JICA Study Team

23.5.3 Preliminary Design of Mindanao River South Dike Road Bridge

(1) Design Condition

1) Topographic and Geotechnical Condition

Topographic condition:

- The contour map from GIS data is used.

Geotechnical condition:

- The bearing layer and ground condition is assumed from the existing data. No geotechnical survey was undertaken.

2) River Condition

Since the hydrologic analysis for the design flood levels is not conducted for the study, the design flood water level was assumed to be the top level of the embankment.

Table 23.5-2 Design Flood Water Level

STA No. (Bridge No.)	Design Flood Water Level
STA.1+451.5-STA1+696.5 (Bridge No.1)	1.872 m
STA.2+810 - STA.2+900 (Bridge No.2)	1.782 m
STA.3+650 - STA.3+740 (Bridge No.3)	1.924 m
STA.4+285 - STA.4+325 (Bridge No.4)	1.433 m
STA.4+680 - SAT.4+720 (Bridge No.5)	1.430 m
STA.4+915 - STA5+65 ((Bridge No.6)	1.905 m
STA.6+830 - STA.7+0.0 (Bridge No.7)	2.106 m
STA.10+460 - STA.10+630 (Bridge No.8)	5.887 m

Source: JICA Study Team

3) Typical Cross Section for the Bridge

The typical cross section for Bridge is planned as shown in Figure 23.5-1.

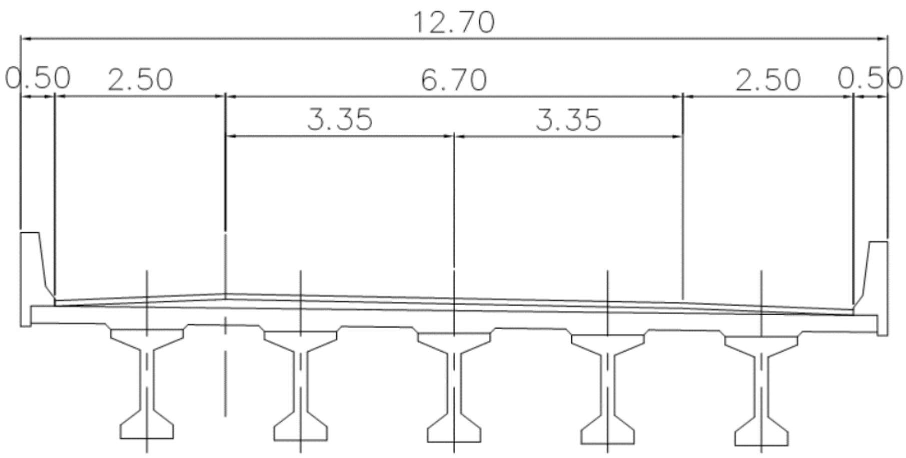


Figure 23.5-1 Typical Cross Section

4) Clearance

The vertical clearance is 5.0m based on the DGCS that shows a minimum clearance of 4.88 m.

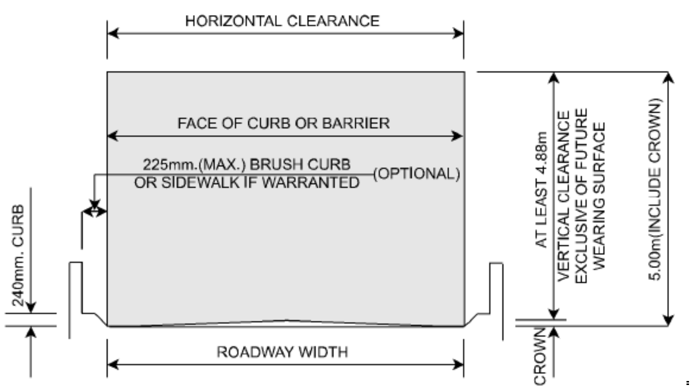


Figure 23.5-2 Bridge Clearance

(2) Study for Bridge Length and Span Arrangement

1) Abutment Location (Bridge Length)

a) Abutment Location for river condition

Abutment location shall be so selected that the current river width should be maintained, so that the river flow should not be restricted even though the bridges are installed.

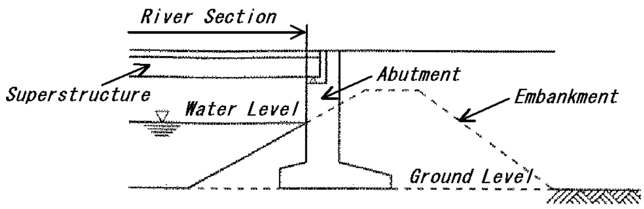


Figure 23.5-3 Abutment Location for River

Initially, the river width /abutment location should be decided from the hydrologic analysis for the design flood levels. Since this study level is Prefeasibility study, the hydrologic analysis is not implemented so that it is decided based on the bank elevation and the river width.

b) Abutment Location for Dike Road

At the right bank side of Bridge No.8, there exists the dike road, therefore, this road should be considered as the installation condition for abutment location of right bank side for Bridge No.8. Since we do not know which construction work is made earlier, we assume that the dike road construction work is commenced first. In this case, before abutment construction work is implemented, improvement work of dike road is completed and already in service.

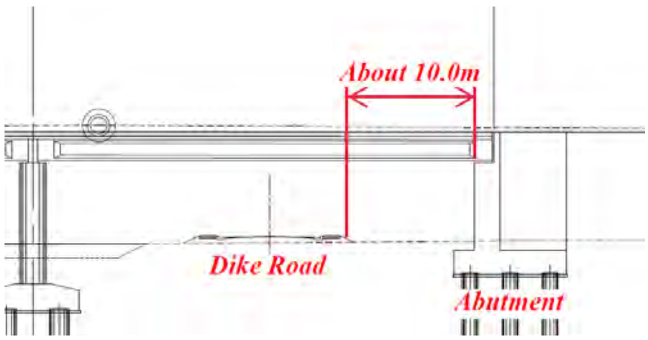


Figure 23.5-4 Abutment Location for Dike Road

Therefore, we need to consider some distance that abutment construction work is not affected by the dike road. Generally, as construction yard for abutment, it is necessary about 10m which is afford from the front of the abutment.

The abutment locations based on current river width and necessity distance from dike road are shown in Table 23.5-3.

Table 23.5-3 Abutment Location

		STA. No
Bridge No.1	Abutment A	STA.1+451.5
	Abutment B	STA.1+696.5
Bridge No.2	Abutment A	STA.2+810.0
	Abutment B	STA.2+900.0
Bridge No.3	Abutment A	STA.3+650.0
	Abutment B	STA.3+740.0
Bridge No.4	Abutment A	STA.4+285.0
	Abutment B	STA.4+325.0
Bridge No.5	Abutment A	STA.4+680.0
	Abutment B	SAT.4+720.0
Bridge No.6	Abutment A	STA.4+915.0
	Abutment B	STA5+65.0
Bridge No.7	Abutment A	STA.6+830.0
	Abutment B	STA.7+0.0
Bridge No.8	Abutment A	STA.10+460.0
	Abutment B	STA.10+630.0

Source: JICA Study Team

c) Bridge Length

The length of each bridge from the location for each abutment location are shown in Table 23.5-4.

Table 23.5-4 Bridge Length

Bridge No	STA. No	Bridge Length
Bridge No.1	STA.1+450.0	245.0m
	STA.1+700.0	
Bridge No.2	STA.2+810.0	90.0m
	STA.2+900.0	
Bridge No.3	STA.3+650.0	90.0m
	STA.3+740.0	
Bridge No.4	STA.4+285.0	40.0m
	STA.4+325.0	
Bridge No.5	STA.4+680.0	40.0m
	SAT.4+720.0	
Bridge No.6	STA.4+915.0	150.0m
	STA5+65.0	
Bridge No.7	STA.6+830.0	170.0m
	STA.7+0.0	
Bridge No.8	STA.10+460.0	170.0m
	STA.10+630.0	

Source: JICA Study Team

2) Pier Location

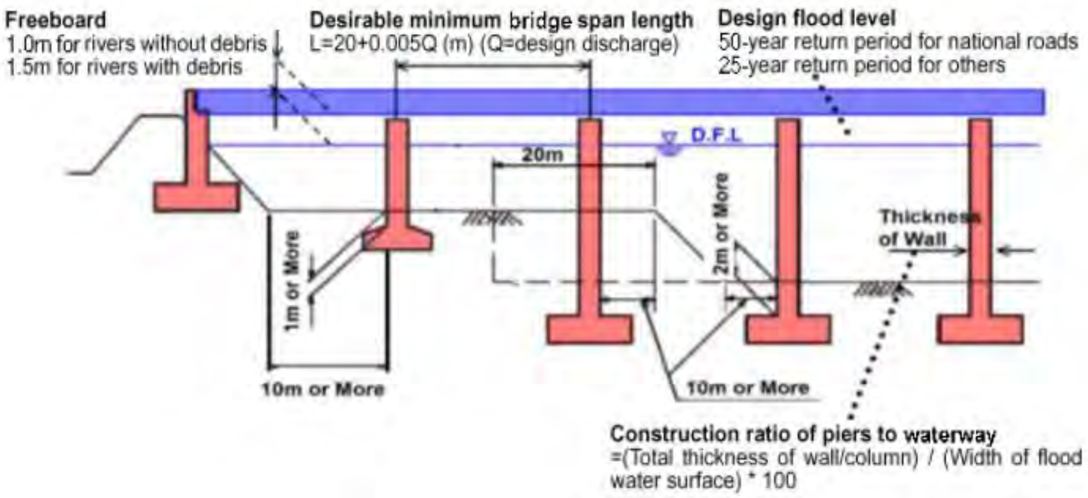
The bridge length of Bridge No.4 and Bridge No.5 is 40.0m. Therefore, AASHTO girder generally used in the Philippines can be applicable and number of spans can be one (1) span.

On the other hand, the bridge length from Bridge No.1 to Bridge No.3 and from Bridge No.6 to Bridge No.8 are 90.0m or more. Since the landscape is considered for Bridge No.7 importantly, we shall consider the special bridge which may require a long span bridge. On the other hand, since the landscape is not considered for other bridges importantly, these bridges are planned to install several piers in the river and AASHTO girder which is generally used in Philippines is planned.

Regarding the installation of several piers in the river, the following will be taken into consideration.

a) River Parameters Associated with Bridge Planning by the River

The following will be considered for the pier location.



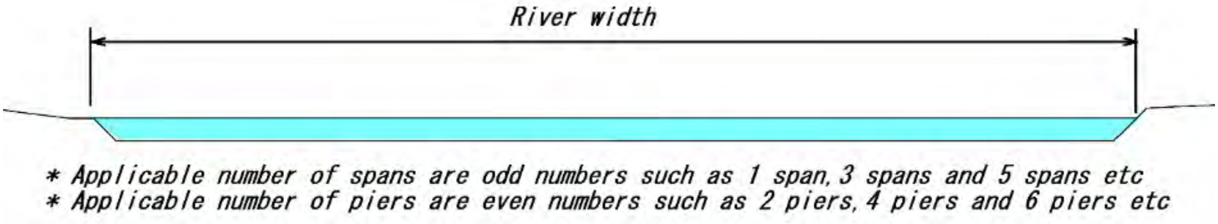
Source: JICA Study Team

Figure 23.5-5 River Parameters Associated with Bridge Planning by the River

b) Number of spans (piers) in river

According to Design Guidelines, Criteria & Standards Volume 5 (DGCS 5), basically, the span arrangement in the river should be odd numbers spans other than the enough river width is ensured by using the special bridge which can correspond with long span.

Therefore, the bridges considered as AASHTO PC I girder except Bridge No.1 and Bridge No.7 shall be needed to consider as the number of spans is odd number and the number of piers is even number.



Source: JICA Study Team

Figure 23.5-6 Consideration of Number of Piers in River

3) Study for Span Arrangement of Bridge No.2, No3, No.6 and No.8

The span arrangement for Bridge No.1, No.2, No3, No.6 and No.8 will be considered based on the result of above bridge length and condition for pier location.

a) Study for Condition

For studying span arrangement, it is necessary to satisfy the following conditions.

- Preferably, no use of the Special bridge, which is expensive, although aesthetic view is superior.
- To use the AASHTO Girder which is generally used in the Philippines
- Applicable number of spans shall be odd numbers
- Bridge length of Bridge No.1 is 245.0m
- Bridge length of Bridge No.2 and Bridge No.3 is 90.0m
- Bridge length of Bridge No.6 is 150.0m
- Bridge length of Bridge No.8 is 170.0m

Applicable span length of AASHTO girder is from 20.0m to 40.0m which refer to Table 23.5-5.

Table 23.5-5 Applicable Span for Each Bridge Type

Materials	Type of Bridge	Range	10	15	20	25	30	35	40	50	100	200 (m)
RC	Precaset Slab, Flat Slab	6- 12m										
	Concrete Deck Girder (RCDG)	13- 20m										
	Box Girder	22- 30m										
	Hollow Slab Bridge	10- 20m										
PC	Channel beams	11- 14m										
	Tee beams	15- 18m										
	I-beams	21- 30m										
	AASHTO girder (PSCG)	20- 40m										
	Box girders	30-200m										
	Hollow (voided) slab	15- 30m										

Source: JICA Study Team

b) Span Arrangement

➢ Span Arrangement for Bridge No.1

- Applicable Span Length to AASHTO Girder

Considering the bridge length, number of spans corresponding with span length and whether these span lengths adopt AASHTO girder or not are show in Table 23.5-6.

Table 23.5-6 Span Arrangement of Bridge No.1

Bridge Length	Number of Spans	Span Length	Applicable to AASHTO Girder
245.0m	1 Span	245.0m	×
	3 Spans	81.7m	×
	5 Spans	49.0m	×
	7 Spans	35.0m	○
	9 Spans	27.2m	○
	11 Spans	22.3m	○
	13 Spans	18.8m	×

As the span arrangement for Bridge No.1 from Table 23.5-6, AASHTO girder can be applicable to 7 spans, 9 spans and 11 spans.

- Cost Comparison

Regarding the 7 spans, 9 spans and 11 spans to which AASHTO girders are applicable, cost comparison shall be conducted. The result of cost comparison is shown in Table 23.5-7. Since number of piers needed by 7 spans are less than those by 9 spans and 11 spans, the piers and foundations cost are low resulting in lower total cost.

Table 23.5-7 Cost Comparison of Bridge No.1

	Cost (Peso)	Rate
7 Spans	356,197,192	1.00
9 Spans	411,319,542	1.15
11 Spans	463,678,578	1.30

Source: JICA Study Team

In addition, in the point of view of a river flow, it is better to install a minimum number of piers in river. Therefore, we recommend ***7 spans used AASHTO girder type 5 for Bridge No.1***

➢ Span Arrangement for Bridge No.2 and No.3

・ Applicable Span Length to AASHTO Girder

Considering the bridge length, number of spans corresponding with span length and whether these span lengths adopt AASHTO girder or not are show in Table 23.5-8.

Table 23.5-8 Span Arrangement of Bridge No.2 and No.3

Bridge Length	Number of Spans	Span Length	Applicable to AASHTO Girder
90.0m	1 Span	90.0m	×
	3 Spans	30.0m	○
	5 Spans	18.0m	×

Source: JICA Study Team

As the span arrangement for Bridge No.2 and No.3 from Table 23.5-8, AASHTO girder can be applicable to 3 spans. Therefore, we recommend 3 spans used **AASHTO girder type 4 for Bridge No.2 and No.3**.

➢ Span Arrangement for Bridge No.6

・ Applicable Span Arrangement to AASHTO Girder

Considering the bridge length, number of spans corresponding with span length and whether these span lengths adopt AASHTO girder or not are show in Table 23.5-9

Table 23.5-9 Span Arrangement of Bridge No.6

Bridge Length	Number of Spans	Span Length	Applicable to AASHTO Girder
150.0m	1 Span	150.0m	×
	3 Spans	50.0m	×
	5 Spans	30.0m	○
	7 Spans	21.4m	○
	9 Spans	16.7m	×

Source: JICA Study Team

As the span arrangement for Bridge No.6 from Table 23.5-9, AASHTO girder can be applicable to 5 spans and 7 spans.

・ Cost Comparison

Regarding 5 spans and 7 spans to which AASHTO girders are applicable, cost comparison shall be conducted. The result of cost comparison is shown in Table 23.5-10. Since number of piers needed by 5 spans are less than those by 7 spans, the piers and foundations cost are low, hence resulting in lower total cost.

Table 23.5-10 Cost Comparison for Bridge No.6

	Cost (Peso)	Rate
5 Spans	257,006273	1.00
7 Spans	308,235,935	1.20

Source: JICA Study Team

Moreover, to attain smooth river flow, minimum number of piers is suggested. Therefore, we recommend ***5 spans used AASHTO girder type 4 for Bridge No.6.***

- Span Arrangement for Bridge No.8

・ Applicable Span Arrangement to AASHTO Girder

Considering the bridge length, number of spans corresponding with span length and whether these span lengths adopt AASHTO girder or not are show in Table 23.5-11.

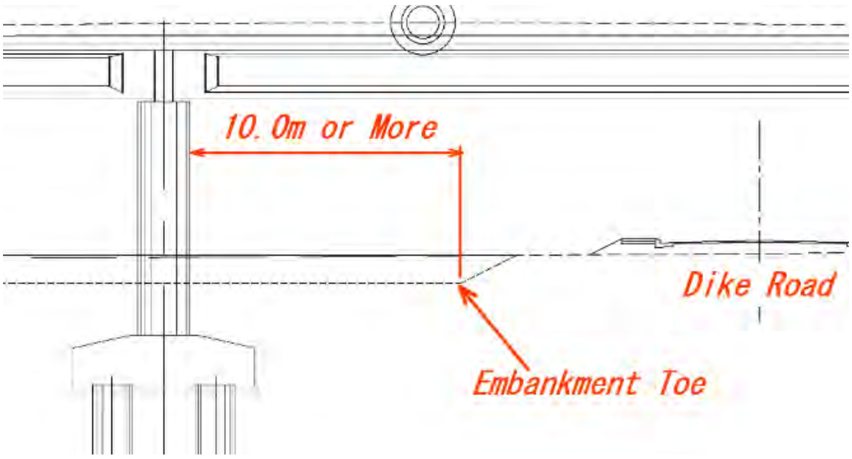
Table 23.5-11 Span Arrangement for Bridge No.8

Bridge Length	Number of Spans	Span Length	Applicable to AASHTO Girder
170.0m	1 Span	170.0 m	×
	3 Spans	56.7 m	×
	5 Spans	34.0 m	○
	7 Spans	24.3 m	○
	9 Spans	18.9 m	×

Source: JICA Study Team

As the span arrangement for Bridge No.8 from Table 23.5-11, AASHTO girder can be applicable to 5 spans and 7 spans.

As the span arrangement for Bridge No.8 from Table 23.5-11, AASHTO girder can be applicable to 5 spans and 7 spans. On the other hand, according to Table 23.5-5, the pier location where it is most near abutment B needs to be 10m or more at the left side from embankment toe, as shown in Figure 23.5-7. In this case, 5 spans and 7 spans should be modified according to Table 23.5-12 below, showing modification of span arrangement.



Source: JICA Study Team

Figure 23.5-7 Required Distance from Embankment Toe

Table 23.5-12 Modification of Span Arrangement

Number of Span	Original Span Arrangement	Modification of Span Arrangement
5 Spans	5@34.0m =170.0m	**3@30.0m + 2@40.0m = 170.0m**
7 Spans	7@24.3m =170.0m	**6@21.7m + 40.0m = 170.0m**

Source: JICA Study Team

- Cost Comparison

Regarding 5 spans and 7 spans to which AASHTO girders are applicable, cost comparison has been conducted. The result of cost comparison is shown in Table 23.5-13. Since number of piers needed by 5 spans are less than those by 7 spans, the piers and foundations cost are low, hence resulting in lower total cost.

Table 23.5-13 Cost Comparison for Bridge No.8

	Cost (Peso)	Rate
5 Spans	254,305,405	1.00
7 Spans	304,615,695	1.20

Source: JICA Study Team

Again, in the point of view for smooth river flow, minimum number of piers is desirable in river. Therefore, we recommend ***5 spans used AASHTO girder type 5 for Bridge No.8.***

4) Study for Span Arrangement of Bridge No.7

The span arrangement for Bridge No.7 shall be considered as Special Bridges which will be considered based on the result of above bridge length and condition for pier location.

a) Study for Condition

For studying span arrangement, it is necessary to satisfy the following conditions.

- To use the Special bridge of which aesthetic view is superior.
- Applicable number of spans shall be odd numbers.
- If it is possible to ensure enough river width for one span, span arrangement can consider as even number spans.
- Not to install the piers on river centerline
- To select both steel bridge type and concrete bridge type as bridge comparison proposal.
- Bridge length for Bridge No.7 is 170.0m

b) Span Arrangement

Regarding the special bridge for Bridge No.7, considering for above study for condition, we shall propose 2 spans or 3 spans because it gives the cost merit compared with 1 span clearly, and equivalent landscape with them, due to that bridge length is 170m.

➢ Proposal for the alternative of bridge type

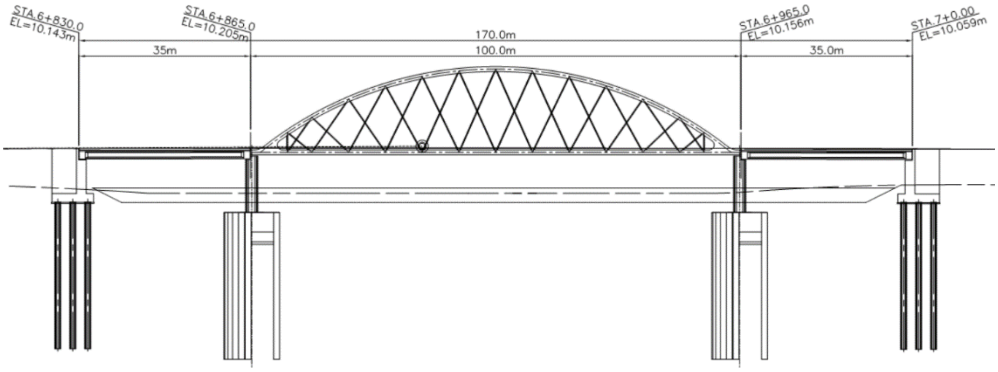
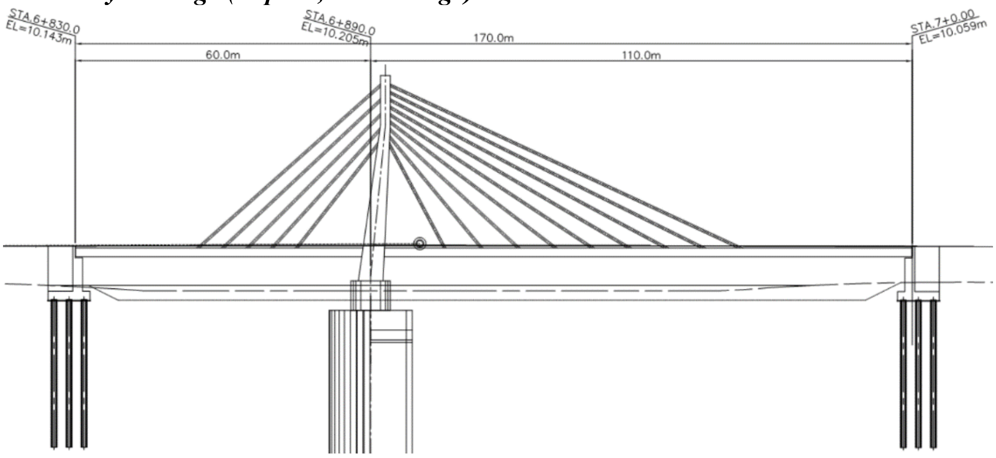
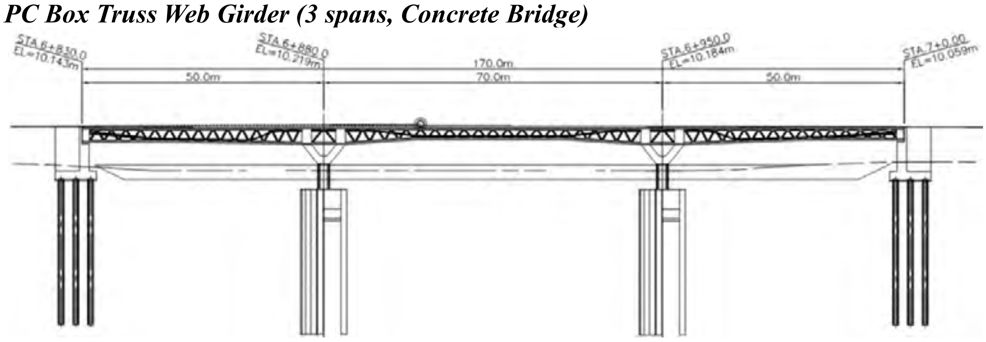
The bridge length is 170m and we shall consider the span length corresponding to the number of spans. Also, since bridge length is short for using the special bridge, therefore, we propose three bridge types as three alternatives, considering the landscape of the site.

- ***Alternative 1: Arch Bridge + AASHTO Girder (3 spans, Steel bridge)***
- ***Alternative 2: Cable-Stayed bridge (2 spans, Steel Bridge)***
- ***Alternative 3: PC Box Truss Web Girder (3 spans, Concrete Bridge)***

➢ Span Arrangement for Comparison of Bridge Types

We shall suggest the following as the span arrangement corresponding to each alternative of the Bridge No.7.

Table 23.5-14 Comparison Alternatives of Bridge Type for Bridge No.7

	Span Arrangement
Alternative 1	***Arch Bridge + AASHTO Girder (3 spans, Steel bridge)*** 
Alternative 2	***Cable-Stayed bridge (2 spans, Steel Bridge)*** 
Alternative 3	***PC Box Truss Web Girder (3 spans, Concrete Bridge)*** 

Source: JICA Study Team

c) Study for Comparison of Bridge Type

➢ Summary of Study Result

Table 23.5-15 shows the results of quantitative comparisons of the comparative study plans extracted in the next section with respect to structure, workability, maintainability, landscaping, and life cycle cost. As a result of the comparison, we recommend the "Arch Bridge + AASHTO Girder" with the highest evaluation rating.

Table 23.5-15 Summary of Result for Selection of Bridge Type for Bridge No.1

Bridge Type	Weight	Alternative 1 Arch Bridge + AASHTO Girder	Alternative 2 Cable-Stayed bridge	Alternative 3 PC Box Truss Web Girder
Structure	15	12.2	9.4	15.0
Constructability	15	12.0	13.0	13.0
Maintainability	10	9.6	8.0	6.8
Landscaping	20	16.4	15.6	16.4
Cost	40	40.0	13.5	38.7
Total	100	90.2 Recommend	59.5	89.0

Source: JICA Study Team

➢ **Result of Comparison**

Evaluation criteria and evaluation results are shown in Table 23.5-16 to Table 23.5-17, with General bridge type drawings.

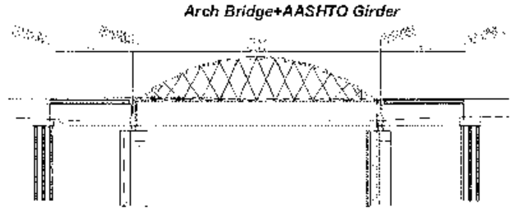
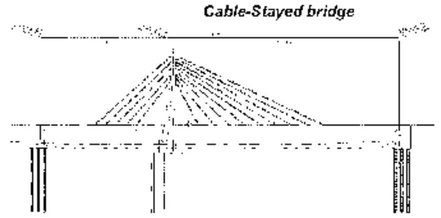
The Arch Bridge + AASHTO Girder has the excellent aesthetic and in most harmony with the landscape. Also, its maintainability and cost are found to be economically excellent. In addition, other evaluation items are in the middle among three alternatives. The PC Box Truss Web Girder has the excellent structure and constructability due to simple structural type. Also, in terms of landscaping, it has the same evaluation rating as Arch Bridge + AASHTO Girder. The Cable-Stayed bridge is inferior in almost all evaluation items among three alternatives.

Table 23.5-16 Evaluation Criteria for Bridge No.7

Evaluation Items			Score	Evaluation Point	★★★★★: x 1.0	★★★★: x 0.8	★★★: x 0.6	★★: x 0.4	★: x 0.2
Structure (20 Points)	Wind Resistance Stability		5	The type that is less likely to be deformed and the viblation does not easily occur are evaluated as high	Less deformation and vibration				Deforms signigicantly in the lateral direction Vibration is likely to occur
	Impact on foundation ground		7	High evaluation is given for the case where the superstructure is low weight and is low impact on foundation ground.	Superstructure with light weight Low impact on foundation ground				Superstructure with heavy weight High impact on foundation ground
	Seismic Adequency		5	High evaluation is given for the inertia force acts at low position and light weight of the superstructure. And it is given for structural characteristic of Long period because seismic frequency characteristics in Philippines is short.	Low inertia force action position Superstructure with low weight Long nartural period				High inertia force action position Superstructure with heavy weight Short natural preiod
	Redundancy		3	A type with high redundacy is high evaluated . And if it has a critial member, the evaluation is low	High redundancy No critical members				Low redundacy And there is a critical member whose damased case the bridge collapse.
Conmstructability (15 Points)	Safety Risk		5	The type that the temporary structure is not at a high place, has excellent structural stability during construction, and has a small influence on the navigation route when the member falls is highly evaluated.	Temporary structures are not at altitude The structure is stable during construction Small conponents and little effect on the navigation route.				Temporary structure is at high altitude The structure becomes unstable during construction The components are large and the effect on the navigation route is large
	Construction Duration		7	High evaluation is for the type with a short construction period.	Short construction period				Long construction period
	Construction Yard Required		3	The type with a small constrution yard and type that dose not require concrete plant eququment will be highly evaluated.	Small construction yard No plant facilities required				Large construction yard Requires plant facilities
Maintainability (10 points)	Work Volume		4	Highly rated if: Number of parts to be inspection: Small Repainting area: Small Inspection frequency: Less type	Number of parts to be inspecterd; Less Repaint area; Low Inspection frequency; Low	It is halfway between ★ 5 and ★ 1, but closer to ★ 5	The intermediate value between ★ 5 and ★ 1	It is halfway between ★ 5 and ★ 1, but closer to ★ 1	Number of parts to be inspected; Many Repaint area; Many Inspection frequency; Many
	Workability		4	A type with sufficienct maintanace worckspace and a short total length of maintenance rute will be highly evaluated.	The space for maintenance work is enough. The total length of the maintenace route is short.				The space for maintenance work is narrow. The total length of maintenance route is long
	Availability of Purocuament for Maintenance Works		2	The type that can be maintained by general equipment is highly appreciated.	Can be maintained with common equipment				Requires special maintenance equipment
Landscaping (15 Points)	The maintaining harmony with the surrounding landscape		5	The form that harmonizes with the characteristics of the surrounding landscape(elements of the natural landscape) are highly evaluated.	Harmony with the surrounding landscape; Good				Existing bridge; Similar in bridge type Harmony with the surrounding landscape; Bad
	Architectual Features	Landmark	3	A type that is different from the current bridge and that creates a landscape that is a symbol of this place is highly evaluated as having high landmarkbility	Highly symbolic and constitutes a unique landscape				Due to the same type as the existing bridge the difficult to create a unique landscape
		Originality	3	The use of new technologies and new materials will be highly evaluated for the type in the originality	Can be created advanced structures and types				It is difficult to express novelty because there is little room for new technology to be applied
		Technological Progress	2	A type that has a visual sense of stability against horizontal force is highly evaluated.	There is a sense of stability in the hem spread The low visual center of gravity				There is a no sense of stability in the hem spread The high visual center gravity
	Environment Impact		2	High evaluation is given to a type that visually non-impaired when viewed from outside by a bridge user	A strong sense of open because there are few members that obstruct the view				A strong sense of obstruction because there are many members that obstruct the view
Cost (40 Points)	Lifr Cycle Cost		40	= 40 - 40 x (ratio - 1.0)	Life Cycle cost = Initial Cost + Maintenance Cost (100 Years)				

Source: JICA Study Team

Table 23.5-17 Comparison Table for Bridge Type for Bridge No.7

Item				Alternative-1		Alternative-2		Alternative-3	
Bridge Type (★★★★★: x 1.0, ★★★★: x 0.8, ★★★: x 0.6, ★★: x 0.4, ★: x 0.2)				Arch Bridge+AASHTO Girder 		Cable-Stayed bridge 		PC Box Truss Web Girder 	
Evaluation Items			Score						
Structure (20 Points)	Wind Resistance Stability		3	2.4	Relatively larger deformation and vibration because low impact from wind with the low member thickness	1.8	Both deformation and vibration are the largest in alternatives due to High tall pylon and low member rigidity.	3.0	Less deformation and vibration because the concrere bridge with high member rigidity.
	Impact on foundation ground		5	4.0	Middle impact on foundation ground in alternatives because superstructure weight loaded to pier foundations is intermediate characteristics between PC truss web and extradosed.	3.0	High impact on foundation ground in all alternatives because among three alternatives is the same bridge length but number of foundation is the least.	5.0	The least impact on foundation ground in all alternatives because superstructure with fight weight.
	Seismic Adequency		5	4.0	Since groud condition is soft in this site, the design seismic intensity can be considered low due to long natural period. In additional, the position where the inertial force acts and superstructure weight loaded to pier foundations are intermediate characteristics between PC truss web and extradosed.	3.0	Since groud condition is soft in this site, the design seismic intensity can be considered low due to long natural period. In additional, in all alternatives, the position where the inertial force acts is the highest and the superstructure weight loaded to pier foundation is the largest.	5.0	Since groud condition is soft in this site, the design seismic intensity can be considered low due to long natural period. In additional, in all alternatives, the position where the inertial force acts is the lowest and the weight loaded to pier foundations are the least.
	Redundancy		2	1.8	Redundancy is second only to PC Truss Web. And it is necessary to take measures against cable breakage.	1.6	Redundancy is the least in all alternatives, Measures must be taken to prevent the main cable from breaking in order to prevent the bridge collapse	2.0	Have a high degree of redundancy.
Conmstructability (15 Points)	Safety Risk		5	4.0	In Block division erection by Truck crane, the enough attention is needed when block division members are lifted.	5.0	Overhanging construction is possible over all sections.	5.0	Overhanging construction is possible over all sections.
	Construction Duration		5	5.0	Shortest construction period among three alternatives due to Block division erection by Truck crane	3.0	Longest construction period among three alternative because Cantilever used for erection of Cable-Stayed bridge is difficult for management of erection.	4.0	Middle construction period among three alternative despite used for Cantilever as erection method because PC Box Truss Web Girder is easier management of erection than Cable-Stayed bridge
	Construction Yard Required		5	3.0	The construction yard will be maximum in all alternatives because needing the plant facility for AASHTO Girder and the stockyard for member of Arch bridge will be required.	5.0	The construction yard will be minimum in all alternatives because it is necessary the stockyard for member of Cable-Stayed bridge but the erection method is Cantilever.	4.0	The construction yard will be middle in all alternatives because the erection method is Cantilever though it is necessary the plant facilities and the stockyard for the girder.
Maintainability (10 points)	Work Volume		4	4.0	The number of parts to be inspected is low and The painting area is low because AASHTO girder based on concrete material is installed as side span.	3.2	The number of parts to be inspected is low but large repainting area will be need.	2.4	There are many parts to be inspected due to Truss web and large repainting area will be needed.
	Workability		4	4.0	The space for maintenance work: middle(Cable fixing part, Lateral beam) The total length of the maintenance route; Low	3.2	The space for maintenance work: middle(Cable fixing part, Lateral beam) The total length of the maintenance route;Longest	2.4	The space for maintenance work: Many(Truss members, PC cable inside Box girder) The total length of the maintenance route;Longest
	Availability of Purocuament for Maintenance Works		2	1.6	Requires special maintenance equipment for hanging material	1.6	Requires special maintenance equipment for hanging cable	2.0	Can be maintained with common equipment
Landscaping (15 Points)	Harmony with the Bridge of the Surroundings		5	5.0	The arch shape and the steel material by some paint can be expressed the best architecture in harmony with surrounding landscape.	3.0	The higher pylon used for Cable-Stayed bridge will be difficult to match at the higher level with surrounding landscape	4.0	The simple shape for Box girder along with truss web can be expressed the better architecture in harmony with surrounding landscape.
	Architectual Features	Landmark	5	4.0	The arch bridge with arch rib can attract attention from local residents and visitors and it can be landmark in surrounding area.	5.0	The cble-Stayed bridge with high pylon can attract the high level attention from local residents and visitors and it can be landmark in surrounding area.	3.0	Since PC Box Truss Web Girder is what symbolic structure is not installed above carryway so that it will be difficult to attract high level attention as landmark from local residents and visitors.
		Originality	5	4.0	It is possible to bring out the novelty of the part of members and materials, but the room for newness in form is limited only to arch rib.	3.0	It is possible to bring out the novelty of the part of members and materials, but the room for newness in form is limited only to the pylon	5.0	It is possible to bring out the novelty of the part of members and materials like the truss members used for web of PC Box girder. Like this, new materials and technologies can produce advanced structures and type.
		Technological Progress	3	1.8	Arch bridge cane show the extensibility of technology by using the new material and devising but AASHTO girder is the poor in freshness as of now	3.0	The silhouette can be combined with delicateness, showing the extensibility of technology by using the new material and devising the shape.	2.4	PC Box Truss Web Girder can show the extensibility of technology by using the new material and devising the shape
	Environment Impact		2	1.6	Arch bridge will obstruct for the view because large arch rib and hanging material exist.	1.6	Cable-Stayed bridge will obstruct for the view because high pylon and hanging cablel exist.	2.0	Since there are no members in the vertical direction, an open space can be secured.
Cost (40 Points)	Lifr Cycle Cost								
	Initial Cost (Peso_unit Milion)				817		2,499		865
	Maintenance Cost (peso_unit Milion)		40	40.0	409	13.5	1,125	37.8	433
	Total Cost (Peso_unit Milion)				1,226		3,624		1,298
	Ratio				1.000		2.957		1.059
Total Score				90.2		59.5		89.0	

Source: JICA Study Team

(3) Summary for the Type of Superstructure, Span Arrangement and Length

The summary for the type of Superstructure, Span arrangement and Length, for Bridge No. 1 to No. 8 are shown in Table 23.5-18.

Table 23.5-18 Summary Superstructure Type

Bridge No.	Bridge Length	Span arrangement	Span length	Superstructure Type
Bridge No.1	245.0m	7 spans	7@35.0m	AASHTO Girder Type5
Bridge No.2	90.0m	3 spans	3 @ 30.0m	AASHTO Girder Type 4
Bridge No.3	90.0m	3 spans	3 @ 30.0m	AASHTO Girder Type 4
Bridge No.4	40.0m	1 span	40.0m	AASHTO Girder Type 6
Bridge No.5	40.0m	1 span	40.0m	AASHTO Girder Type 6
Bridge No.6	150.0m	5 spans	5 @ 30.0m	AASHTO Girder Type 4
Bridge No.7	170.0m	3 spans	35m+100m+35m	Arch Bridge + AASHTO Girder Type 5
Bridge No.8	170.0m	5 spans	3@30.0m + 2@40.0m	AASHTO Girder Type 3 AASHTO Girder Type 6

Source: JICA Study Team

(4) Study for the Type of Substructure and Foundation

1) Substructure

a) Abutment Type

In the Philippines, pile bent type abutment is commonly used. However, its seismic resistance performance may be insufficient to resist adequately the soil slippage at the back of abutment when an earthquake strikes. As shown in Figure 23.5-8, there are many earthquake-induced damage cases seen in the Philippines. Therefore, a reverse T-shaped abutment will be proposed and utilized for this project because it will be able to resist sufficiently the soil slippage at the back of abutment during an earthquake with better seismic performance.

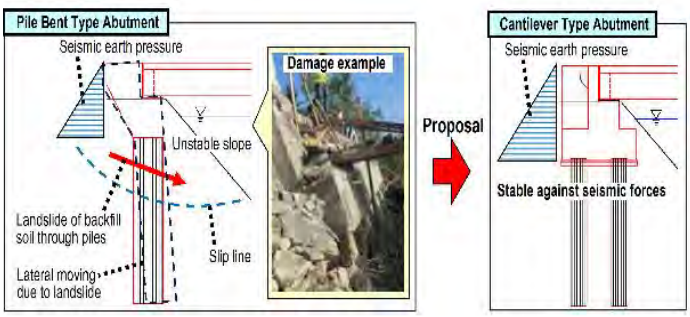


Figure 23.5-8 Pile Bent Type Abutment and its Damage

b) Pier type

Similarly, in the Philippines, it is common to use pile bent type piers inside the river due to the ease of construction. This shape, however, may disturb the river flow and cause the phenomenon of scouring locally at the pier as illustrated in Figure 23.5-9. This fact leads to the adverse impact on the structural stability of the pier. Therefore, it is proposed that a pier cross section that has an oval shape or a round shape be used in order to minimize the impact from scouring and give less adverse effect to the river flow.

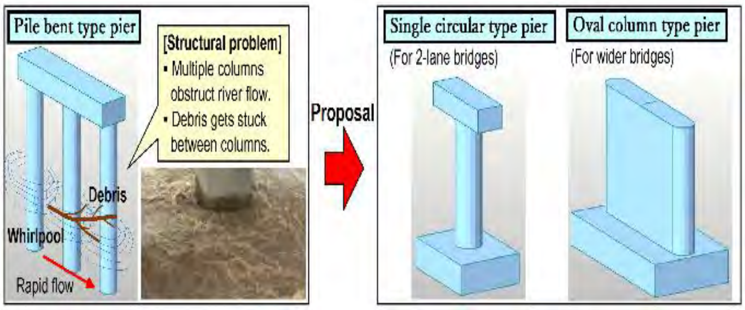


Figure 23.5-9 Pile Bent Type Pier and Scour

2) Foundation

For soft ground which is widely distributed in this location, it cannot use the spread footing for the foundation.

Therefore, regarding the foundation for the bridge using AASHTO girder as superstructure, it shall be cast-in-place piles which is generally used in the Philippines, since reaction force from superstructure is small.

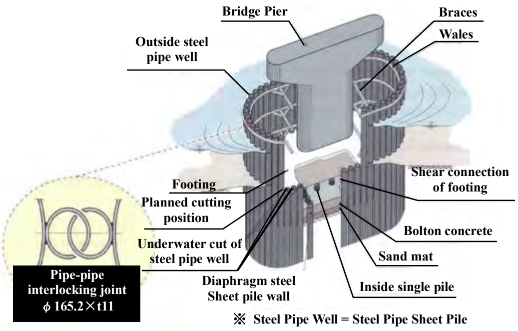


Figure 23.5-10 Steel Pipe Sheet Pile Foundation

As for the foundation for Special bridge, such as Bridge No.7, since reaction force from superstructure is large due to long span, A foundation with higher rigidity than general cast-in-place piles is required.

In addition, Steel Pipe Sheet pile foundation does not need the temporary structure, such as the temporary cofferdam at the substructure construction works in river, since permanent structure can be used also as temporary structure.

Therefore, we recommend the Steel Pipe Sheet Pile as the foundation for Special bridge.

23.6 Preliminary Construction Execution Plan and Cost Estimate

23.6.1 Contract Packaging for Initial Stage（2- lane construction）

The project road runs basically parallel to and 3 - 4 km away from the seashore. Soil condition of the project area is basically soft and settlement at road embankment is expected, therefore, replacement of soil is proposed.

There are many small and large rivers and 8 bridges with total bridge length of 1,000 linear meters are required as shown in Figure 23.6-1.

The project site is located within Cotabato City and adjacent municipalities. Urbanization along the east side of this road is expected.

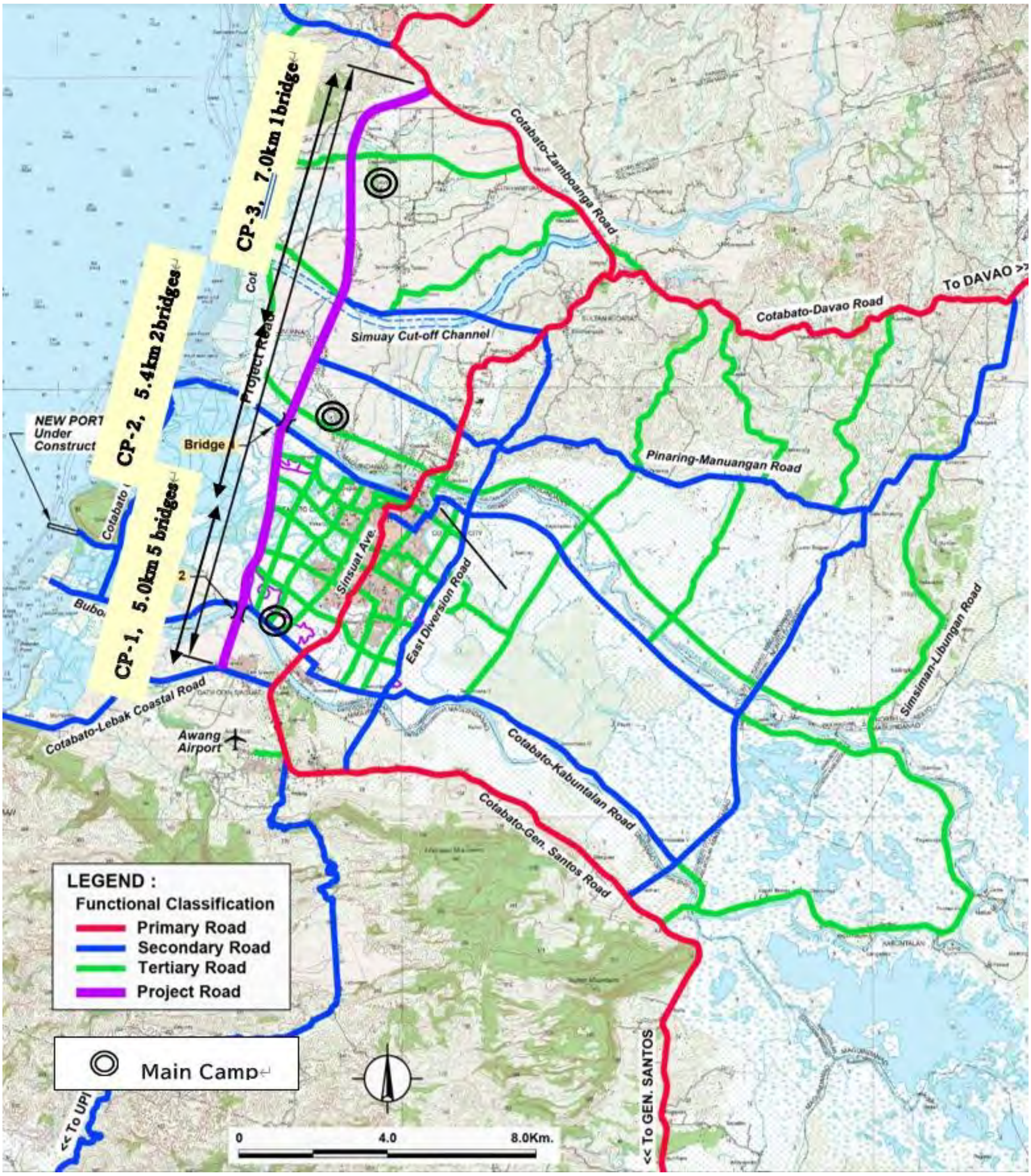


Figure 23.6-1 Construction Site and Contract Packages

The construction work is proposed to be divided into three contract packages, i.e., Contract Package-1 (5.0km), Contract Package-2 (5.5km) and Contract Package-3 (7.0 km) in due consideration of the following:

- Availability of experienced and capable contractors, the size of one contract package is set to be about PhP 3.5 billion or less.
- Construction material transport routes are considered in each contract package.
- To achieve shorter construction period and faster construction, the Project is proposed to be divided into 3 contract packages.

23.6.2 Construction Plan for West Diversion Road

(1) Scope of Civil Work

Scope of civil work for each contract package of West Diversion Road Project is shown in Table 23.6-1.

Table 23.6-1 Scope of Civil Work of Each Contract Package

		Contract Package-1	Contract Package-2	Contract Package-3	Total
Road Length		5.0km	5.5 km	7.0 km	17.5 km
Earthwork	Clearing	8.4 ha.	10.0 ha.	13.0 ha.	31.4 ha.
	Replacement of Soft soil	91,700 m^3	86,000 m^3	8,000 m^3	185,700 m^3
	Embankment by Borrow	584,100 m^3	920,500 m^3	1,044,400 m^3	2,549,000 m^3
Pavement Work		PCCP (t=280mm), 33,260m^2	PCCP (t=280mm), 39,270m^2	PCCP (t=280mm), 51,410m^2	PCCP (t=280mm), 123,940m^2
Shoulder Work		PCC shoulder (t=150mm) =24,390m2	PCC shoulder (t=150mm) =28,800m2	PCC shoulder (t=150mm) =37,700mm2	PCC shoulder (t=150mm) =90,890m2
Bridge Work		Bridge No. 1	Bridge No. 6	Bridge No. 8	
		L= 245m	L=150m	L=170m	
		Bridge No. 2	Bridge No. 7		
		L=90m	L=170m		
		Bridge No.3			
		L=90m			
		Bridge No.4			
		L=40m			
		Bridge No.5			
		L=40m			
		Subtotal	**Sub-total**	**Sub-total**	
		5 Bridges	**2 Bridges**	**1 Bridge**	**8 Bridges**
		L=505m	**L=320m**	**L=170m**	**L=995m**
Drainage and Slope Protection Work	Road Underpass	1 Place L=23 m	2 Places L=50 m	5 Places L=124 m	8 Places L=197 m
	Farm road underpass	-	1 Place L=24 m	-	1 Place L=24 m
	RCBC	-	1 Place L=30 m	4 Places L=118 m	5 Places L=148 m
Miscellaneous	Guardrail	2,020 m	2,390 m	3,120 m	7,530 m
	Coco Net	40,850 m^2	48,220 m^2	63,120m^2	152,190m^2
Approach Road Length		L1=4.9 km	L3=2.5 km	L8 =5.6 km	
		L2=1.4 km	L4 =2.1 km		
			L5 =2.0 km		
			L6 =1.8 km		
			L7 =4.4 km		
		6.3 km	12.8 km	5.6 km	24.7 km

Source: JICA Study Team

Approach road is designed with a total of 24.7 km of the 8 routes from the urban area and main road to the West Diversion Road as shown in the Figure 23.6-2.

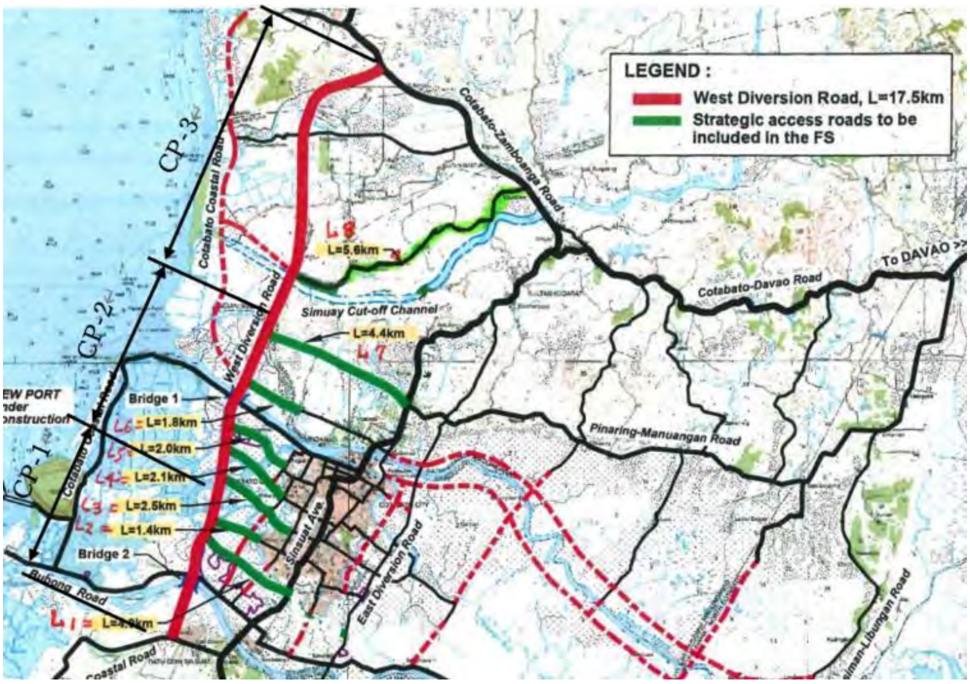


Figure 23.6-2 Routes of Approach Road

(2) Construction Equipment

Major construction equipment necessary for each contract package of the project is shown in Table 23.6-2**.**

Table 23.6-2 Construction Equipment for Each ContractPpackage

Category	Equipment	
Earth work	Backhoe (0.8 m^3) Bulldozer (20 t) Pay loader (1.5 m^3)	Dump truck (12 yd^3) Vibratory roller (10 t) Water truck (15 m^3)
Pavement work	Road grader Transit mixer (30 m^3)	Concrete screed (5.5 hp) Concrete vibrator
Bridge work	Drilling rig (300 hp) Crawler crane (190 hp)	Generator (300 kw)

Source: JICA Study Team

(3) Material Sources, Labor Force and Equipment

Sources of Material, Labor Force and Equipment required for each contract package is shown in Table 23.6-3.

Table 23.6-3 Sources of Material, Laboure and Equipment

Item	Conditions
Common Soil from Borrow Source	Mangit hill quarry (North side 20km of WDR Project) Dimapatoy hill quarry (South side 20km of WDR Project)
Gravel & Sand	Simuay river quarry (East side 10km of WDR Project) Dimapatoy river quarry (South side 10km of WDR Project)
Other materials	Cotabato City, Davao City, Cebu City,
labour force	Skilled labour: Employed from Cotabato City and other nearby areas of Mindanao Unskilled labour: Employed from neighbour barangays
Construction equipment	Leased from equipment lease company in Cotabato City, Davao City, and other cities in Mindanao. If necessary, procured from other areas.

(4) Camp Location

A main camp location is proposed at the south, Center and north side of Cotabato City for each Contract Package, whereas, a main camp for each contract is proposed at the eastern side of the project as shown in Figure 23.6-3.

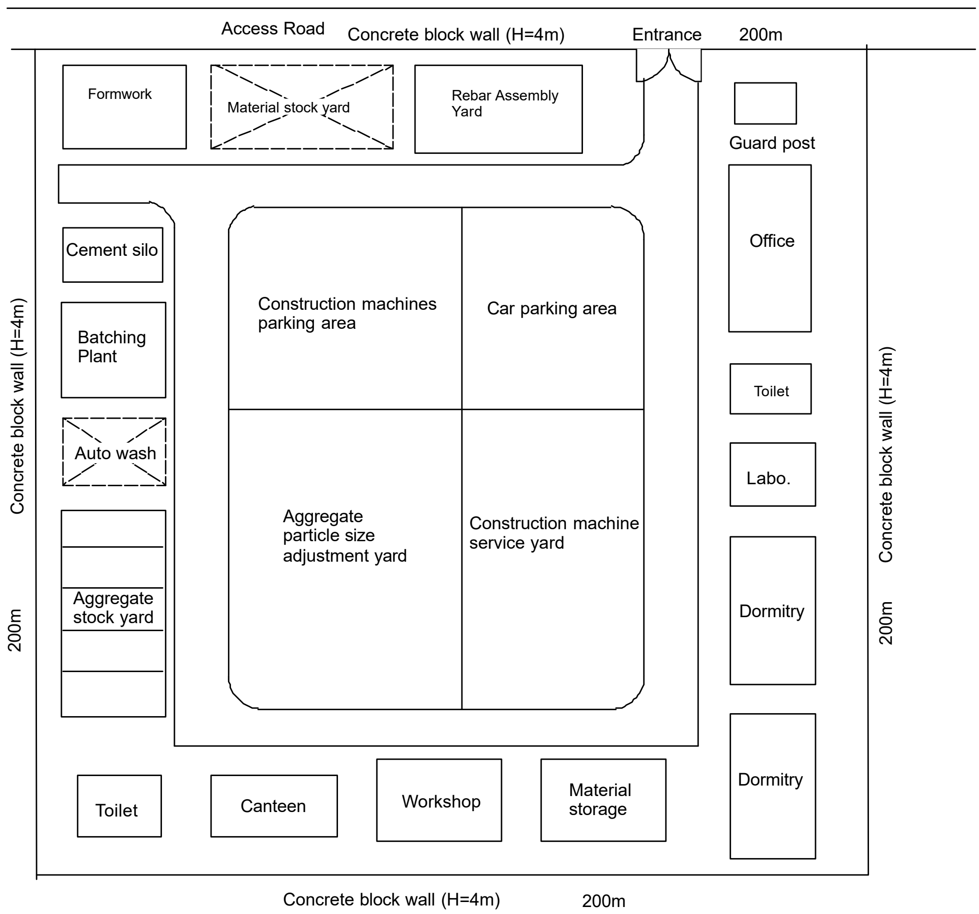


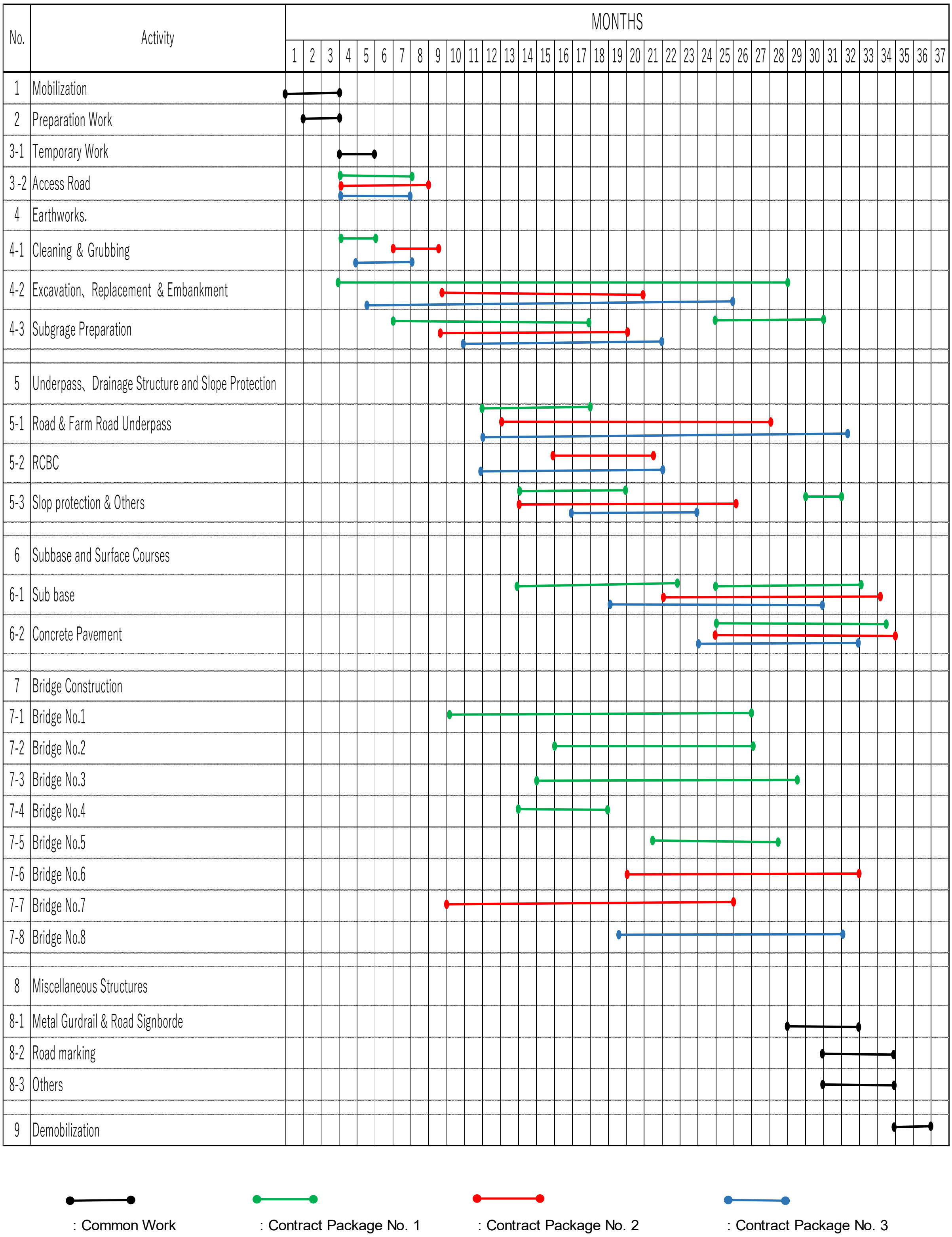
Figure 23.6-3 Proposed Typical Main Camp Yard Layout

23.6.3 Construction Schedule

Proposed construction schedule is shown in Table 23.6-4. Total construction period is estimated to be 36 months.

Table 23.6-4 Construction Schedule for West Diversion Road Project

Table 22.8-1 Construction Schedule for WEST DIVERSION ROAD



23.6.4 Construction Cost Estimate

(1) Cost Estimation Component

Construction Cost estimates were prepared based on the following parameters:

- Unit prices for civil work items were estimated using year 2020 market prices.
- Facilities for engineers and other general requirements were estimated based on previous costs of similar projects.
- Construction cost was composed of nine components, as follows:

A. Facilities for Engineers	E. Surface Course
B. Other General Requirements	F, Bridge Structure
C. Earth Work	G. Road and Farm Underpass, Drainage and Slope Protection
D. Subbase and Base Course	H. Miscellaneous Itemsl

(2) Methodology Adopted for Construction Cost Estimates

The unit price was applied to estimated quantity of each work item based on preliminary design, to come-up with construction cost for each work item.

While the provision of facilities and/or field office for engineers and other general requirements, such as, project billboards, occupational safety and health program, traffic management, mobilization/demobilization, etc. were based on costs of previous similar project.

(3) Procedures Undertaken to come-up with Construction Cost Estimate

The followings were used to derive the construction cost.

- Labor Costs
- Equipment Costs: Equipment lease cost indicated in Association of Carriers and Equipment Lessors, ACEL was used.
- Material Costs were based on the prices determined and announced by DPWH.

(4) Unit Price Analysis

1) Cost of Material

Cost of materials was based on the cost provided by DPWH.

Table 23.6-5 Materials Unit Prices

REF. NO.	DESIGNATION	UNIT	UNIT PRICE
M200.01-0001	AGGREGATE SUBBASE COURSE MATERIAL	m3	571.00
M311.13-0013	CURING COMPOUND	L	30.00
M311.20-0020	STEEL FORMS 30 CM WIDTH	m	79.00
M404.04-0004	REINFORCING STEEL BARS DEFORMED GRADE 60	kg	60.00
M405.02-0002	COMMON NAILS ASSORTED	kg	73.00
M405.06-0006	GRAVEL G1	m3	526.27
M405.11-0011	FINE AGGREGATE	m3	434.80
M405.14-0014	LUMBER GOOD	bd-ft	10.00
M405.22-0022	PLYWOOD ORDINARY (0.0125m x 1.4m x 2.44m)	pc	165.00
M700.02-0002	PORTLAND CEMENT	bag	265.00
M900.10-0010	GREASING	L	251.00
M9000.16-0016	Asphalt Sealant	L	578.95
M9000.47-0047	Pipe Sleeve, 1" Ø	m.	41.20

source: DPWH:BARMM (2020)

2) Cost of Equipment

The cost of equipment is based on “ACEL” 2020 rental rates which include operator’s wages, fringe benefits, fuel, oil, lubricants, and equipment maintenance.

Table 23.6-6 Equipment

REF. NO.	DESIGNATION	NO. OF UNIT	HOURLY RATE
Eqp.1.1	Payloader, LX80-2C, 1.50 m3/1.95 yd3, 110HP	1	1,733.00
Eqp.2.1	**Plate Compactor, 400-500 Gasoline Engine, 5HP**	1	3,938.00
Eqp.7.1	One Bagger Mixer, 4-6 ft3/min	1	172.00
Eqp.7.2	Transit Mixer, 5 m3	1	1,461.00
Eqp.8.1	Dump Truck, 12 yd3, 290HP	1	1,544.00
Eqp.8.4	Water Truck/Pump (16000L), 360HP	1	2,450.00
Eqp.14.1	Concrete Vibrator, Flexible Shaft Type 2" Head dia. w/ 5 Amperes Gasoline Drive Unit	1	92.25
Eqp.14.3	Bar Cutter, 25 mm Maximum Rebar dia. (Grade 40), Single Phase	1	219.75
Eqp.15.1	Concrete Batch Plant	1	1,759.50
Eqp.19.1	Bulldozer, D6R STD, 6FR (1997-up), 165HP	1	4,159.00
Eqp.19.2	**Bulldozer w/ Ripper,D6R STD, 6FR (1997-up), 165HP**	1	4,782.85
Eqp.19.3	Motorized Road Grader, G710A, 140HP	1	2,173.00
Eqp.19.5	Vibratory Roller, SD100D, 10mt, 125HP	1	2,498.00
Eqp.19.7	**Backhoe (Caterpillar), 318C, BTG(2003), 0.88 m3/1.16 yd3, 94HP**	1	2,304.00
Eqp.19.8	**Backhoe (Caterpillar) w/ Breaker, 318C, BTG(2003), 0.88 m3/1.16 yd3, 94HP**	1	2,995.20
Eqp.19.10	Concrete Screeder, Wacker Truss Screed, 5.5HP	1	545.00
Eqp.19.17	**Chainsaw, HUSQVARNA 2100 CD w/ CR22, 7 ft Reach, 9 in Standard Blade**	1	70.73
Eqp.19.18	**Concrete Saw, 14" Balde Ø w/ 4 3/4" Cutting Depth, 7.50HP**	1	176.64

source: ACEL(2020)

3) Cost of Labor

Labor costs used in the analysis are the wages authorized by the Department of Labor and Employment. All fringe benefits, such as vacation and sick leaves, Workmen’s Compensation Act, GSIS and SSS contributions, allowance, and bonus, are taken into account.

Table 23.6-7 Labor Rates

Resource Code No.	Description	Rate per Month	Rate per Day	Rate per Hour
L-4	Foreman	1,444.39	1,031.71	128.96
L-5	Leadman	1,301.53	929.66	116.21
L-6	Heavy Equipmentt Operator	1,178.66	841.90	105.24
L-7	Highly Skilled Operator	1,178.66	841.90	105.24
L-8	Light Skilled Operator	1,136.75	811.96	101.50
L-9	Driver	1,054.84	753.46	94.18
L-10	Skilled Laborer	1,054.84	753.46	94.18
L-11	Semi-skilled Labor	972.93	694.95	86.87
L-12	Unskilled Laborer	849.11	606.50	75.81

source: DOLE Region XII(2019)

(5) Estimated Construction Cost

Construction cost of Sub-Project 1 was estimated based on the above parameters and procedures. The summary of civil work cost is shown in Table 23.6-8.

Table 23.6-8 Summary of Construction Cost (West Diversion Road Project)

ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	165.6	2.1%	9.5	-
B	Other General Requirement	L.S.	1	105.1	1.4%	6.0	-
C	Earth Work	L.S.	1	3,247.4	41.7%	185.6	-
D	Subbase and Base Course	L.S.	1	84.9	1.1%	4.9	-
E	Surface Course	L.S.	1	300.7	3.9%	17.2	-
F	Bridge Structure (Total)	m	1,000	2,463.5	31.7%	-	2.5
	Bridge-1	m	245	406.1	-	-	1.7
	Bridge-2	m	90	189.7	-	-	2.1
	Bridge-3	m	90	176.6	-	-	2.0
	Bridge-4	m	40	83.9	-	-	2.1
	Bridge-5	m	40	93.1	-	-	2.3
	Bridge-6	m	150	293.0	-	-	2.0
	Bridge-7	m	170	931.2			5.5
	Bridge-8	m	170	289.9			1.7
G	Box Culvert、Drainage and Slope Protection	L.S.	1	262.4	3.4%	15.0	-
H	Miscellaneous Item	L.S.	1	220.2	2.8%	12.6	-
I	Approach Road	L.S.	1	932.4	11.9%		-
Grand Total				7,782.2	100.0%	250.7	

Source: Estimated by JICA Study Team

Table 23.6-9 Summary of Construction Cost (CP-1)

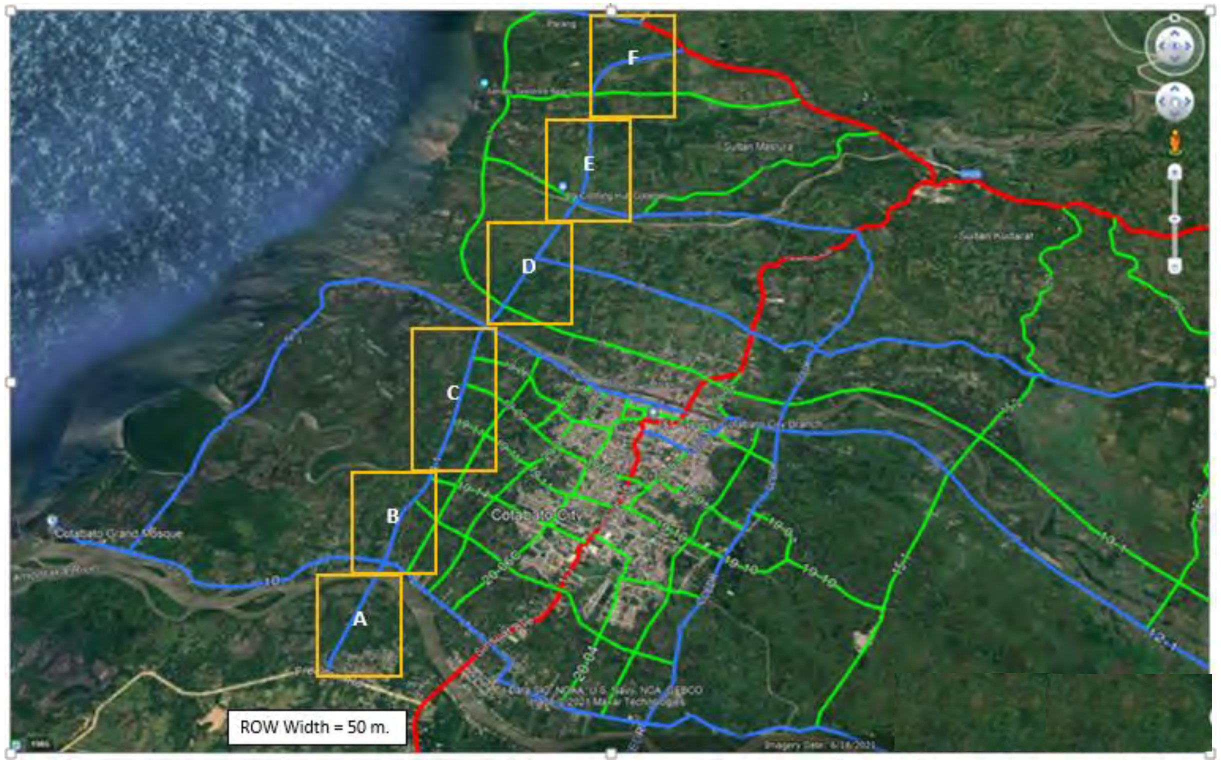
ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	55.2	2.4%	11.2	-
B	Other General Requirement	L.S.	1	34.2	1.5%	6.9	-
C	Earth Work	L.S.	1	812.8	35.4%	164.7	-
D	Subbase and Base Course	L.S.	1	22.8	1.0%	4.6	-
E	Surface Course	L.S.	1	80.7	3.5%	16.4	-
F	Bridge Structure (Total)	m	505	949.4	41.3%	-	1.9
	Bridge-1	m	245	406.1	-	-	1.7
	Bridge-2	m	90	189.7	-	-	2.1
	Bridge-3	m	90	176.6	-	-	2.0
	Bridge-4	m	40	83.9	-	-	2.1
	Bridge-5	m	40	93.1	-	-	2.3
G	Box Culvert、Drainage and Slope Protection	L.S.	1	45.9	2.0%	9.3	-
H	Miscellaneous Item	L.S.	1	59.1	2.6%	12.0	-
I	Approach Road	L.S.	1	237.8	10.3%		-
Grand Total				2,297.9	100.0%	225.1	

Table 23.6-10 Summary of Construction Cost (CP-2)

ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	55.2	1.7%	10.0	-
B	Other General Requirement	L.S.	1	35.1	1.1%	6.3	-
C	Earth Work	L.S.	1	1,194.7	36.5%	215.8	-
D	Subbase and Base Course	L.S.	1	26.9	0.8%	4.9	-
E	Surface Course	L.S.	1	95.3	2.9%	17.2	-
F	Bridge Structure (Total)	m	320	1,224.2	37.4%	-	3.8
	Bridge-6	m	150	293.0	-	-	2.0
	Bridge-7	m	170	931.2	-	-	5.5
G	Box Culvert、Drainage and Slope Protection	L.S.	1	85.7	2.6%	15.5	-
H	Miscellaneous Item	L.S.	1	69.8	2.1%	12.6	-
I	Approach Road	L.S.	1	483.2	14.9%	-	-
Grand Total				3,270.1	100.0%	282.3	

Table 23.6-11 Summary of Construction Cost (CP-3)

ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	55.2	2.5%	7.9	-
B	Other General Requirement	L.S.	1	35.8	1.6%	5.1	-
C	Earth Work	L.S.	1	1,239.9	56.0%	176.5	-
D	Subbase and Base Course	L.S.	1	35.2	1.6%	5.0	-
E	Surface Course	L.S.	1	124.7	5.6%	17.8	-
F	Bridge Structure (Total)	m	170	289.9	13.1%	-	1.7
	Bridge-8	m	170	289.9	-	-	1.7
G	Box Culvert、Drainage and Slope Protection	L.S.	1	130.8	5.9%	18.6	-
H	Miscellaneous Item	L.S.	1	91.3	4.1%	13.0	-
I	Approach Road	L.S.	1	211.4	9.6%		-
Grand Total				2,214.2	100.0%	243.9	



F	Km 13+600 – Km 17+500	L = 3.90 km	A = 3,900 x 50 x Php 400 = 78.00 M. Php
E	Km 10+500 – Km 13+600	L = 3.02 km	A = 3,020 x 50 x Php 200 = 30.20 M. Php
D	Km 6+980 – Km 10+500	L = 3.52 km	A = 3,520 x 50 x Php 200 = 35.20 M. Php
C	Km 3+400 – Km 6+800	L = 3.40 km	A = 3,400 x 50 x Php 500 = 85.00 M. Php
B	Km 1+700 – Km 3+400	L = 1.70 km	A = 1,700 x 50 x Php 500 = 42.50 M. Php
A	Km 0+000 – Km 1+500	L = 1.50 km	A = 1,500 x 50 x Php 400 = 30.00 M. Php
			Total
			= 300.90 M. Php

Source: JICA study team

Figure 23.6-4 ROW Acquisition

23.6.5 Construction Plan and Cost for 4-lane road

(1) Construction Plan and Packaging

After opening and operating the 2 lanes West Diversion Road for about 18 years, widening to 4 lanes will be planned and implemented.

The construction work is divided into three contract packages, same as in Initial stage and shown in Table 23.6-12.

- In due consideration of availability of experienced contractors, the size of one contract package should be about Ph. 3.5 billion or less.
- Construction material transport routes should be considered in contract packaging due to availability of 2 lane Initial Stage West Diversion Road, as access road for construction of widening to 4-lane road
- To achieve shorter construction period and faster construction, the Project is proposed to be divided into 3 contract packages.

Scope of civil work of the project for widening work is shown in Table 23.6-12**.**

Table 23.6-12 Scope of Civil Work of Each Contract Package for Widening 4-lane

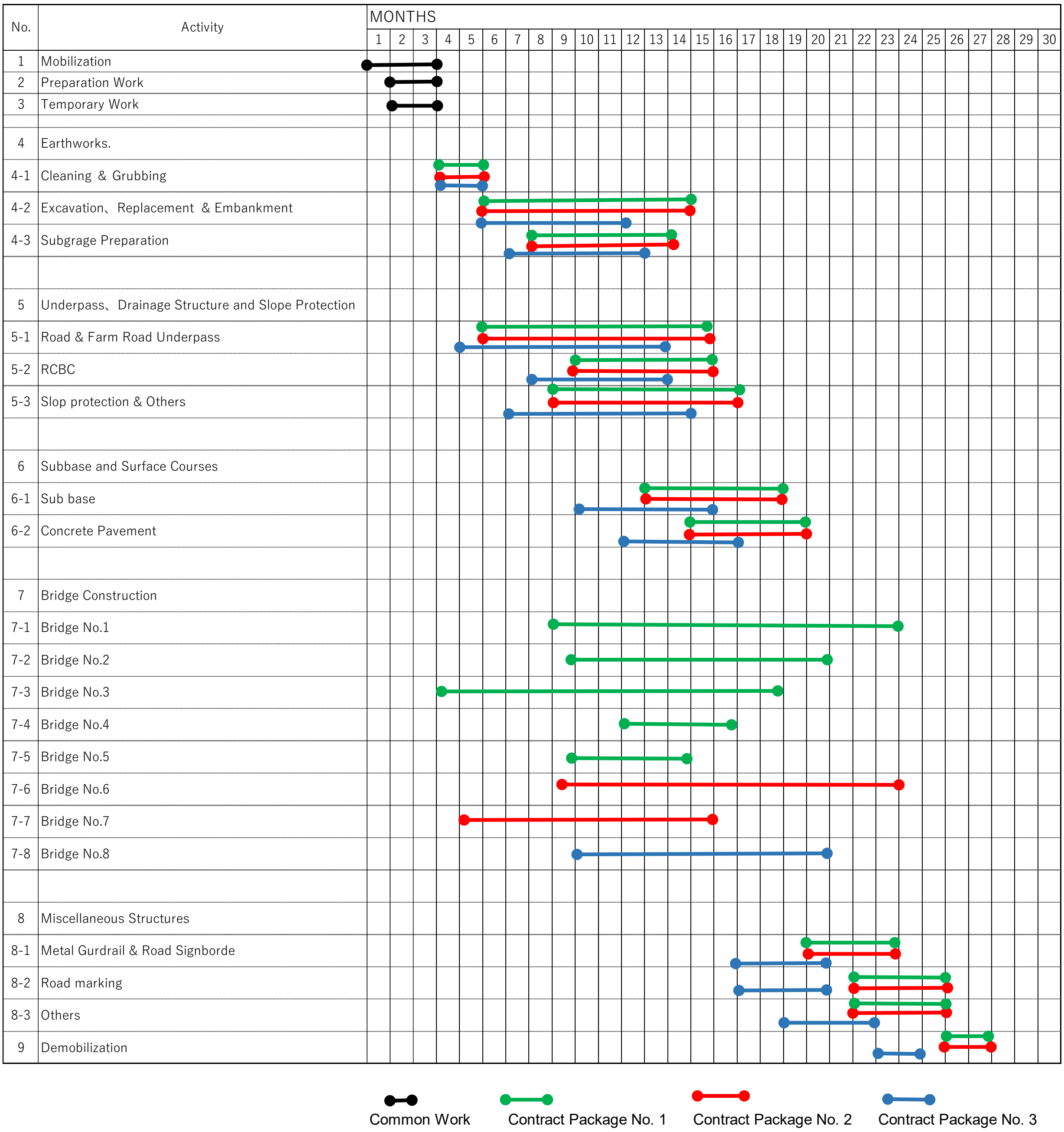
		Contract Package-1	Contract Package-2	Contract Package-3	Total
Road Length		5.0km	5.5 km	7.0 km	17.5 km
Earthwork	Clearing	6.8 ha.	7.9ha.	10.5ha	25.2 ha.
	Replacement of Soft soil	26,600 m^3	18,100 m^3	6,200 m^3	50,900 m^3
	Embankment by Borrow	272,400 m^3	412,700 m^3	480,700 m^3	1,165,800 m^3
Pavement Work		PCCP (t=280mm), 28,830m^2	PCCP (t=280mm), 34,020m^2	PCCP (t=280mm), 44,530m^2	PCCP (t=280mm), 107,380m^2
Shoulder Work		PCC shoulder (t=150mm) 2,220m^2	PCC shoulder (t=150mm) 2,610m2	PCC shoulder (t=150mm) 3,420m^2	PCC shoulder (t=150mm) 8,250m2
Bridge Work		Bridge No. 1	Bridge No. 6	Bridge No. 8	
		L= 245m	L=150m	L=170m	
		Bridge No. 2	Bridge No. 7		
		L=90m	L=170m		
		Bridge No.3			
		L=90m			
		Bridge No.4			
		L=40m			
		Bridge No.5			
		L=40m			
		Subtotal	**Sub-total**	**Sub-total**	
		5 Bridges	**2 Bridges**	**1 Bridge**	**8 Bridges**
		L=505m	**L=320m**	**L=170m**	**L=995m**
Drainage and Slope Protection Work	Road Underpass	1 Place	2 Places	5 Places	8 Places
		L=11m	L=22m	L=61m	L=94m
	Farm road underpass	-	1 Place	-	1 Place
			L=11m		L=11m
	RCBC	-	1 Place	4 Places	5 Places
			L=11m	L=44m	L=55m
Miscellaneous	Guardrail	1,610m	1,910m	2,500m	6,020m
	Coco Net	32,680 m^2	38,570m^2	50,500m^2	121,750m^2

Source: JICA Study team

(2) Construction Schedule

Proposed construction schedule of widening to 4-lane road is shown in Table 23.6-13. Total construction period is estimated to be 27 months.

Table 23.6-13 Construction Schedule for 4-lane Road



(3) Construction Cost Estimate

Construction cost of 2 lane Widening West Diversion Road project was estimated based on the above Table 23.6-8 parameters and procedures. The summary of civil work cost is shown in Table 23.6-14.

Table 23.6-14 Summary of Construction Cost for 4 lanes

ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	139.3	3.0%	8.0	-
B	Other General Requirement	L.S.	1	92.0	2.0%	5.3	-
C	Earth Work	L.S.	1	1,463.3	31.2%	83.7	-
D	Subbase and Base Course	L.S.	1	45.6	1.0%	2.6	-
E	Surface Course	L.S.	1	188.9	4.0%	10.8	-
F	Bridge Structure (Total)	m	1,000	2,463.5	52.6%	-	2.5
	Bridge-1	m	245	406.1	-	-	1.7
	Bridge-2	m	90	189.7	-	-	2.1
	Bridge-3	m	90	176.6	-	-	2.0
	Bridge-4	m	40	83.9	-	-	2.1
	Bridge-5	m	40	93.1	-	-	2.3
	Bridge-6	m	150	1,224.2	-	-	8.2
	Bridge-7	m	170	1,221.1			7.2
	Bridge-8	m	170	385.0			2.3
G	Box Culvert、Drainage and Slope Protection	L.S.	1	117.3	2.5%	6.7	-
H	Miscellaneous Item	L.S.	1	176.0	3.7%	10.1	-
Grand Total				4,686.0	100.0%	127.1	

Source: Estimated by JICA Study Team

Table 23.6-15 Summary of Construction Cost (CP-1)

ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	47.3	3.1%	9.6	-
B	Other General Requirement	L.S.	1	30.6	2.0%	6.2	-
C	Earth Work	L.S.	1	363.6	23.9%	73.7	-
D	Subbase and Base Course	L.S.	1	12.2	0.8%	2.5	-
E	Surface Course	L.S.	1	50.7	3.3%	10.3	-
F	Bridge Structure (Total)	m	505	949.4	62.3%	-	1.9
	Bridge-1	m	245	406.1	-	-	1.7
	Bridge-2	m	90	189.7	-	-	2.1
	Bridge-3	m	90	176.6	-	-	2.0
	Bridge-4	m	40	83.9	-	-	2.1
	Bridge-5	m	40	93.1	-	-	2.3
G	Box Culvert、Drainage and Slope Protection	L.S.	1	22.2	1.5%	4.5	-
H	Miscellaneous Item	L.S.	1	47.2	3.1%	9.6	-
Grand Total				1,523.2	100.0%	116.3	

Table 23.6-16 Summary of Construction Cost (CP-2)

ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	47.3	2.4%	8.4	-
B	Other General Requirement	L.S.	1	31.0	1.6%	5.6	-
C	Earth Work	L.S.	1	515.9	26.0%	93.2	-
D	Subbase and Base Course	L.S.	1	14.5	0.7%	2.6	-
E	Surface Course	L.S.	1	59.9	3.0%	10.8	-
F	Bridge Structure (Total)	m	320	1,224.2	61.6%	-	3.8
	Bridge-6	m	150	293.0	-	-	2.0
	Bridge-7	m	170	931.2	-	-	5.5
G	Box Culvert、Drainage and Slope Protection	L.S.	1	38.7	1.9%	7.0	-
H	Miscellaneous Item	L.S.	1	55.8	2.8%	10.1	-
Grand Total				1,987.3	100.0%	137.8	

Table 23.6-17 Summary of Construction Cost (CP-3)

ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	44.7	3.8%	6.4	-
B	Other General Requirement	L.S.	1	30.4	2.6%	4.3	-
C	Earth Work	L.S.	1	583.8	49.7%	83.1	-
D	Subbase and Base Course	L.S.	1	18.9	1.6%	2.7	-
E	Surface Course	L.S.	1	78.3	6.7%	11.2	-
F	Bridge Structure (Total)	m	170	289.9	24.7%	-	1.7
	Bridge-8	m	170	289.9	-	-	1.7
G	Box Culvert、Drainage and Slope Protection	L.S.	1	56.4	4.8%	8.0	-
H	Miscellaneous Item	L.S.	1	73.0	6.1%	10.4	-
Grand Total				1,175.5	100.0%	126.1	

23.7 Proposed Implementation Plan

23.7.1 Proposed Implementation Schedule

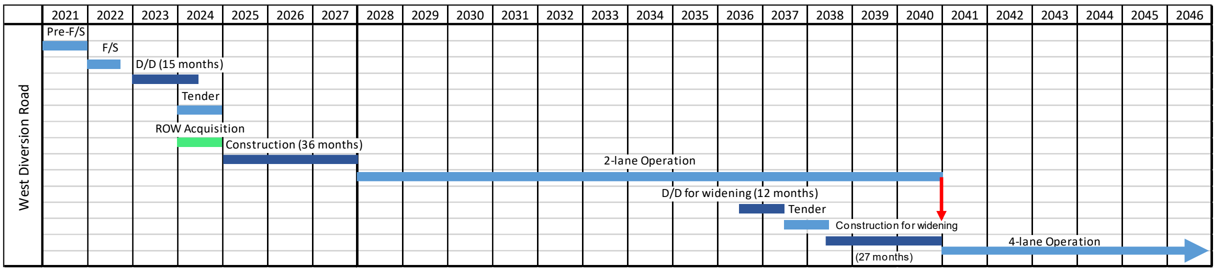
With the recent expansion of the urban area, a new road which supports sound urbanization is urgently needed. Traffic volume is yearly increasing and the existing roads are experiencing serious traffic congestion, thus additional roads to support smooth traffic movement are required. Thus, realization of proposed West Diversion Road is urgently required.

Overall implementation schedule of West Diversion Road is shown in Figure 23.7-1. Pre-feasibility Study (this Study) is completed by the end of 2021. Following this study, the Feasibility Study (FS) needs to be undertaken in 2022. It is also expected that soon after completion of FS, the project is appraised by a lending institution within 2022.

The detailed engineering design is scheduled to start in 2023 and completed by the middle of 2024. Meanwhile, tendering for Contractor selection needs to be completed within 2024. The right-of-way acquisition is also implemented and completed within 2024. Construction which takes three (3) years will start in 2025 and be completed by the end of 2027. West Diversion

Road is expected to be in service at the beginning of 2028. It is also expected that widening of the West Diversion Road from 2-lane to 4-lane will be required by 2041. The detailed design for the widening of this 2-lane road to a 4-lane road needs to be done by around 2036. Widening from 2-lane to 4-lane will be required about 13 to 14 years after opening to traffic in 2028.

Figure 23.7-1 Overall Implementation Schedule of West Diversion Road



Source: JICA Study Team

23.7.2 Project Implementing Organization

The Central Office of the Department of Public Works and Highways (DPWH) is proposed to be the implementing office of this project. The Ministry of Public Works (MPW) of the BARRM Government is proposed to be the co-implementing office. Since MPW has not yet implemented a large scale foreign-assisted projects, it is hoped that MPW staff will learn how to handle such a foreign-assisted projects under the staff of Central Office of DPWH.

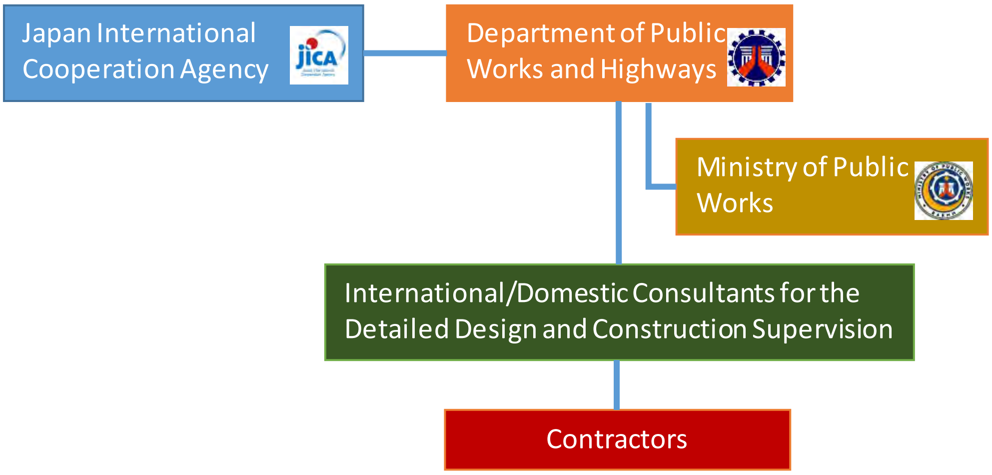


Figure 23.7-2 Proposed Implementation Organization

23.7.3 ROW Acquisition

ROW Acquisition has been a bottleneck in the project implementation. Common problems encountered are as follows:

- Some landowners do not have a land title.
- Some landowners do not keep evidence of land tax paid.

Several foreign-assisted projects which require land acquisition have been or being implemented in the area and measures how to cope with such cases have been or being established. How to expedite right-of-way acquisition should be learned from the past projects and such previous experiences should be used as reference for smooth right-of-way acquisition.

23.8 Environmental and Social Considerations

The level of environmental and social consideration for the project road (West Diversion Road Project as part of the Urban Infrastructure Development in Greater Cotabato Area Study) is at "pre-feasibility study level". Environmental and Social considerations is essential as an integral part of project development from the earliest stages such as pre-feasibility study level, to provide information about the general environmental and social setting of the project area. Through the preliminary environmental and social impact assessment (ESIA) during the action plan study, potential environmental and social issues shall be sorted, and recommendation for deep study in the F/S shall be pointed out, based on the secondary existing data, the site visit and opinions from relevant stakeholders. The result of preliminary ESIA during action plan study stage will be utilized for EIA contents during the F/S.

Hence, further study and evaluation shall be implemented during the Feasibility Study (F/S) stage in the future.

23.8.1 Project Component

WDR is planned not only as an arterial road project but also as barrier to protect Cotabato City and nearby municipalities from the possible damage caused by tsunami. Furthermore, this is aimed to reduce traffic congestion by constructing another road to divert a portion of the traffic away from the lone arterial road of Cotabato City (Sinsuat Avenue). Moreover, it will strengthen the link of Cotabato City and Polloc Port, the primary port of Bangsamoro region. Project components which will cause adverse impact during road construction and bridges installation.

This is a pre-feasibility study without fixed conditions, such as associated projects by other proponents, relevant activities including soil borrow pits, quarry pits, construction roads, camp yards etc., and pre-acquired land for the project, therefore, further study and confirmation shall be implemented during the next phase which is the F/S. As far as the action plan study in this survey is concerned, implementation timing is not yet decided, and other specific planned or reasonably defined developments are not yet available. Therefore, the survey focuses on direct impact caused by the project during action plan study stage, and the possibility of cumulative impact will be considered during F/S.

The project involves the construction of a 17.5 km arterial road (dike road which serve as tsunami barrier) and eight (8) access roads, of which five (5) would be situated within Cotabato City. These access roads are important components of the project to increase the functionality of the arterial road.

23.8.2 Environmental Study Area

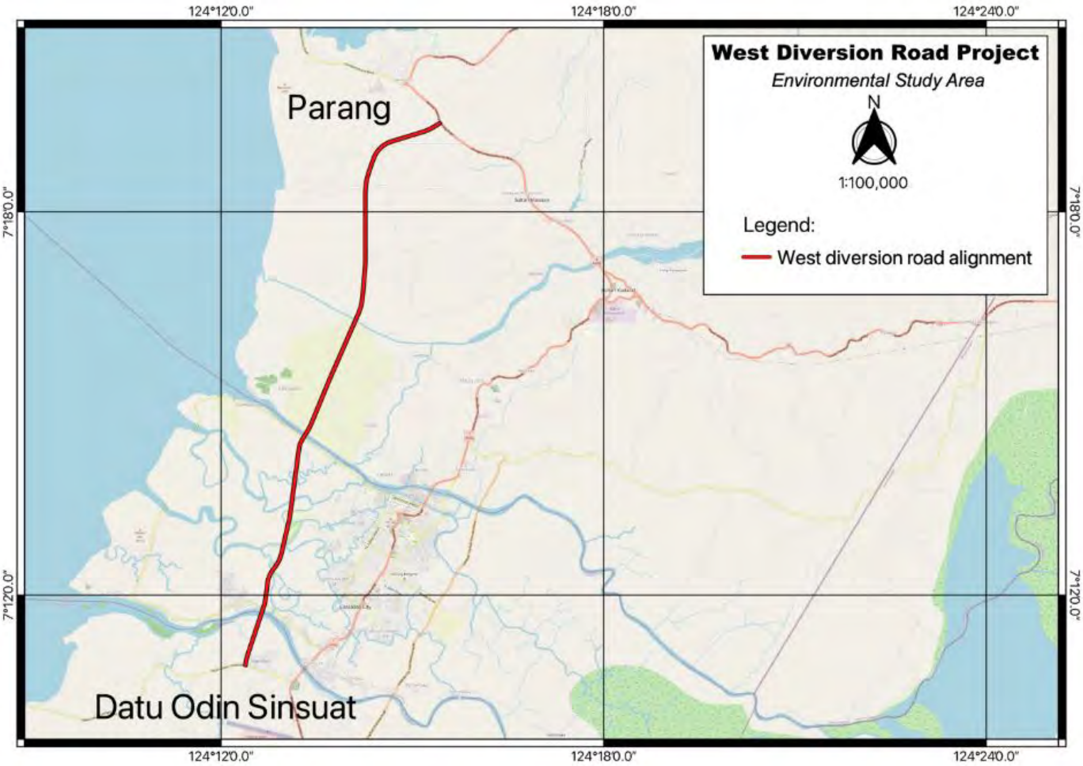
In order to conduct initial environmental and social impact assessment at action plan study, LGUs in and around the proposed project area are selected as the study area. The Project will traverse the four municipalities as shown in Table 23.8-1. The study area for secondary data collection of environmental and social baseline covers the geographic jurisdictions of the entire alignment.

The study area involving site visits, public consultations and initial environmental and social impact assessment at action plan study covers the entire section of the Project.

Table 23.8-1 LGUs in the Proposed Project Area

<table>
<tr><th>Island</th><th>Region</th><th>Province</th><th>Municipality/City</th><th>Barangays</th><th>Project Component</th></tr>
<tr><td rowspan="15">Mindanao</td><td rowspan="15">BARMM</td><td rowspan="15">Maguindanao</td><td>Datu Odin Sinsuat (DOS)</td><td>Semba</td><td rowspan="15">Project Alignment (17.5km)</td></tr>
<tr><td rowspan="3">Cotabato City</td><td>Kalanganan II</td></tr>
<tr><td>Mother Kalanganan</td></tr>
<tr><td>Kalanganan I</td></tr>
<tr><td rowspan="2">Sultan Kudarat</td><td>Inawan</td></tr>
<tr><td>Sambulawan</td></tr>
<tr><td rowspan="7">Sultan Mastura</td><td>Solon</td></tr>
<tr><td>Tariken</td></tr>
<tr><td>Namuken</td></tr>
<tr><td>Kirkir</td></tr>
<tr><td>Dagurungan</td></tr>
<tr><td>Boliok</td></tr>
<tr><td>Tambu</td></tr>
<tr><td>Parang</td><td>Landasan</td></tr>
</table>

Source: JICA Study Team, 2021



Source: Study Team 2021

Figure 23.8-1 Environmental Study Area

23.8.3 Baseline of Environmental and Social Conditions

The following descriptions are collected information on pollution items, natural environment, reserved areas of natural protection and cultural heritage sites, land use, living areas of indigenous people, and social conditions of land acquisition and involuntary resettlement.

(1) Natural Environment

a) Air Quality

Based on the air quality monitoring in January-February 2018 at Cotabato Station conducted by EMB Region XII, PM10 parameter was within the National Ambient Air Quality Guideline Values (NAAQGV) of the DENR. PM10 is the only parameter being monitored by the station. Other parameters such as Sulphur Dioxide (SOx), Nitrogen Dioxide (NOx), Carbon Monoxide (CO), Ozone (O3) and Lead (Pb) were not regularly monitored.

Table 23.8-2 2018 Air Quality Indices (PM10)

PM10 (24 hour)

Air Quality Levels	Ug/Ncm
Good	0 - 54
Fair	55 - 154
Unhealthy for Sensitive Groups	155 - 254
Very Unhealthy	255 - 354
Acutely Unhealthy	355 - 424
Emergency	425 - 504

Source: DENR-EMB NAAQGV, Philippine Clean Air Act of 1999

Table 23.8-3 PM10 Air Quality Monitoring

Station Number:		COTABATO STATION							
Address:		Cotabato City							
SAMPLE CONDITION:									
A									
		Sunny							
A		B			C		D		
No unusual		Sand/Dust			Construction		Farming Operation		
Condition					Nearby				
E		F			G		H		
Fire Nearby		Sampler			Rain		Others		
		Malfunction							
REMARKS		Results relates only as samples as collected.							
Result of Sampling				PM 10		SO_2		NO_2	
PM10	SO2	NO2		26.3	Ug/Ncm		ppm		ppm
(PASSED)									
SAMPLE COLLECTION DATA									
	DATE			TIME		TEMP	PRESSURE	FILTER	VOL.
	YEAR	MONTH	DAY	HOUR	MIN.			WEIGHT (mg)	STD
FINISH	2018	Feb.	1	0640H		29.2	0.990	147.298	17.510
START	2018	Jan.	31	1130H				146.849	

Source: EMB Region XII, 2018

b) Noise and Vibration

According to the survey and consultation undertaken under the Road Network Development Project in Conflict-Affected Areas in Mindanao Project (2019), local people expressed increase of noise problem due to construction and eventually operation of a new roads as some of their concerns. Monitoring data along the project sites are not measured at the time of action plan study. National standard of NPCC and IFC/WB are as shown in the following Table 23.8-4 and Table 23.8-5.

Table 23.8-4 NPCC Noise Standard

Category	Maximum Allowable Noise (dBA) by time periods		
	Daytime (9:00 AM – 6:00 PM)	Morning/Evening (5:00 AM to 9: AM/ 6:00 PM to 10 PM)	Nighttime (10:00 PM to 5:00 AM)
AA	50	45	40
A	55	50	45
B	65	60	55
C	70	65	60
D	75	70	65

- Class AA – a section of contagious area which requires quietness, such as areas within 100 meters from school site, nursery schools, hospitals and special house for the aged
- Class A - a section of contagious area which is primarily used for residential area
- Class B - a section of contagious area which is primarily a commercial area
- Class C - a section of contagious area reserved as light industrial residential area
- Class D - a section which is primarily reserved as heavy industrial area

Source: DENR-EMB

Table 23.8-5 IFC/WB's EHS Standard (Noise)

Receptor	One Hour LAeq (dBA)	
	Daytime 07:00 -22:00	Nighttime 22:00 – 07:00
Residential; industrial; educational	55	45
Industrial; commercial	70	70

Source: International Finance Corporation

c) Odor

There are observed offensive odor in the area close to existing dumping site of the Cotabato City.

Figure 23.8-2 Solid Waste Management Facility of Cotabato City

d) Water Quality

The Project will traverse 3 rivers (Tamontaka River, Rio Grande de Mindanao and Ambal-Simuay River) and roughly 24 creeks. The said water bodies are mostly serving as surface water sources for domestic use.

Studies on water quality in Cotabato City and its environs are very critical in shaping policies and legislations in line with the maintenance of the river and in keeping the health and sanitation of the communities mostly along and within the river system. The water may become contaminated with coliform bacteria which may lead to various public health concerns. In a study conducted by Notre Dame University (NDU) in 2012, data were generated to come up with the physico-chemical and bacteriological analyses of the waters in the major rivers of Cotabato City. The study covers the following rivers: Rio Grande de Mindanao along Quirino Bridge and Matampay Bridge, Rio Grande de Tamontaka, and Esteros river.

Table 23.8-6 Physico-chemical and bacterialogical analyses of Rio Grande deMindanao

Depth	The depth of the rivers ranges from 45.0 – 53.7 m. The river along Esteros is the shallowest (29.4 m) while the deepest is along Quirino (53.7 m).
Temperature	Water temperature was measured in situ at 9 -10 AM. The water temperature of the four rivers ranges from 29–30 0C.
pH	The pH of the rivers ranges from 7.35 – 7.54 which is considered to be slightly alkaline.
TSS	Tamontaka river has 18mg/L total suspended solids, Rio Grande has 28 mg/L, Esteros has 37 mg/L, and Matampay has 39 mg/L. It shows that Matampay river has the highest TSS and Tamontaka has the lowest.
Turbidity	The turbidity value of Matampay river is 40.8 NTuS, Esteros with 10.4 NTuS, Quirino with 5.7 NTuS and Tamontaka with 1.2 NTuS. Among the four rivers, Matampay river is most turbid and Tamontaka is least turbid.
Salinity:	The rivers along Quirino and Matampay have the salinity value of 0.2 ppt while Esteros and Tamontaka do not contain dissolved salts.
Dissolve Oxygen	The rivers have high DO values (Quirino, Matampay, Esteros and Tamontaka is 6.23 mg/L, 5.9mg/L, 5.0 mg/L, and 6.06 mg/L respectively). This means that there is adequate amount of oxygen necessary to support aquatic life.
Biological Oxygen Demand	The BOD values of the rivers show that these rivers are not considered to be polluted The BOD values of Quirino, Matampay, and Esteros rivers is 3.33 mg/L while in Tamontaka river is 3.0 mg/L.
Coliform bacteria	Coliform bacteria are present in all water samples.

Source: Water Analysis of Cotabato City Rivers and its Implication to Human and Aquatic Life, July 2012, Corcoro, Alombro, Herrera, NDU-CAS

Table 23.8-7 Water Quality Monitoring Results for Cotabato Rivers, 2012

Parameters	Unit	Results: Cotabato City Rivers (see above table)	Guidelines*	WHO's Global Overview of National Regulations and standards for Drinking-Water Quality (2018)	Remarks
pH	-	7.35 – 7.54	**6.5-9.0**	6.5 - 8.5	Above the standard
DO	mg/L	6.23 mg/L, 5.9mg/L, 5.0 mg/L, and 6.06 mg/L	**minimum 5**		Above the standard
BOD	mg/L	3.33 mg/L	7		Below the standard
Total Suspended Solids (TSS)	mg/L	18mg/L; 28 mg/L; 37 mg/L; 39 mg/L	80	-	Below the standard
Total Dissolved Solids (TDS)	mg/L	6.23 mg/L, 5.9mg/L, 5.0 mg/L, and 6.06 mg/L	-	-	Good quality
Fecal coliform	MPN/ 100mL		200	Must not be detectable in any 100 ml sample (recommended median value – 0 per 100 ml)	Present in all study sites
Nitrates	mg/L		7	50mg/l	
Phosphates	mg/L		0.5	-	
Surfactants as MBAS	mg/L		1.5	-	
Oil and Grease	mg/L		2	Non set (recommended median value - 0.1mg/l)	
Ammonia	mg/L		0.05	Non set (recommended median value - 0.2mg/l)	

Notes: * DAO 2016-08 (Water Quality Guidelines and General Effluent Standards for Class C waters).
** Method Detection Limit
- No specified standards/values/unit
Bold font – Values are not consistent with the guidelines

Source: DENR-EMB and JICA Study Team 2021

Table 23.8-8 Metro Cotabato Water District Coverage

Section	Covered Barangays	2015	2020	2025	2030	2035
Section 1	Kalanganan 2, Mother Brgy. Tamontaka, Tamontaka 1, Tamontaka 2, Tamontaka 3, Rosary Heights 10, Rosary Heights 11	3,994	4,630	5,368	6,223	7,214
Section 2	Rosary Heights 8, Rosary Heights 9, Rosary Heights 6, Rosary Heights 7, Poblacion 8, Poblacion 9	4,390	5,089	5,900	6,839	7,928
Section 3	Rosary Heights 4, Rosary Heights 5, Rosary Heights 2, Rosary Heights 3, Mother Barangay Poblacion, Poblacion 2, Poblacion 3, Poblacion 4	5,448	6,316	7,322	8,488	9,840
Section 4	Mother Barangay Rosary Heights, Rosary Heights 1, Rosary Heights 13, Poblacion 1, Poblacion 7, Poblacion 5, Poblacion 6	4,989	5,784	6,705	7,773	9,011
Section 5	Rosary Heights 12, Bagua 3, Mother Barangay Bagua, Bagua 2, Lugay-Lugay (Bagua 1), Mother Barangay Kalanganan	4,355	5,048	5,852	6,784	7,865
Total		**23,176**	**26,867**	**31,147**	**36,107**	**41,858**

Source: Feasibility Study, Cotabato City Septage Management Program, 2019, MCWD

Table 23.8-9 Utility Services, by Classification

Utility Services	Water	Electricity
Classification	**Average rate per cu.m. in Peso**	**Ave. rate per kilo watt in Peso**
Residential	18.40	31.458
Commercial	36.80	32.898
Industrial	36.80	26.247
Semi Commercial	27.60	
Minimum consumption	180.40	

Source: Colight as of July 2013, MCWD

e) Hydrology

Geographically, Cotabato City is situated in low-lying delta. The city being surrounded by two major rivers, the Rio Grande de Mindanao and Rio Grande de Tamontaka makes it a delta. As such, as much as seventy percent of the city is below sea level. Most of the city's land area is prone to flash floods, which have made development difficult and expensive. This has also hindered development thrust in the outlying and lower elevation areas of the city.

The city is crisscrossed by meandering and braided creeks and rivers like the Matampay, Parang, Timako, Esteros and Miwaruy. These water bodies serve as sources of both agricultural, industrial and domestic water requirements of some rural barangays. These rivers also serve as the natural drainage flow of the city's wastes.

In Datu Odin Sinsuat (DOS), the hydro-geological feature is such that the surface is irregular especially in the south-western portion. The south-eastern part is plain area in which lowland crops are mostly grown.

A proposed seaport would be put up off the coast of Kalanganan to further spur development of the city. The barangays of Kalanganan would be the immediate beneficiaries of whatever development that may attach to it. Without doubt, high intensity uses would evolve in the area. Thus, convergence of different land and water uses would be identified on the area for agro-industrial uses. At the coastal area of Kalanganan and along its riverbanks, mangrove planting would suitable and recommended. If assessed as feasible, a marine fish sanctuary could also be established at the offshore area of Kalanganan.

Rivers and creeks traversing the city would remain as a transport route to different barangays in the city by rural residents, farmers and fisherfolks of this city as well as adjacent municipalities. Some residents of adjacent municipalities ship their products through these rivers and creeks.

f) Land Classification and Cover

Under the 1987 Constitution lands are classified either as public domain or private lands. Public Domain are considered lands for public use or for government use and those which are unappropriated. Unappropriated use are further classified into Non-Disposable and Non-Alienable; and Alienable and Disposable (A & D). Alienable and disposable lands refer to those lands of the public domain which have been the subject of the present system of classification and declared as not needed for forest, mineral purposes or national parks.

The project area covering four (4) municipalities/city (Parang, Sultan Mastura, Sultan Kudarat and Datu Odin Sinsuat) and the city of Cotabato are covered under A & D land classification (Figure 23.8-3). The location of the WDR alignment where project component will be undertaken is within A & D or private land. A & D land includes those land for agriculture, residential use, institutional use, educational use, commercial use and industrial areas.

Source: Study Team 2021

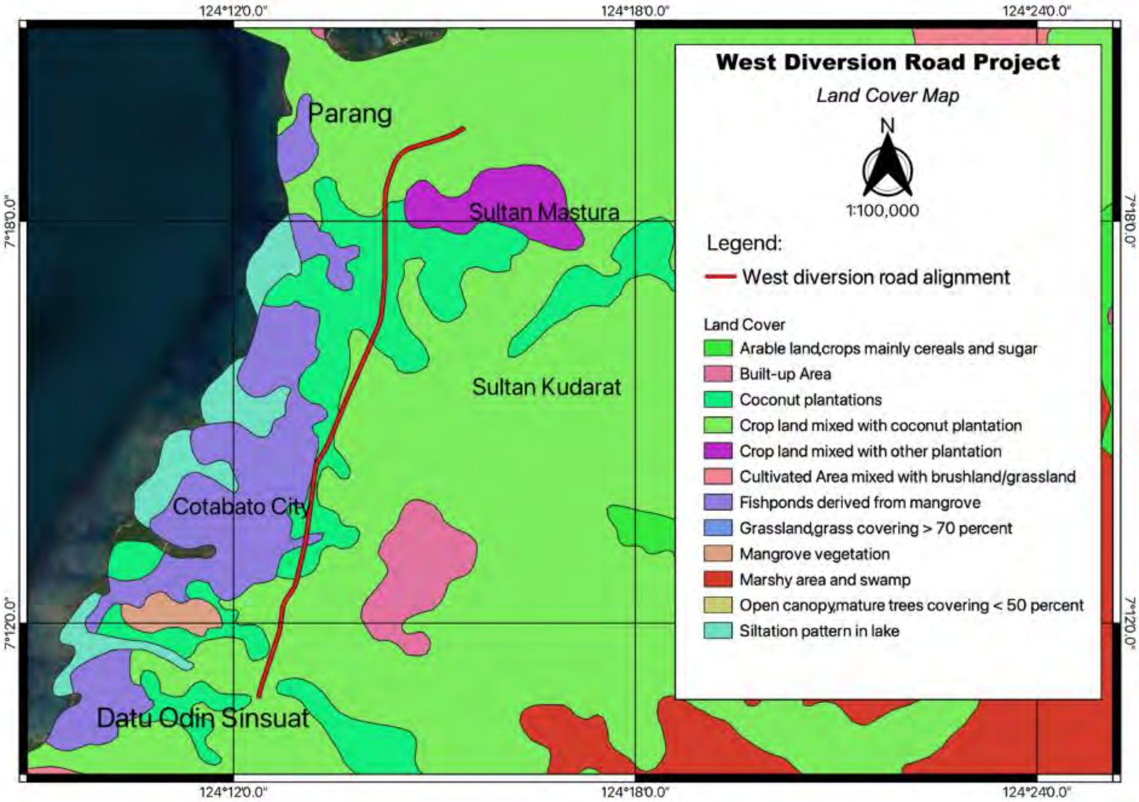
Figure 23.8-3 Land Classification Map (NAMRIA, 2015)

In terms of land cover (Figure 23.8-4), project area is primarily covered by coconut plantation and cropland mixed with coconut plantation from Datu Odin Sinsuat to Parang. The Project will traverse the agricultural area of DOS, Cotabato City, Sultan Kudarat and Sultan Mastura. The east starting section of the proposed alignment (Barangay Semba, Municipality of DOS) and the end section of the proposed alignment (Barangay Tambu, Municipality of Sultan Mastura) are designed for the new road network amidst vast agricultural areas. The main land use along the proposed alignment is agricultural/farmlands. The proposed alignment will traverse at least 3 river mouths (Tamontaka River, Rio Grande de Mindanao and Ambal-Simuay River) and several creeks.

Based on satellite image interpretation, it is expected that some existing natural resources and few structures (in areas with residential communities) are affected due to the implementation of the Project.

As secondary impact of the project, development along the project area may cause adverse impact on land use and local resources, such as agriculture, forestry and water.

Mangrove vegetation and siltation pattern in lake are mostly located along the shoreline in Cotabato City while Marshy area and swamp where situated in some areas of Datu Odin Sinsuat. Fishponds derived from mangrove also have a significant area within the project site.



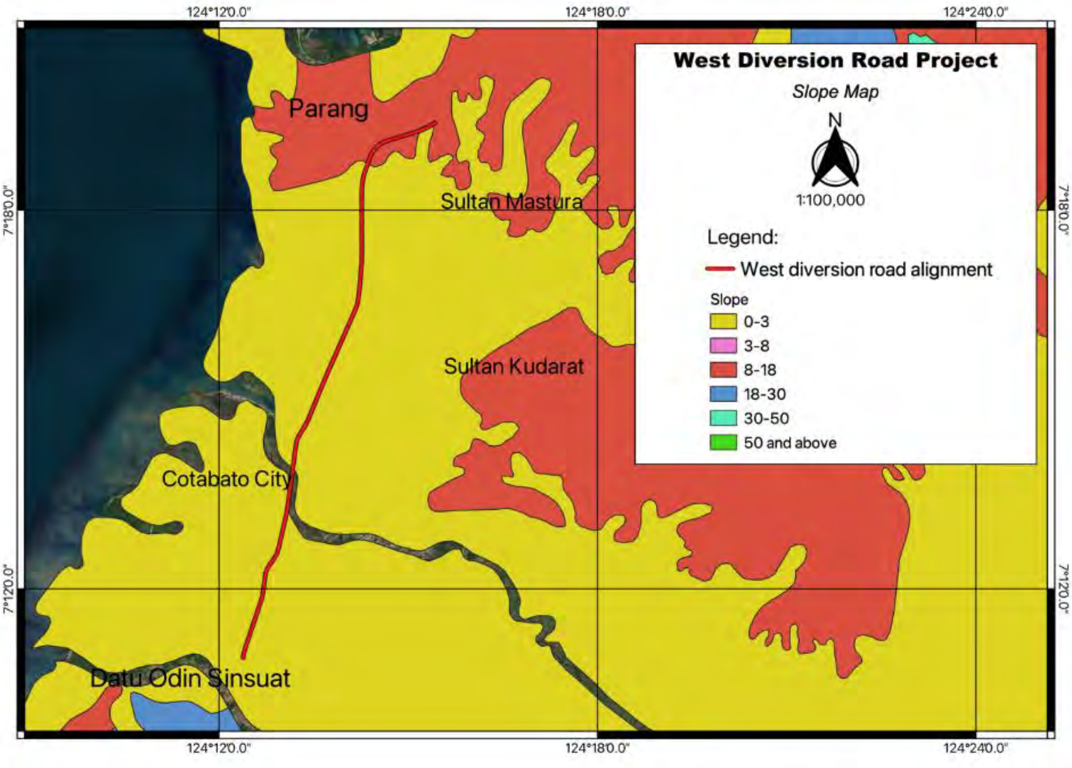
Source: Study Team 2021

Figure 23.8-4 Land CoverMap (NAMRIA, 2015)

g) Topography and Geology

The city is situated in the lowest portion of Maguindanao province. The City of Cotabato with its 37 barangays spans an area with marked landscapes of flat, level to nearly level, very gently sloping to gently undulations to moderately sloping or rolling. It is basically a delta formed by two big rivers, the Tamontaka River and the Rio Grande de Mindanao. Basically 70% of its total land area is below sea level. There are only 2 existing elevated areas in the city, the PC Hill and the Timako Hill with an altitude of 90 and 150 feet, respectively.

Figure 23.8-5 presents the slope characterized by the project area. It shows that the proposed project component as well as the WDR alignment does not fall under critical slope areas. Slope ranges to level to nearly level (0-3%) and rolling to moderately steep (8-18%).



Source: Study Team 2021

Figure 23.8-5 Slope Map

During the earthquake of 1976, nine (9) significant infrastructures in the city were damaged and two (2) ground rupturing were recorded. Most of these earthquakes related misfortune was located within the Central Business District (CBD). The CBD covers the area bounded by Quezon Avenue on the south and east. Shariff Kabunsuan Boulevard on the north and Mabini St. on the west. The damage infrastructures (buildings) either had its pillar sank or totally collapsed. Studies conducted later by the Department of Environment and Natural Resources-Mines and Geosciences Bureau reveals that the CBD is susceptible to liquefaction. Liquefaction is a process that transforms the behavior of a water-saturated deposit from a solid to liquid. The vulnerable deposits for liquefaction are sand layers below the water table and poorly densified.

As it is, development cost in the CBD is high since building owners/ proponents will have to put more piles and contract a certified structural engineer to designed an appropriate foundation or support that would go along with the shaking of the ground just to be assured that the occupants would be safe once fortuitous events such as ground trembling occurs. Existing roads in CBD may be vulnerable to earthshaking as the previous earthquake has recorded ground rupturing in the area.

h) Ground Subsidence

The city has been identified to be within the earthquake belt. This was clearly demonstrated during the 1976 earthquake that caused vast destruction of lives and properties.

The susceptibility of the soils in the area to be eroded were those that are Erosion Potentials located along the banks of the Matampay River, Tamontaka River and the Rio Grande de

Mindanao. Barangays located along low-lying areas occasionally experience flash floods brought about by heavy rains. It is also noted, however, that more than half of the city's land area is below sea level, thus seemingly an appropriate drainage system could prevent flooding and clogging of waterways. Potential flooding areas are those found in almost all four directions in the north, south, east and west. The meandering and occasional braided courses of rivers like Rio Grande de Mindanao, Tamontaka River, Tarbung, Kakar, Matampay, Miwaruy, Masukul, Manday, Lugay-lugay, Bagua and Kalanganan Rivers and Pagalamatan Creek could aggravate the flooding hazards of the area where these rivers are found especially during rainy season. Approximately, 85% of the soils in the area have good external and internal drainage while the other 15% have poor external and internal drainage.

i) Bottom Sedimentation

Broadly, there are three (3) soil types present in the area. The most dominant soil type found in Cotabato which make up 80% of the total land area or 14.079 hectares is the Faraon clay type. These are moderately good lands suitable for limited cultivation and less appropriate for urban development due to soil characteristics. Urban development would require very careful, and complex soil utilization practices. This type is found in the innermost portion of the area, the Tamontaka clay type found in the areas along Rio Grande de Mindanao on the north and south directions total to 2,640 hectares or 15% of the city's total land area. This type of soil has high fertility level, good lands which can be cultivated and suited for urban development but requires carefully, planned erosion control measures. The third type of soil embracing an area of 880 hectares or barely 5% of the city's total land area is where settlements and other urban uses are highly concentrated. These are very good lands which can be cultivated safely and require very simple soil management practices and with high density for urban development.

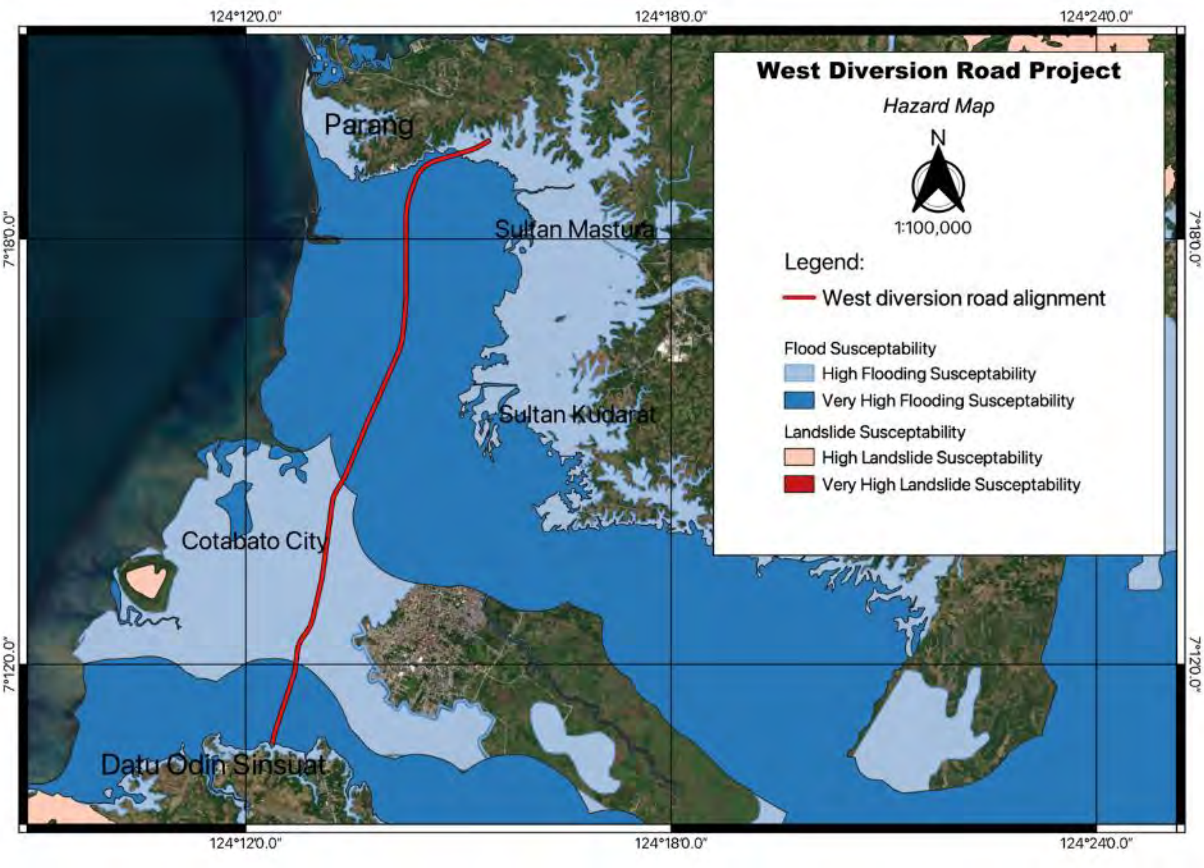
j) Hazards and Disaster

About half of the city's total land area is considered to be below sea level and therefore flood prone whether due to tidal intrusion from sea water or heavy precipitation from within or from upstream. The areas of Barangays Poblacion 8 and 9, Barangays Tamontaka 1, 2, 3, 4 and 5 are inundated whenever heavy rainfall occurs persisting for a considerable number of days. This is further aggravated as the city major river the Rio Grande de Mindanao is heavily silted so much so that the capacity of the river to contain the flow is greatly diminished resulting sometimes to over spilling of water to low leveled barangays of the city. The city is at the receiving end of what is considered the biggest river basin in Mindanao the Cotabato-Agusan River Basin. The government has put efforts to improve the situation. Periodic dredging of silt from Rio Grande de Mindanao has greatly improved the situation.

The occurrences of flooding were attributed to the city's geographical characteristic that is being a delta and the drainage outlet of Liguasan and Agusan Marshes, Pulangi and Allah Rivers, and other major rivers located upstream towards the sea. This has made Rio Grande de Mindanao and Tamontaka River heavily silted thus, causing flooding in the low-lying areas of the city. This situation was further aggravated with the periodic presence of water hyacinth along the Rio

Grande de Mindanao. In the last two (2) years, the city has experienced three (3) flooding occurrences and has affected 89% of the city's total barangays. Incidences of flooding in the city is also attributed to the off-course overflowing of Simuay River towards Rio Grande de Mindanao which has contributed greater volume of water to the already limited drainage outflow capacity of the said river due to heavily siltation. The recurring incidences of flooding has resulted a lot of damage to the daily activities of the residents of the city notwithstanding the emotional anxiety every time there is a heavy downpour.

Figure 23.8-6 shows the very high and high susceptibility to flooding and landslide at the project area.



Source: Study Team 2021

Figure 23.8-6 Hazard Map

k) Environmental Sensitive Areas

Environmentally sensitive areas (ESAs) are landscape elements or places which are vital to the long-term maintenance of biological diversity, soil, water or other natural resources both on the site and in a regional context.

Mangrove Areas

On the western part of the Cotabato city lies the mangrove stand covering an area of 408.64 has or 2.31% of the total area. Mangrove is known to provide nursery grounds for fish, crustaceans and mollusk especially those located along tidal mudflats. Inland mangroves provide protection to communities from storm surges, waves, tidal currents and typhoons. It is also an excellent site as recreational grounds for bird watching and observation of other wildlife such as egrets which is still present in the coastal areas. However, these areas are quite distant to the project sites.

Marine/Coastal Ecosystem

The coastal and marine ecosystem of Cotabato City was once rich with biotic and abiotic component. Mangrove trees extend inland providing a fine habitat to different wildlife. Various species of egrets wander freely, crustaceans and mollusk abound and fishes as well. Niches were rich and diverse complementing each other and ensured their survival. Gradually, anthropogenic activities cross the threshold and sluggishly destroyed the ecological balance that once existed. Some mangrove stands were unsustainably cut to give way to settlements and fishponds, some were even cut for fuel or building materials, all for economic reasons.

In Datu Odin Sinsuat, there has a wide tract of fishery areas. It has four coastal barangays, namely: Tapian, Kusiong, Badak and Linek.

Marine Ecosystem may not have impacts on the project since it is significantly distant to the project area.

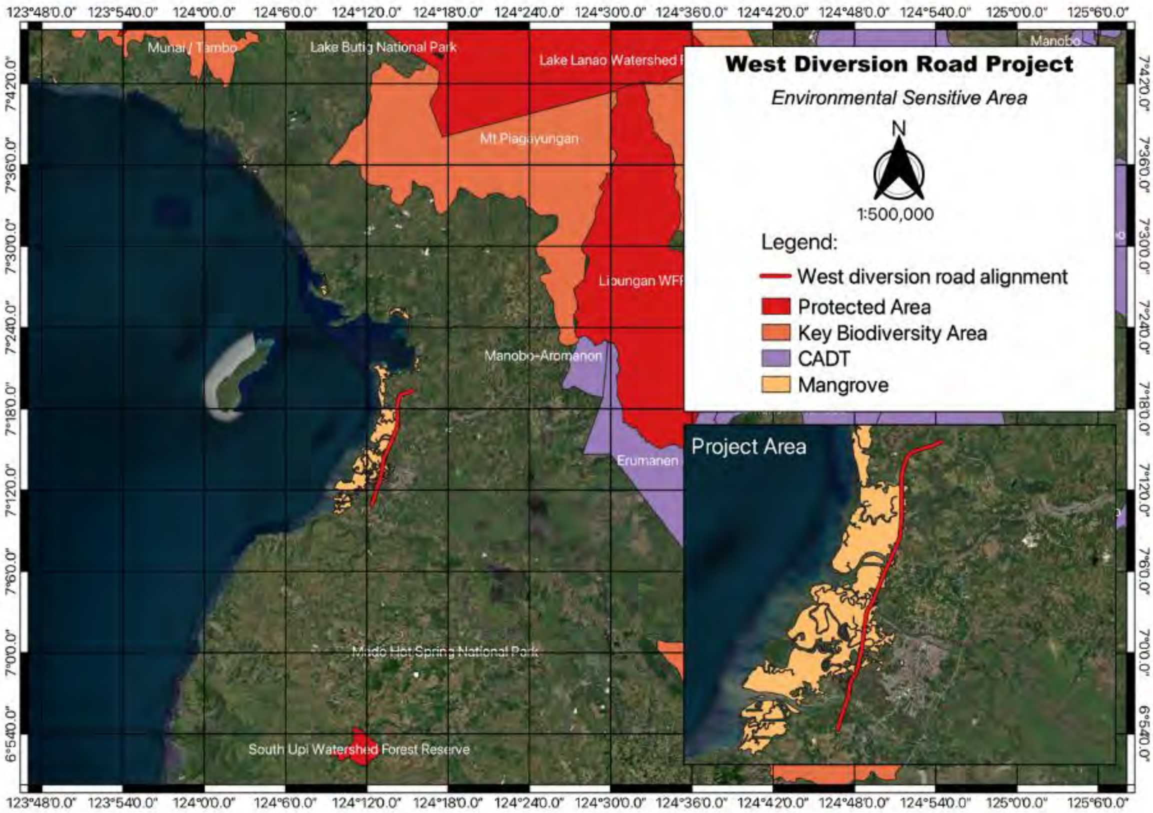
Ancestral Domain

The project will not encroach any ancestral domain or lands, territories, and resources of indigenous peoples (Figure 23.8-7).

Protected Area/ Key Biodiversity Area

Protected areas are declared s such under RA No. 7586 or the National Integrated Protected Area System (NIPAS) Act or declared as such through other issuances from pertinent national and local government. Although there are protected areas designated by the Philippines government around the project area as shown in Figure 23.8-7, there is no protected area in the project area or the protected area on which the project may have impacts.

The closest is mangrove area but based on the land cover and classification presented in Figure 23.8-3 and Figure 23.8-4, the alignment is characterized by coconut plantation and cropland mixed with coconut plantation and within Alienable and Disposable land classification.



Source: Study Team 2021

Figure 23.8-7 Environmental Sensitive Area at the Project Site (NAMRIA, Geoportal.gov.ph)

(2) Socio-Economic Environment

Based on the 2020 statistical survey, the total population of city and municipalities in the influence area of the study is about **572,299** as shown in Table 23.8-10.

Table 23.8-10 Population of the Proposed Project Area

Municipality/ City	Area (km^2)	Population (2020)	Population Density ($Person/km^2$)
Cotabato City	176.00	325,079	1,800
Datu Odin Sinsuat (DOS)	461.80	116,768	250
Sultan Kudarat	712.91	105,121	150
Sultan Mastura	242.07	25,331	100
Total Population (4 LGUs)	1,592.78	572,299	360

Source: Socio-Economic Profile of LGUs; JICA Study Team, 2021

1) Socio-economic Profile of the Project Area

a) Cotabato City

Population and Demography

The city has a land area of 176.00 square kilometers or 67.95 square miles. Its population as determined by the 2020 Census was 325,079. This represented 6.63% of the total population of the SOCCSKSARGEN region. Based on these figures, the population density is computed at 1,847 inhabitants per square kilometer or 4,784 inhabitants per square mile.

Existing Social Infrastructures and Services

- **Education**

Education has always been regarded as an important priority in governance. Regardless of cultural diversity and traditions, it is made accessible to all. The government is driven to make education a priority as it contributes to peace building and economic development.

Overcrowded schools are a serious problem in Cotabato City school systems student-to-classroom ratio is a concern over the past years. As a result, students find themselves trying to learn while jammed into spaces never intended as classrooms, such as libraries, gymnasiums, laboratories, lunchrooms, and even open spaces. This somehow have an impact in the quality of learning among students.

There are still barangays in the city that have no presence of public schools. Out of the 37 barangays of Cotabato City, 11 do not have any public schools that will cater to the growing number of school-going population. By Year 2030, the school age population projection will reach up to 297,610 individuals.

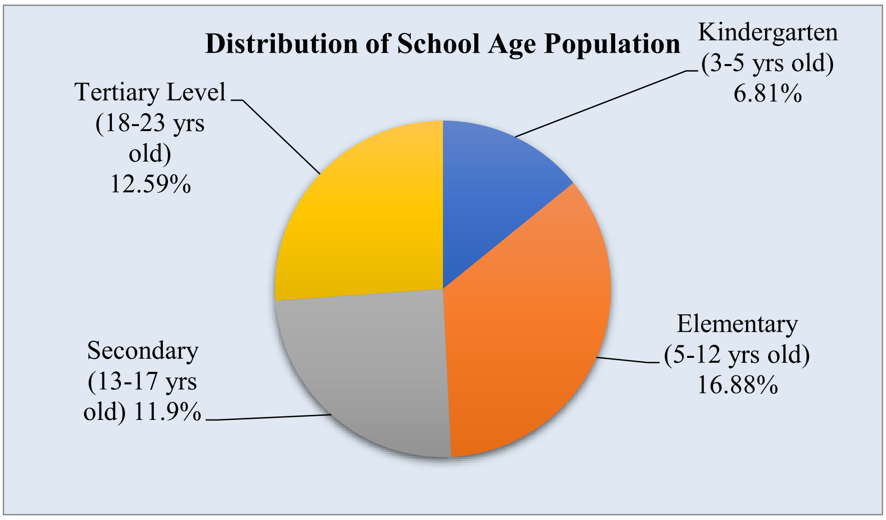
Aside from lack of classrooms, most of these public elementary schools in the city are currently in need of basic school facilities such as computer rooms, comfort rooms, libraries, home economics buildings, and water system. Except for Central Pilot Schools, not all has laboratory facilities and clinics to cater to the medical and first aid needs of the pupils.

The school going age population now refers to those who belong to ages 3 to 23 years old recorded at 144,335 students or 48.18% of the entire population (Table 23.8-11). Males dominate in number in pre-school and elementary while female dominates in secondary and tertiary level. Figure 23.8-8 presents the school-age population composition.

Table 23.8-11 Population Composition by School-Age and Sex, Year 2015

AGE GROUP	2015 BOTH SEXES	Male		Female		Sex Ratio
		No.	%	No.	%	
School Age population	144,335	71,175	23.77	73,160	24.43	97.29
Pre-school (3-5)	20,424	10,373	3.46	10,051	3.35	103.20
Elementary (6-12)	50,599	25,531	8.52	25,068	8.36	101.85
Secondary (13-17)	35,611	17,293	5.78	18,318	6.12	94.40
Tertiary (18-23)	37,701	17,978	6.00	19,723	6.59	91.15

Source: Cotabato City Eco-Profile, 2017, CPDO



Source: Cotabato City Eco-Profile, 2017, CPDO

Figure 23.8-8 Percentage Illustration of School Going Age by Level of Education

Literacy rate is presented in Table 23.8-12**.** About 90% of the total population is literate, this means able to read and write.

Table 23.8-12 Population Distribution 10 Years and Over Literacy Rate

Total Population 10 years old and over	No. of population Literate			Simple Literacy Rate		
	Total	Male	Female	Total	Male	Female
230,161	206,529	89,786	95,538	90.00	91.00	88.50

Source: RSE trends 2015

- **Health Status**

The Cotabato Regional and Medical Center (CRMC), located along Sinsuat Avenue (National Highway) is the only tertiary government hospital in the Greater Cotabato area. It is considered well-equipped and has a total bed capacity of 300.

The CRMC offers a variety of medical services ranging from the simple medical consultation through its Out-patient Department and Emergency Services to treatment of various illnesses requiring particular medical field of specialization. It has basic and modern medical equipment as well.

Cotabato City health services includes one Main Health Center, the Office on Health Services (OHS) of the city government and 43 Barangay Health Centers (BHC's) spread throughout its 37 barangays.

The OHS is manned by 5 medical doctors/physicians providing medical consultation services. The facility can perform minor surgeries and emergency treatments but refer severe cases to higher health facilities especially when it requires particular field of specialization and/or admission. The center's laboratory has basic equipment but are limited only to the conduct of urinalysis, fecalysis, sputum and smear testing. It has no blood testing equipment and other modern and advance diagnostic equipment except for a manual X-Ray machine. It has a dental clinic and a sub-dental clinic situated beside the Rosary Heights Mother Barangay Hall, along Sinsuat Avenue.

Of the existing BHCs, only 17 centers are currently occupying their own buildings. The rest are either sharing spaces with their respective Barangay Halls or situated in makeshift or borrowed buildings/houses each manned by a Midwife.

The general health situation in Cotabato City reflects inadequacy of birthing homes and basic obstetrics care facilities at the community levels and the need to enhance the implementation of basic and primary health care program and services to address the leading causes of mortality and morbidity of all ages in general but more importantly of children and mothers.

- **Transportation System**

The city's present road network system consists of grid pattern network where there is only one (1) main corridor (Sinsuat Avenue) traversing the city from south to north.

Almost all barangays are interconnected with the main backbone except for one (1) barangay that can only be accessed by water transportation. Public utility vehicles ply the routes along the major roads of the City. Non-motorized vehicles and habal-habal serve the needs of the commuters of the interior barangays. Terminals of these informal mode of transportation are situated along intersections of major city roads.

- **Protected Services**

A key priority for the police service is to ensure that it deals effectively with terrorism, serious crime and other major challenges to public safety. Protective services include counter-terrorism and extremism, serious organized and cross-border crime, civil contingencies and emergency planning, critical incident management, major crime, public order, strategic roads policing and protecting vulnerable people.

Under the Protective Services Sector, the Philippine National Police office of Cotabato City has 201 police officers. Fourteen (14) are currently detailed to different personalities, seven (7) are scheduled to retire in 2009 and are now processing their retirement papers while 13 are office based personnel assigned at various sub-stations. Only 121 field police officers, spread thinly among 7 sub-stations at strategic locations, were left to maintain and implement the needed protective service in the area. This figure is currently not absolute considering that, from time to time, some of these personnel are sent outside the city for further training and skills enhancement activities.

In terms of logistics, the police have 6 four-wheeled serviceable vehicles and eleven motorcycles distributed in the various police stations. The City Police is equipped with 2 units of closed circuit television (CCTV) camera but are yet sufficient. Police officers cannot immediately respond due to unavailability of handheld radios to fast-track communication in the police force, especially those assigned in the field.

These manpower and logistical inadequacies resulted to lesser police visibility.

The Barangay Tanod is the freedom and peace-loving citizens organized at the Barangay levels mainly aimed to respond to atrocities and violence at their respective areas. It also aims for civic purposes and community defense in line with the security program of the government. It assists the police and military personnel in some basic crime solution efforts such as gathering crime related information and, further, compliments the PNP in securing the barangays by conducting watch activities. In case of emergencies and disasters, the Tanod provides quick response assistance.

Despite the presence of Barangay Tanod as an auxiliary support to public safety, the index crime rate from 2005 to 2009 showed an alarming increase in terms of grave offenses committed against persons. The figures for non-index crimes or light offenses like slight physical injuries also manifest an undeniable increase. However, it is confusing to observe that the data for crime solution efficiency presents a laudable figure.

In 2008, the felonies rose to a very alarming number of 165 cases for index crimes and 195 cases for non-index crimes for a total of 360 crimes where only 312 of which was accordingly solved while 48 remains unsolved. For the period covering January to February 2009, misdemeanor records listed 57 cases, 49 of which are considered solved.

As one of the five pillars of the Criminal Justice System, the BJMP was created to address growing concern of jail management and penology problem. Primarily, its clients are detainees accused before a court who are temporarily confined in such jails while undergoing investigation, waiting final judgment and those who are serving sentence promulgated by the court 3 years and below.

As provided for under R.A. No. 6975, the Jail Bureau is mandated to take operational and administrative control over all city, district and municipal jails. The Bureau has four major areas of rehabilitation program, namely: Livelihood Projects, Educational and Vocational Training, Recreation and Sports, and Religious/ Spiritual Activities. These are continuously implemented to eliminate the offenders' pattern of criminal behavior and to reform them to become law-abiding and productive citizens.

Manned by only 20 personnel, Cotabato City has only one (1) City Jail located at Rajah Tabunaway Boulevard, Poblacion 5. It has a very limited area against the total number of inmates. Seventy-five (75) inmates fill up in one (1) quarter. Presently, the facility accommodates 143 inmates.

The jail personnel aired concerned that, aside from insufficiency of firearms, the absence of BJMP vehicle hamper their function as jailers. They use or hire passenger vehicles as their mode of transportation for jail related transactions such as ferrying inmates to and from the courts, City Health Office and other destinations.

There is also a need to look into the plight of minor inmates who are not supposed to be mixed with hardened adult criminals.

The Cotabato City Bureau of Fire Protection is composed of three (3) stations inclusive of its headquarter which is located at Rajah Tabunaway Boulevard in Poblacion 5. It is manned by 43 personnel. Substation 1 is situated at Sinsuat Avenue, Rosary Heights Mother with five (5) personnel while Fire Substation 2 with five personnel also is located at Lugay Lugay area in Barangay Bagua 1.

Despite the existence of the city firefighters both from the Bureau of Fire Protection and from the Filipino Chinese Fire Brigade, fire incidence is still alarming. This can readily be attributed to the absence of fire hydrants in strategic locations or unserviceability of the existing ones. The community also needs more fire prevention orientation as well as organization or reactivation of fire/disaster prevention group at the barangay levels.

- **Sports & Recreation Sector**

Whether you are a varsity athlete, a play-for-fun jock, a casual game player, or someone who just wants to get into shape, Cotabato City has not so many opportunities to stay fit and competitive. City residents need not be an athletic star to get in the game in the city. One can stay in shape with 2 major school sports arenas, the Cotabato City State Polytechnic School and the Cotabato City Central Pilot Elementary School outdoor track/oval. The city has 5 basketball and volleyball gymnasium and 4 indoor tennis/badminton courts

The City offers plenty of ways to stay fit in non-competitive settings. Jog or walk in the ORC Compound, in the City Plaza and the People's Palace grounds. One can also take commercial aerobics and cardiovascular training and conditioning at the City Mega Square Commercial Center situated beside the New City Hall at Malagapas, Rosary Heights 10 and at the City Government's state-of-the-art body fitness equipment will give your strength and weight training routines a boost.

The YMCA Recreation Center is a popular gathering place for people who intend to spend their time and unwind. There's a lot of activity in this one building: bowling, darts, billiards and others.

For cyber space afficionados, internet cafes are available everywhere and one can hang out in the computer lounges of hotel lobbies and coffee shops and enjoy wireless connectivity or play games.

- **Utilities Services Facilities**

Power Supply

Electrical needs of the City Cotabato are being provided by the competent Cotabato Light and Power Company.It has a standby diesel facility that provides power during interruptions and power outages. About 19,642 households have accessed to electricity while the rest have other power sources such as kerosene and liquefied petroleum gas (LPG). Only barangays of

Poblacion 5 and Rosary Heights 11 have more than a hundred percent access to electrical services. More than 50% of the households in the whole 13 barangays of Rosary Heights are amply provided with electricity.

Water Services/Usage

Potable water supply is being provided by the Metro Cotabato Water District (MCWD). There are a total of 22,898 households having accessed to level 3 water supply system. Of the total 37 barangays, about 4 have level 2 water supply provisions. These barangays are Tamontaka 2 and 3, Poblacion 9 and Kalanganan Mother. Three barangays that do not have accessed to the services of MCWD get their water needs from other sources.

There is one spring located in Bagua 3. However, its water resource is not guaranteed potable water source. Thus, level 2 water system in the city is being connected with the services provided by the local water district. Level 2 water system projects were implemented jointly with the assistance from Growth with Equity in Mindanao (GEM) Program Phase 2 and the local water district. To date, 4 rural and remote barangays of the city have benefited with this assistance. As of 2008, there are a total 37 active level 2 connections.

Communication Sector

Among the utility sectors, Communication is the most dynamic for it changes dramatically over time. Previous years, there are 3 landline companies telephone services to the residents of the city. Currently, there are only 2 landline companies left provide telephone services to the city of Cotabato, the Philippine Long Distance Telephone Company (PLDT) and Telof and only urban barangays are provided with landline facilities. Telephone density in 2007 was pegged at 62.5 per 1000 people. More landline telephone users have availed of the mobile telephone services primarily due to convenience, accessibility and affordability the latter offers. Presently, PLDT published landline subscribers totaled to 2,662 with 1,365 residential and 1,297 non-residentials.

To date, there are 31 registered and licensed internet café establishments in the city. The city has 3 AM and 4 FM Radio Stations, 2 cable TV companies and 3 Internet Service Providers (ISP) which either provides dial-up and wireless internet connections.

The city being the primary urban center in Central Mindanao has access to daily national newspapers and the local print media outfit that produces weekly local newspaper. The local newspapers are circulated not only in the city but also in provinces of Cotabato and South Cotabato, Maguindanao and Sultan Kudarat.

In the city of Cotabato, 3 cellular phone companies have a total of 19 cellular transmission towers located in various strategic areas. Globe Telecom has the most number of towers followed by SMART communications and Digitel Mobile Philippines. Most of these towers are installed in areas with higher elevation and strategic enough to serve the company's desired area of coverage. To date, almost all barangays have cell phone signal.

Solid Waste Management

Cotabato City's population has grown over the years. Being the leading institutional, financial and service center in the region, people continue to migrate in the city for employment and other social welfare benefits and services.

As the population of Cotabato City is increasing, naturally the amount of solid waste is also increasing. With such scenario, Cotabato City and even its nearby LGUs are challenged to properly manage their waste collection and disposal.

Studies conducted earlier reveal that a substantial portion of waste is generated from household level followed by the waste coming from the public markets. Waste from commercial, institutional, industrial, agricultural, and city government services trailed next.

To meet the growing problems on solid waste, some barangays, by virtue of Republic Act 9003 or the Ecological Solid Waste Management Act of 2000, have established a solid waste collection system. Barangays Poblacion I, II and V as well as Barangays Rosary Heights I, IX and XIII have set up a full collection system while Barangays Poblacion IV, VII and Barangay Rosary Heights II have a partial collection system.

The Waste Analysis and Characterization Study (WACS) conducted at both public markets disclosed that solid waste generated within the markets is composed largely of biodegradables. Ideally, such solid waste should be diverted from the waste stream to delay the full up and extend the service life of the city's dumpsite. Other studies are being undertaken as to putting up a composting facility in the area of the dumpsite or in a privately owned lands which would be operated by an accredited cooperative or any private entity to receive the biodegradables from the public markets. The establishment of a Central Materials Recovery Facility (MRF) is also seriously considered to cater to the recyclables coming from all sources. Below are tables showing the breakdown of waste in both public markets of the city. A simple WACS was also conducted in selected areas of the city. Table 23.8-13 shows the types of waste being generated in the city and their respective sources.

Table 23.8-13 Solid Waste Characterization by Category

Type of Solid Waste	Percentage Distribution by Source							Average Percentage
	Households	Markets	Food Establishments	Commercial	Schools	Offices	Hospitals	
Compostable	64.44	88.33	52.87	33.33	82.3	26.46	42.62	55.76
Recyclable	22.84	6.86	38.64	56.91	12.45	67.70	30.06	33.64
Non-recyclable	12.72	4.81	8.49	9.76	5.25	5.84	27.32	10.60
Special Wastes	-	-	-	-	-	-	-	100.00

Source: Cotabato City 10 Year Ecological Solid Waste Management Plan/LGU-General Services Office

Local Economy such as Employment and Livelihood

The erstwhile administrative role of Cotabato City as the seat of Central Mindanao (Region XII) paved the way for the establishment of regional offices of National Line Agencies (NLAs) thereby providing employment to its constituents. Together with the Office of the Regional Governor and its component Regional Line Agencies (RLAs) in the Autonomous Region in Muslim Mindanao (ARMM), it comprises a big chunk of employed persons within the labor force. These employees in the government sector have contributed largely to the growth of the city's economy in terms of accessing social and economic services through spending on household needs, consumer goods, use of entertainment facilities, engagement in entrepreneurial concerns and payment of local taxes.

From the private sector, the Commerce and Trade sub-sector represents the major employment provider covering such endeavors as wholesale and retail activities, banking and finance, service facilities, and others. The agriculture sub-sector, in general, has no visible employment participation since most of the concerned populace are self-employed. Fisher folks based in the 3 Kalanganan barangays are engaged in fishing off the coast of Illana Bay while fishpond owners operate their own brackish water fishponds. Even the members of fishpond cooperatives tend to their own fishponds. Workers are hired on piece rate basis as the need arises during harvest, casting of fingerlings at the start of production cycle and maintenance activities. It is more simplified in the case of freshwater fishpond owners as they are all engaged in backyard-raising and do not demand labor support.

The same is true in the case of farmers who also own the land they are tilling. In effect, they are also self-employed. The average family in Cotabato City earns more than what it spends for its basic family needs and services. Going by the generally accepted norm, the average number of family members of 5, has 27,761.00 PhP to use for meeting their personal requirements.

In contrast, the per capita poverty threshold represents the amount needed by an individual to meet his minimum basic needs. The average family in Cotabato City is above the poverty threshold as shown in the poverty incidence of families. This is one reason why the city is classified as a highly urbanizing city in South-Central Mindanao.

Table 23.8-14 Income and Prices Survey for Cotabato City (Year 2008)

Particulars	Reference Period	Amount/Percentage
A. Ave. Annual Family Income	2000	P 138,805.00
B. Average Annual Family Expenditures	2000	P 112,816.00
C. Inflation Rate (2000=100)	2008	14.4%
Particulars	**Reference Period**	**Amount/Percentage**
D. Peso Purchasing Power (2000=100)	2008	P 0.63
E. Annual Per Capita Poverty Threshold	2006	P 17,335.00
F. Poverty Incidence of Families	2006	38.0

Source: National Statistics Office (NSO), National Statistics Coordination Board (NSCB), 2008

b) Sultan Kudarat

Population and Demography

The municipality has a land area of 712.91 square kilometers or 275.26 square miles which constitutes 7.15% of Maguindanao's total area. Its population as determined by the 2020 Census was 105,121. This represented 7.83% of the total population of Maguindanao province, or 2.39% of the overall population of the Bangsamoro Autonomous Region in Muslim Mindanao. Based on these figures, the population density is computed at 147 inhabitants per square kilometer or 382 inhabitants per square mile.

Existing Social Infrastructures and Services

- **Education**

The Municipality of Sultan Kudarat has six (6) primary schools, thirteen (13) elementary schools (1 private and 12 public) and six (6) high schools (1 private and 5 public) and one (1) private tertiary school located in Barangay Calsada. The total enrollees of the year 2015-2016 was 11,648 of all levels from preparatory down to the college level.

Table 23.8-15 Student-Teacher and Student-Classroom Ratio by Level SY 2016

Student-Teacher and Student-Classroom Ratio by Level SY 2016					
Type/Level	**Total Number Enrolment**	**Number of Teachers**	**Number of Classroom**	**Student-Teacher Ratio**	**Student-Classroom Ratio**
Private					
Preparatory					
Elementary					
Secondary	988	25	25	1:40	1:40
Junior High School					
Grade 7-10					
Senior High School					
Tertiary	77				
Sub-Total	**1,065**	**25**	**25**		
Public					
Preparatory					
Elementary	10,520	234	245	1:45	1:43
Secondary	1,128	28	25	1:40	1:45
Junior High School					
Grade 7-10					
Senior High School					
Tertiary					
Sub-Total	**11,648**	**262**	**270**		

Source: Municipality of Sultan Kudarat CLUP 2017-25 Planning Period, CPDO

- **Health Status**

The Municipality has 30 barangay health units, one Rural Health Unit (RHU) and one sanitarium hospital manned by one doctor, 7 nurses including the deployment project nurse, one Mid-tech, one sanitary inspector and 22 midwives servicing the 39 barangays of the municipality.

As per record of Municipal Health Office, diarrheal diseases ranked high which constitute 36.50% of the total notifiable diseases reported. Influenza cases comes second and third is pneumonia. TB respiratory diseases have been reported at the age group from 15 years and over. The report indicates that the age group 0-14 is hardly hit by diarrheas and pneumonia diseases which can be associated with drinking water and the unsanitary practices observed in the community.

- **Transportation System**

Sultan Kudarat, traversed by a national road connecting major cities in Mindanao, is relatively accessible through a well-paved roads connecting to the city of Davao via Cotabato-Davao Road, Cagayan de Oro via Narciso Ramos Highway, General Santos City via Cotabato- Marbel-Ala Road. It is 225km to Davao City, 237km to Cagayan de Oro City and 186 km. to General Santos City. The Municipality is also accessible to Public Transportation such as Buses (Mindanao Star) and other public utility vehicles serving the area.

The municipality has a total of 120.76 km of road networks consist of National, Provincial, Municipal and Barangay Roads with road surface type of concrete, asphalt, gravel and earth. The condition of the roads is relatively fair but undergoing upgrading its road network for public convenience.

At present, there is one (1) overland public transport terminal in the Municipality located in Barangay Crossing Simuay which occupies about one (1) hectare of the Barangay area. The terminal is equipped with facilities to include the following: parking areas for both outgoing and waiting vans, waiting area for passengers, comfort room and public assistance counter. Another terminal is the Sultan Kudarat Transport Company (SUKUTSCO) a privately operated terminal for vans located at Barangay Salimbao occupying an area of 0.35 hectares more to less to cater passengers bound to Pagadian City.

- **Protected Services**

There are Police Stations located in Dalumangcob, Bulalo, Crossing and presence of outpost to all barangays in Sultan Kudarat. Personnel to population ratio for uniformed personnel is 1:1,402. There is one (1) Jail (detention cell) also located in Dalumangcob.

Fire station is located in Dalumangcob with one (1) fire truck.

- **Sports & Recreation Sector**

In terms of sports and recreation, facilities are available in some areas in Sultan Kudarat. Table 23.8-16 shows the existing sports and recreational facilities by barangay.

Table 23.8-16 Existing Sports and Recreational Facilities by Barangay

Barangay	Area (Hectares)	Sports Facilities	Recreational Facilities	Ownership	Physical Condition Good, Poor, Critical
Dalumangcob		Basketball Covered Court	-	Public	Good
Dalumangcob		Multi-Purpose Gymnasium	Municipal Plaza	Public	Good
Salimbao		Open basketball Court	-	Public	Good
Salimbao		Public Market			
Limbo		Basketball Court	-	Public	Poor

Source: MPDO, Sports and Recreational Facilities Map

- **Utilities Services Facilities**

Power Supply

There are three (3) electrical companies serving the municipal town, the Cotabato Light and Power Company (COLIGHT) Maguindanao Electric Company (MAGELCO) and the Cotabato Electric Cooperative (COTELCO). The COLIGHT supplies the power requirement of urban areas of the municipality which consists of the twelve (12) barangays and the remaining barangays except the interior barangays of the Municipality energized by MAGELCO and COTELCO. COTELCO energized some household of Barangays of Panatan and Alamada. COLIGHT, MAGELCO, and COTELCO receives power supplies from the NAPOCOR hydroelectric plant at Iligan City. The only advantage of COLIGHT over MAGELCO and COTELCO is that COLIGHT has stand-by direct electric generator to operate in case the NAPOCOR power fails.

Out of 39 barangay in the municipality there are 23 barangays that are not yet served by the 3 electrical companies due to its remote location. At present, there are 218 households that are served with electricity. There is backlog of 13,312 Households for both Urban and Rural Barangays awaits for electrification. On the other hand, the unserved household are utilizing solar power technology and kerosene.

Water Services/Usage

The 1991 inventory of water supply facilities in the Municipality of Sultan Kudarat reveals that its constituents are basically dependent on the underground water for their daily water consumption. The Cotabato City Water District(CCWD) have make use of the Municipality's underground water resources by constructing their pumping station at the Barangay Rebuken. The CCWD is pumping a volume of 2,700 cubic meter daily and serving 10 barangays of this Municipality with a total number service connection of 2,511 as of 2012.

Communication Sector

The municipality has its own operational communication system popularly known as PLECS or Provincial Law Enforcement Communication System that interlinks municipalities, provinces, regions or with national agencies. The Philippine Long Distance Telephone Company (PLDT) is already serving the municipality particularly at its five southern barangays. The municipality still enjoys the services of the Municipal Telecommunications Office stationed at the Municipal Hall. The Philippines Postal Office have put up three (3) postal offices at the Municipal Hall, Provincial Capitol, and at Barangay Salimbao purposely to effectively provide better services in this areas. The introduction of two (2) way radio communication have greatly enhance the communication linkages particularly at the far-flung barangays of the Municipality. Television and radio receivers are also common ways of sending message being enjoyed by its populace.

Solid Waste Management

The Municipality is already preparing its Solid Waste Management Plan with the technical capacitating assistance from the USAID- ECOGOV. The plan, if finished and made operational, will serve as the municipality's tool in its effort of sustaining its eco system.

The Municipal Composting Plan was already finished and ready for implementation. It was formulated through the technical assistance provided by the Eco-Gov. It entails a cost of more than Four Million (4,000,000) pesos.

It will be adopting the high-tech MRF facility of the Solid Waste Management Project of the City of Koronadal. It was decided as a result of the study tour sponsored by the Eco-Gov to the selected areas and LGUs in the South Cotabato areas which was participated by the members of the SWMB of the municipality.

The municipality has an estimated solid waste generation of 47,033 kilograms/day. With this it can generate a total bio-degradable solid waste of about 27,853 kilogram/day and 10,166,324 kilograms/year, while non-biodegradable will be 9,407 kilograms/day or 3,433,409 kilograms/day. The residuals and special wastes have a combined weight of 6,886 kilograms/day or 2,169,914 kilograms/year.

The Municipal Solid Waste Management Board (MSWMB) has already identified the area of the proposed Municipal Material Recovery Facility (MRF) and the Sanitary Landfill site.

Preliminary site suitability investigation has been undertaken by the Bureau of Science and Mines of the Department of Environment and Natural Resources. The lot is located at Brgy. Ladia going to its boundary with Brgy. Damaniog.

The proposed site has an area of about nine hectares and with the estimated municipal residual waste generation of about 2,169,919 kilograms/year or 21,700 cum/year. It is estimated to last for about 50 years.

Local Economy such as Employment and Livelihood

The 2010 population projection reveals that the labor force population of the municipality is 47,395 indicating that the major portions of its population are in the labor force. The main bulk of the work force is in the agricultural sector. Of the said figure, the employed labor force have totaled to 19,906 or 42 % of the total labor force of 47,395. The unemployed labor force constitutes about 58 % or 27,489 while the remaining percentage remains as dependents. In terms of participation rate of labor force, the male group has 23,542 and the female group accounted for 23,853. It can be noted that the female workforce is becoming active partner in the municipal economy.

Labor force is simply defined as those persons belonging to ages ranging from 15 to 64 years old. These include employed, self-employed, and non-employed population who falls under the said age bracket. About 47,395 persons or 57% of the total population of 2010 constituted the labor force.

c) Datu Odin Sinsuat (DOS)

Population and Demography

The municipality has a land area of 461.80 square kilometers or 178.30 square miles which constitutes 4.63% of Maguindanao's total area. Its population as determined by the 2020 Census was 116,768. This represented 8.70% of the total population of Maguindanao province, or 2.65% of the overall population of the Bangsamoro Autonomous Region in Muslim Mindanao. Based on these figures, the population density is computed at 253 inhabitants per square kilometer or 655 inhabitants per square mile.

Existing Social Infrastructures and Services

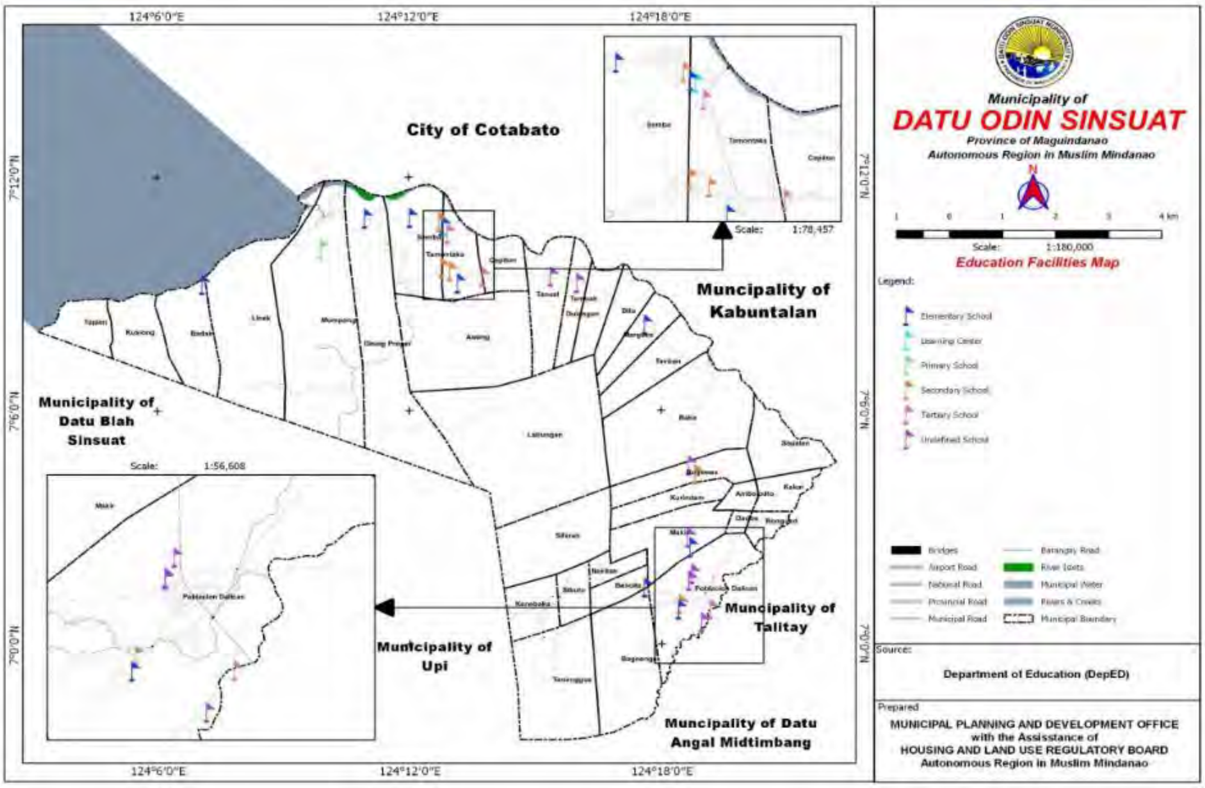
- **Education**

The schools in the Municipality of Datu Odin Sinsuat Municipality are sub-divided into two districts: South District and North District. In the South District there are 1 primary school, 15 elementary, 4 secondary schools and 1 tertiary (MSU) while in the North District there are 12 primary schools, 13 elementary schools and 5 secondary schools all of which are located in different barangays of the municipality. The total number of schools in both districts is 51. Meanwhile, literacy profile of the municipality is presented in Table 23.8-17, while education facilities is presented in Figure 23.8-9.

Table 23.8-17 Literary Profile

Indicator	Municipal						Provincial					
	Male		Female		Both Sex		Male		Female		Both Sex	
	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %
Literate	33,999	93	34,957	92	68,956	93	375,941	90	368,947	89	744,888	89
Illiterate	2,421	7	2,869	8	5,290	7	43,259	10	46,157	11	89,416	11
Total (Pop > 10 yr.)	36,420	49	37,826	51	74,246		419,200		415,104		834,304	

Source: Municipality of Datu Odin Sinsuat CLUP 2019-2027 Planning Period, CPDO



Source: Municipality of Datu Odin Sinsuat CLUP 2019-2027 Planning Period, CPDO

Figure 23.8-9 Datu Odin Sinsuat Education Facilities

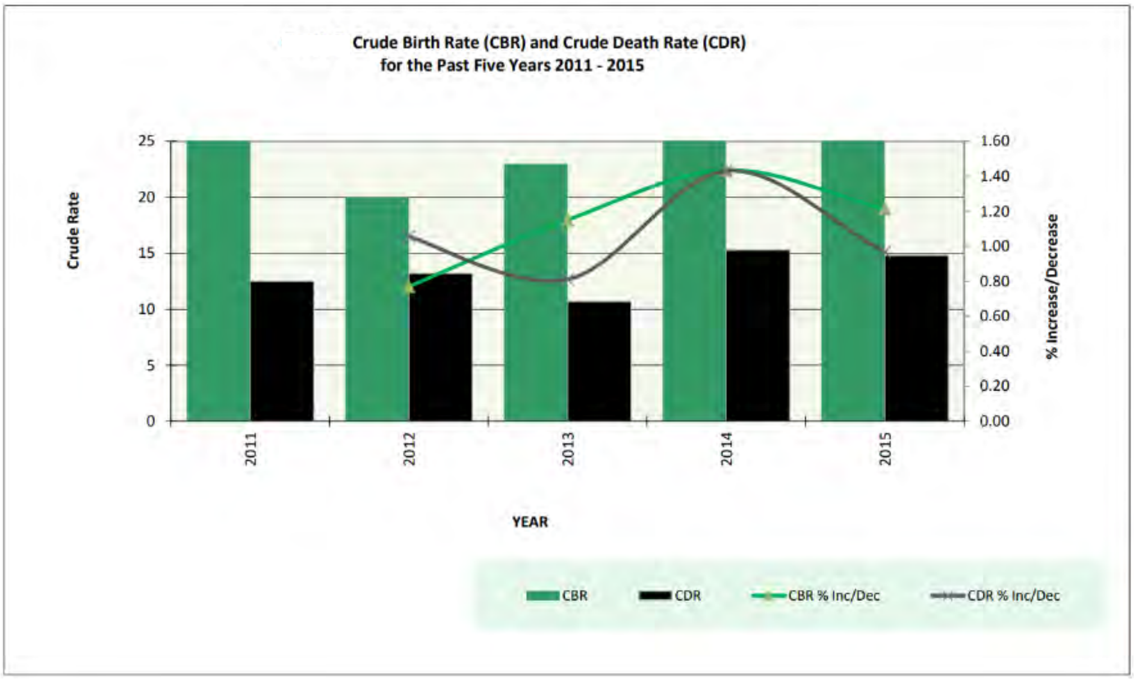
- **Health Status**

As per record of the Rural Health Unit, Crude Birth Rate (CBR) and Crude Death Rate (CDR) are presented in Figure 23.8-10 for the past five (5) years (2011-2015).

Table 23.8-18 Crude Birth and Death Rates

Period	CBR	% Increase/Decrease from previous Year	CDR	% Increase/Decrease from previous Year
2011	20		12.5	
2012	26	0.77	13.2	1.06
2013	23	1.15	10.7	0.81
2014	33	1.43	15.3	1.43
2015	40	1.21	14.8	0.97

Source: Municipality of Datu Odin Sinsuat CLUP 2019-2027 Planning Period, CPDO



Source: Municipality of Datu Odin Sinsuat CLUP 2019-2027 Planning Period, CPDO

Figure 23.8-10 Crude Birth and Death Rates

- **Transportation System**

The municipality of Datu Odin Sinsuat is one of the areas in Maguindanao fortunate to have an air and land transportation services in its credit. The domestic airport in Awang is where most of the people of Cotabato city and neighboring people in the region take their travel through airlines. The presence of the said domestic airport in this barangay formally created to be an urban center where visitors, investors and other sectors powered to invest in central Mindanao thru the presence of this airport. Various transportation vehicles are regularly traveling in this area. At present, the municipality has its official records approximately one hundred fifty five thousands nine hundred Eight (155,908) kms total road length. On this figure on road 50.38% municipal road and 15.10% concrete and 49.68% are earth filled.

- **Protected Services**

The police Station of the Municipality of Datu Odin Sinsuat, is located at Poblacion Dalican and Barangay Awang. At present police station are manned by fifty six (56) police personnel to include the chief of police, the police personnel ratio 1:1000 (1:921.57), however some of the policemen are designated in the traffic control, investigation of traffic incidents and other personnel police are assigned in sub-station in Barangay Awang. The two (2) units of mobile car/patrol car are utilized in conducting routinary mobile and police visibility.

- **Sports & Recreation Sector**

The sports facilities were initiated by the Local Government of DOS in coordination with the Provincial Government of Maguindanao. There were several facilities constructed in the different barangays.

Table 23.8-19 Existing Sports and Recreational Facilities by Barangay, Year 2015

Barangay	Area	Sports Facilities	Recreational Facilities	Ownership	Ph ysical Condition Good, Poor, Critical
Pob. Dalican	800	Basketball Court	None	Municipal govt.	Existing
Awang	1000	Basketball Court, Volley Ball, Tennis Court, Billiard Table	None	BLGU	Existing
Subtotal Rural Barangay	300		None		
Dinaig Proper	1000	Basketball Court		BLGU	Existing
Kusiong	300	Basketball Court, Billiard Tables		BLGU	Existing
Labungan	350	Basketball, Volleyball Court, Sipa Court		BLGU	Existing
Tapian	500	Basketball Court		BLGU	Existing
Semba	300	Basketball Court		BLGU	Existing
Baka	300	Basketball Court		BLGU	Existing
Dulangan	300	Basketball court		BLGU	EXISTING
Tamontaka	400	Basketball court		BLGU	EXISTING

- **Utilities Services Facilities**

<u>Power Supply</u>

The Municipality of Datu Odin Sinsuat, Maguindanao shows that there are both by MAGELCO and by COLIGHT and there are 17,888 households unserved.

<u>Water Services/Usage</u>

Table 23.8-20 and Table 23.8-21 presents the Level I & II Water Supply System by Type and Number of Population Served, Year 2015

Table 23.8-20 Level I Water Supply System by Type and Number of Population Served, Year 2015

Barangay	Shallow Well			Deep Well			Improved Spring		
	Number	HH Pop. Served		Number	HH Pop. Served		Number	HH Pop. Served	
		No.	%		No.	%		No.	%
Ambolodto				1	30	2.110			
Badak				1	28	2.037	1	69	5.021
Bagoenged							1	103	5.981
Baka				5	867	35.002			
Benelon				10	387	30.424			
Bitu				12	282	24.977			
Bugawas									
Kurintem				30	1096	40.015			

Table 23.8-21 Level I Water Supply System by Type and Number of Population Served, Year 2015

Location of Water Sources	Number of Pumps	Number of Communal Faucets	Barangays Served	No. of HH Population Served
Labungan			Labungan	
Linek			Linek	
Baka			Baka	
Bagoenged		1	Bagoenged	
Bugawas			Bugawas	
Makir			Makir	
Poblacion Dalican			Poblacion Dalican	

<u>Communication Sector</u>

All of the communication facilities are located in Poblacion Dalican and Barangay Awang. The postal service, internet providers and cell sites are located at Poblacion Dalican and barangay

Awang. However, the source of information and communication is thru radio stations in the nearby Cotabato City and the other source of information in local radio station like Datu Odin Sinsuat Radio Information Association Incorporated (DOSRIA) VHF Radio is one of the sources of information and communication by the residents. There are five (5) types of communication facilities in the municipality. The municipality has existing and presence of one (1) postal service, 3 providers (Globe, Smart and Sun Cellular) of internet services and cellular communication network, one (1) courier (LBC) and also the VHF Radio that provide communication services facilities. All of these are located in Barangays Dalican Poblacion, Awang and some barangays. Private entity owned 19 communication services facilities, while the 2 facilities owned by the government.

Solid Waste Management

The solid waste of the municipality particularly from the collection up to the Dumping areas is being managed by the Local Government Units of Datu Odin Sinsuat. This routinely collection of solid waste is being done in Dalican and in barangay Awang. The collection areas are the public market, food establishments and household along Poblacion streets and at the barangay Awang market and commercial establishments. Waste Collection was done three times a week usually every Wednesday, Friday and Sunday. Two dump truck and one old model tractor are used in collecting waste materials every collection schedule. Drivers and the waste collector are being paid by the Local Government Units with counterpart from Barangay Local Government Unit.

At the moment the Municipality Do not have Sanitary Landfill but eying to have within the 9-year planning period.

Local Economy such as Employment and Livelihood

<u>Revenue Sources</u>

The income of the Local Government Unit of Datu Odin Sinsuat Municipality is derived from real property tax collection; space rentals, building permits, Internal Revenue Allotment, and daily cash tickets from different commercial activities such as Sari-Sari Store, Drug Store, Dry Good Store, Fish Vendor, Carenderia Bakeshop, Computer job, Motorcycle/skylab and Agricultural. Employment

<u>Employment by Type/Classification/Type of Business and Trade</u>

The data below indicates that sari-sari store type/Classification kind of Business & trade has the large number of employment as well as revenue generation while bake shop and motor cycle /skylab has a smaller number of employment as well as revenue generation.

Average Family Income and Expenditures vis- -vis poverty level

The results of the recently conducted Based-Line Emergency Food Security Assessment (BEFSA) indicate that the average monthly income of household is at PhP 7,393.00 which is 4.5% lower than the national poverty threshold of PhP 7,821.00

The average expenditure for food based on BEFSA is PhP 2,722.00 which is about 49.8% of the monthly national per capita food threshold (PhP 5,458) this indicates an expenditure gap of about PhP 2,736.

d) Sultan Mastura

Population and Demography

The municipality has a land area of 242.07 square kilometers or 93.46 square miles which constitutes 2.43% of Maguindanao's total area. Its population as determined by the 2020 Census was 25,331. This represented 1.89% of the total population of Maguindanao province, or 0.58% of the overall population of the Bangsamoro Autonomous Region in Muslim Mindanao. Based on these figures, the population density is computed at 105 inhabitants per square kilometer or 271 inhabitants per square mile.

Existing Social Infrastructures and Services

- **Education**

For school year 2015-16, the teacher-to-student ratio of 1:68 makes Sultan Mastura's public elementary school education looks inadequate when compared to the national standard of 1:50. Also, with a teacher-to-student ratio of 1:66 for public secondary education, Sultan Mastura has large number of students as compared to national standards. Sultan Mastura's classroom-to-student ratio for public elementary is 1:68.

As to public secondary, the classroom-to-student ratio is 1:88 which means that there is inadequacy of classrooms compared to the national standard of 1:50. Total number of public elementary teachers is 61, while total number of pupils is 4,171. This results to 1:68 teacher-per-student ratio. For public secondary, there are 12 teachers for school year 2015 – 2016. Total number of students is 792. This results to a 1:66 teacher-student ratio. The total number of classrooms for elementary is 546 while the total number of enrollees is 22,371. This accounted for a 1:41 student-to-classroom ratio. For public secondary, there are 9 classrooms for 792 students, resulting to a 1:66 classroom-to-student ratio.

- **Health Status**

Sultan Mastura was able to establish its own Rural Health Unit (RHU) and Birthing Clinic despite of limitation in budget. Also, the LGU put up 11 Barangay Health Stations (BHS). It uses its local funding source in establishing these facilities. Sultan Mastura has only one (1) physician to serve the total population of the municipality. As per Municipal Health Office (MHO) report, total births in Sultan Mastura in 2017 was about 700 while the number of deaths was 97.

According to the primary data gathered from the local health office, the Crude Birth Rate (CBR) for Sultan Mastura in 2017 is 64.51. Of the actual live births (700) in 2017, 51 percent (357) are male while 49 percent (343) are female. The Hospitalization Rate for 2017 is 118, which means for every 1000 population, 118 were hospitalized in 2017.

- **Transportation System**

There are a total of 33 registered Tricycles plying the different routes in Sultan Mastura. Currently, there are no existing ancillary roads and private/public terminals in the municipality. Due to the current development of the municipality, plans for establishing a Public Terminalis on process.

- **Sports & Recreation Sector**

Sports and Recreation Facilities. The newly established municipality in the area of Maguindanao, Sultan Mastura has very limited sports and recreation facilities. Thus, inadequate facilities hinder the development of sports to Mastur ns. Only in Barangays Tapayan, Macabiso, Solon had its own basketball court while poor quality playgrounds exist in various barangays.

- **Utilities Services Facilities**

Power Supply

Electric power services in the municipality is currently provided by the Maguindanao Electric Cooperative (MAGELCO), the only electric cooperative engaged in power retail in Maguindanao aside from the Cotabato Light and Power Company which is located in Cotabato City.

Power is sourced mainly from the Luzon Grid owned and operated by the National Power Corporation (NAPOCOR).

The Sultan Mastura government has already requested the management of MAGELCO to further expand coverage under its rural electrification program.

Installation of Streetlights to provide road illumination to all key points in the municipality especially in the far-flung areas, the municipal government has already been included in its plan.

In terms of power consumption, Domestic users account for an average of 191,932.20 KWA or 71.43 percent every month, while Institutional establishments account for 32,102.12 or 55.54 percent. Others, electrical consumption of Public Buildings eat up the remaining 21 percent.

Water Services/Usage

There are currently two (2) waterworks system existing in Sultan Mastura, only the Level III Water System is located in Sultan Mastura Municipal Hall. Level I (shallow well) and Level II (Water Tank) water system are all situated in13 barangays. About 3,166 households served by 1,055 number of shallow well and almost 792 households served by fifteen (15) water tanks. Currently, the only Level III water system that served only barangays of Tapayan, Tambu, Balut is not yet operated.

To meet the increasing demand for potable water, the municipal government initiated the construction of a new well and assisted the barangays in accessing additional funding for other wells from the NGOs.

Sultan Mastura has existing surface water resources like Lakes and Rivers.

<u>Communication Sector</u>

At present, Sultan Mastura receives signals through analog antennas from three (3) television stations: (ABS-CBN 2, GMA-7, and Studio 23. One (1) digital cable TV company --- Cignal Digital Cable -- - that provide up to date news, relevant information and entertainment to Mastur ns thru Digital Signals of Satellites.

Currently, there are no existing Telephone services in the municipality except for cellular or mobile service like SMART, SUN and GLOBE.

Local Economy such as Employment and Livelihood

The municipality of Sultan Mastura has a total labor force population 13,582 where 6,694 are males and 6,888 are females. Of the said total labor force population 18.8% or 2,548 are employed. Employment rate among rate among males represents 32.2% and 5.7% among female where nature of employment for both covers an employment as households helper, laborer, workers in private establishments and government offices, family business farmers and other forms of employment categorized as self-employment.

e) Parang

Population and Demography

The municipality has a land area of 850.78 square kilometers or 328.49 square miles which constitutes 8.53% of Maguindanao's total area. Its population as determined by the 2020 Census was 102,914. This represented 7.67% of the total population of Maguindanao province, or 2.34% of the overall population of the Bangsamoro Autonomous Region in Muslim Mindanao. Based on these figures, the population density is computed at 121 inhabitants per square kilometer or 313 inhabitants per square mile.

Existing Social Infrastructures and Services

- **Education**

The municipality has a total number of 32 elementary schools, only two comprising the private schools. It was found out that the private schools has a complete set of facilities (laboratory, clinic, comfort room, playground).

The municipality has secondary schools both private and public. Mostly, all schools has a complete set of facilities, only ARMM-RSHS has no complete facilities because the school is adjacent to the main building the Amir Bara Lidasan High School.

In terms of student-teacher ratio and student ratio, private schools meet the standard requirement of DepEd with a ratio of 1:35 and student classroom ratio of 1:40 both from e;ementary and high school levels. In public, more students are handled by one teacher same with student classroom ratio.

Parang has four private schools and one vocational/technology school. About 759 total enrollees for the tertiary level, 400 males and 359 females. The schools are located in Poblacion area.

- **Health Status**

The Rural Health Unit has one (1) doctor as the Municipal Health Officer, one (1) dentist, one (1) nurse, twelve (12) midwives and one (1) Sanitary Inspector. These are all provincial paid medical personnel that are assigned to Parang.

There are twelve (12) functional barangay health centres manned by midwives. There is a birthing center in barangay Sarmiento which is operational and accredited by Philhealth. Also, another birthing center in barangay Making with ultrasound equipment and it has just been turn-over to the said barangay. There are 50 barangay health worker volunteers which are paid by the municipal government to help supplement the RHU for the health requirements of the municipality. The LGU Parang hired one (1) sanitary aide; one (1) microscopist and three (3) midwives.

- **Transportation System**

The municipality has good road networks consist of National, Provincial, Municipal and Barangay Roads. The following road length are: National Road is 30 kms; Provincial Road is 5,293 meters: Municipal Road is 2,717 meters; and barangay road is 4,538 meters. The municipality has a total of 329 hectares of road network. Average carriage way of the road network system is 6 meters in width.

Parang is traversed by a major road that connects to major cities in Mindanao, is relatively accessible through a well-paved roads connecting to the major cities of Pagadian, Marawi, Iligan, Davao and Cotabato passing Narciso Ramos Highway. It is about 30 km away from Cotabato City. Transportation like Public Utility Vans and other public utility vehicles are available in the municipality.

- **Protected Services**

Total number of police personnel is 82 MPS PNP Personnel with 1:1,088 PNP-Population Ratio. On the other hand, firefighting personnel has 30 with 1:2,973 fireman-population ratio.

- **Sports & Recreation Sector**

A total area devoted for parks/playgrounds and other recreational areas have accounted about 6.07 hectares. The existing municipal park and plaza occupies an area of around 4.04 hectares and only 2.03 hectares are distributed in rural barangays. This shows that the municipal lack of adequate recreational areas and play facilities.

- **Utilities Services Facilities**

Power Supply

Out of 25 barangays on 16 barangays have. Electricity in the municipality. The seven (7) barangays of Bongo Island could not be energized by the MAGELCO because of its location which is an island barangays. The barangays not serviced by MAGELCO used solar panel for electrification as their source of power. These areas 11.10% of house household population not served by MAGELCO in the riral barangays with a percentage of 60.55% have no electricity.

Water Services/Usage

There are available Level I and II Water System Supply System in Parang. There are three (3) sources of water in the municipality located in barangays Making, Magsaysay and Nituan. Constituents from this barangays are also served with a total of 450 households.

Barangay Sarmiento has a Level III waterworks system, it has 555 domestic connections and an average consumption of $10m^3$. It source of water is a deep well pump-device water system located in Barangay Sarmiento. The LGU of Parang is now on its completion of level III Parang Water System.

Communication Sector

There were six (6) communication towers installed in the municipality, three (3) in barangay Poblacion 1 (Globe, Smart and Sun Cellular), two (2) in barangay Sarmiento (Globe and Smart) and one (1) in barangay Litayen) Globe) in Bongo Island. Also present in the municipality is the postal service located in barangay Poblacion 1 owned by Philpost. Moreover, Internet providers were present in locality of Polacion 1 & 2, Making and Sarmiento. PLDT Company also installed their tower in barangay Poblacion 1. Also, a government-owned radio station (91.5 FM T-Radio Parang) is also present in the municipality. There is also LBC freight services in the locality. It does not have any print media in the area.

Solid Waste Management

The municipality has not yet established a sanitary landfill. It is still using its dumpsite with an area of more than 2 hectares at barangay Semberen. Wastes from the collection area especially the public are dumped on this site at present.

Local Economy such as Employment and Livelihood

Majority of the households in Parang are engaged in farming and fishing that makes agriculture its primary economic activity. But the main driver of the economy of the municipality is trading and other services.

The trading sector controls the economic condition in terms of profit. Supply of agricultural and fishery product is bought in by traders which offer much lower price than that of the retailers. Supply gap of other prime agricultural products are sourced out from the neighboring municipalities like Buldon. Matanog and Barira.

2) Poverty and Displacement

The Philippine Statistics Authority (PSA) releases data on poverty every three years, with the aim of helping government agencies and policy makers in their efforts to alleviate poverty.

Poverty threshold is defined by the PSA as the minimum income required to meet the basic food and non-food requirements of an individual. Poverty incidence, on the other hand, refers to the proportion of the population with incomes below the poverty threshold.

Cotabato City recorded an annual per capita poverty threshold of PhP 30,349 in 2018. This means that a family of five needed to earn at least PhP 12,645 monthly to meet their essential needs. While poverty incidence among the entire city population decreased from 49% in 2015 to 42% in 2018, the proportion of poor people remained well above the national average of 17%. The magnitude of poor people in Cotabato City was estimated at 130,100 in 2018.

Table 23.8-22 Number of Reported IPs in the Greater Cotabato Area

Area	Annual Per Capita Poverty Threshold (PhP)				Poverty Incidence among Population (%)			
	2009	2012	2015	2018	2009	2012	2015	2018
Philippines	16,871	18,935	22,747	25,813	26	25	24	17
Region XII	16,405	18,737	21,341	25,023	38	45	38	28
ARMM	16,683	20,517	22,650	27,715	47	56	59	62
Cotabato City	**18,103**	**20,567**	**25,581**	**30,349**	**34**	**44**	**49**	**42**

Source: Philippine Statistics Authority

No unified data and information on displacement in Cotabato City and five (5) adjacent municipalities were available. Table 23.8-23 shows the collected data from different sources. The causes and reasons of the Internally Displaced People (IDPs) were reported to be not only due to armed conflict but also from natural disasters, land disputes between rival clans and escape from persecution in their original homeland. The difference of the causes and reasons also meant the difference in period of being IDPs. It was also observed that IDPs in Mindanao had tendency to immediately and voluntarily return to their original places after the initial recovery of the critical situation.

Table 23.8-23 Number of Reported IDPs in the Greater Cotabato Area (2020)

City/Municipality	Number of reported IDPs (2019-21)	Remarks	Source of Information and Data
Cotabato City	1,000 or more families	Since 1990s.	Cotabato City Social Welfare and Development Office (CSWDO)
Datu Odin Sinsuat	779 families	Sum of the IDPs in 4 different locations	Social Welfare Office of Maguindanao
Sultan Kudarat	None		Social Welfare Office of Maguindanao
Parang	1,232 families	Displaced due to Road Clearing and other government projects. No IDPs due to war conflict	CFSI (an international NGO)
Pigkawayan	3,422 families	Displaced due to Natural Disaster (Flooding - Tyhpoon Quinta) in October 2020.	CFSI (an international NGO)
Sultan Mastura	None		Social Welfare Office of Maguindanao
Total	**6,433 families**		

a) Gender and Children Rights

The Philippines is one of the most developed countries in the field of gender equality. Recognition on the rights of women is widely acknowledged and observed. Generally speaking, gender equality is not really a big concern.

Child labor cases in the Philippines are commonly reported and it may occur in the survey are. When the project is implemented, strict monitoring should be undertaken to avoid occurrences of child labor. Children's rights in the survey area may related to poverty.

Table 23.8-24 Gender Indicators

Indicators	Number of Beneficiaries		
	Male	**Female**	**Total**
• No. of Graduates at Women Productivity Skills Center (2007)		133	133
• No. of Women graduates referred for Job Placement (2007)		42	42
• No. of Women entertainers served		173	173
• No. of Women Entertainers undergone counseling		200	200
FAMILIES			
No. of Solo Parents provided IDs:			
CY 2008	2	57	59
CY 2007	26	315	341
CY 2006			237
CY 2005			448
Lack of Parenting Skills			147
• No. of Couples w/ Problem of Relationship given psychosocial therapy/marriage counseling, marriage enrichment seminar	23	26	49
No. of Couples given Marriage Counseling			298
No. of Individuals given Pre-Marriage Seminar	298	298	596
No. of Individuals given PES/ERPAT Training	86	81	167
CRISIS INTERVENTION PROGRAM			
• No. of Walk-in Clients in crisis situation served (2008)	183	228	411
• No. of Disaster Victims given Relief/Support and emergency assistance			101,160
COMMUNITY WELFARE PROGRAM			
• No. of Badjao given support package to counseling, DC Services, health and social hygiene training			84

Indicators	Number of Beneficiaries		
	Male	Female	Total
• No. of Individuals given Business Management Skills/Practical Skills Training			60
POPULATION PROGRAM			
• No. of Individual given pre-marital counseling, Mothers Classes, Reproductive Health and Family Planning	888	2,678	3,566
• Referral to FP Clinic & Contraceptive	29	108	137
• Counseling of Dropouts (FP Users)	17	161	178
• No. of Couples given Pre-Marriage Counseling			298
• Reproductive Health & Family Planning	220	2,010	2,230
• Population Quiz Show	34	36	70
• No. of School-based Youth from different Secondary Schools and OSY attended AHYDP Seminar	439	570	1,009

Source: Cotabato CLUP, 2007, CPDO

b) Ethnic Minority and Indigenous People

The closest known traditional ancestral domains of the Indigenous People in the study area are those in the Municipalities of Upi, South Upi, and Datu Blah Sinsuat which are inhabited by the Teduray tribe. However, due to armed conflict among groups (e.g., AFP vs various armed groups) which affect their communities and further pushed by poverty, some IPs left their homeland to resettle in some of the towns within the study area. The road alignment is not expected to traverse IP lands and/or communities. The estimated number of IPs in the LGUs under the project area which was secured through interview with various agencies/organizations are presented in Table 23.8-25.

Table 23.8-25 Number of Reported IPs in the Greater Cotabato Area

City/Municipality	Number of reported IPs (Year of data)	Remarks	Source of Information and Data
Cotabato City	4,967 (2020)	Around 90% of them are Teduray tribe.	National Commission for Indigenous People, Region 12
Datu Odin Sinsuat	14,170 (2018)		Ministry of Indigenous Peoples' Affairs
Sultan Kudarat	No known significant concentration of IPs (2018)		Froilyn T. Mendoza, Executive Director of the Teduray Lambangian Women Organization, Inc. (TLWO)
Parang	About 1,500 people/300 families (2018)	90% of them are Teduray tribe. Migrated in 1970s at the height of the conflict.	Municipal Planning & Development Coordinator of Parang municipality
Sultan Mastura	No known significant concentration of IPs (2018)		Froilyn T. Mendoza, Executive Director of the Teduray Lambangian Women Organization, Inc. (TLWO)

c) Land Acquisition and Resettlement

There have been various experiences of land acquisition and resettlement in and around the project areas including projects under safeguard policies of Asian Development Bank (ADB) and JICA's Environmental and Social Considerations. Procedures of land acquisition and resettlement follows the country system of the Philippines.

There may be identified zones dedicated to accommodating housing needs due to population growth and backlog. Yet housing sites for displaced population due to government-initiated projects continue to obtain lands in agricultural areas. A detailed inventory of lands and landowners should be undertaken to precisely locate suitable sites especially for socialize housing.

For this study, the number of affected houses and other structures within the road alignment were counted through google earth image following the prepared kmz file of the proposed WDR alignment. An estimated of 45 affected structures were identified. The number of affected structures shall be validated during the F/S level, crops and trees shall then be inventoried as well.

shows the summary of possible affected settlements per municipality along the WDR alignment. Figures below show the settlements along the WDR alignment corresponding to the covering municipalities with coordinates. Impact in land acquisition is foreseen; majority are agricultural lands.

Table 23.8-26 Summary of Possible affected Settlements

Municipality	No. of Houses Affected
Datu Odin Sinsuat	18
Cotabato City	19
Sultan Kudarat	1
Sultan Mastura	1
Parang	6
Total	45

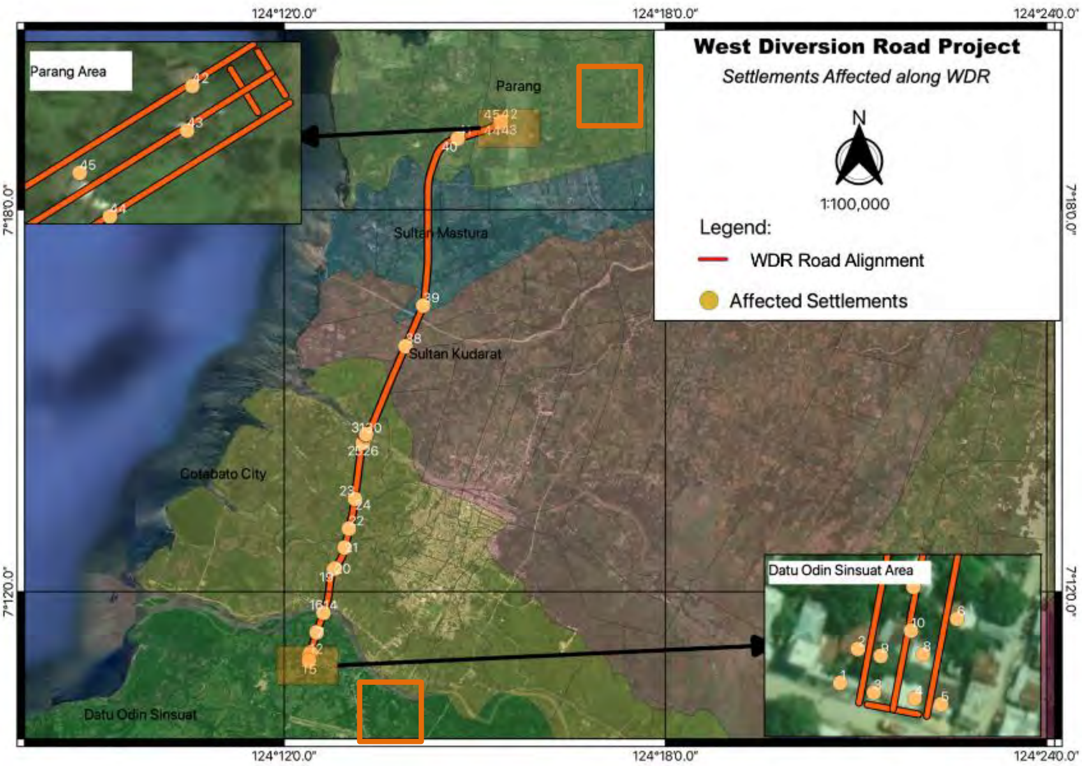
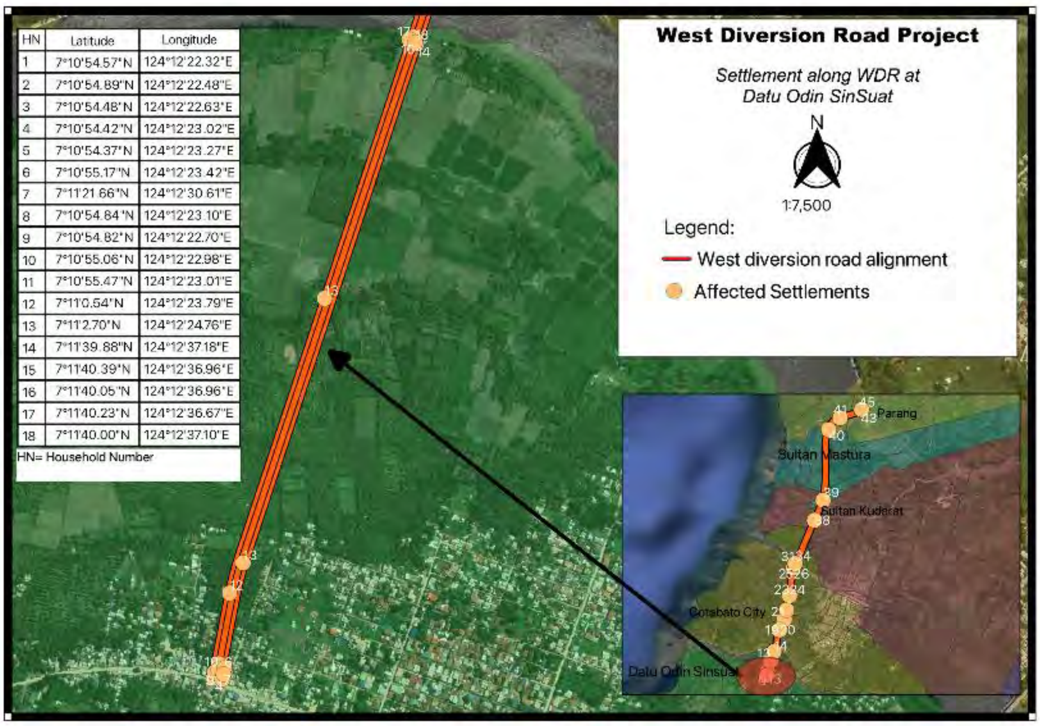


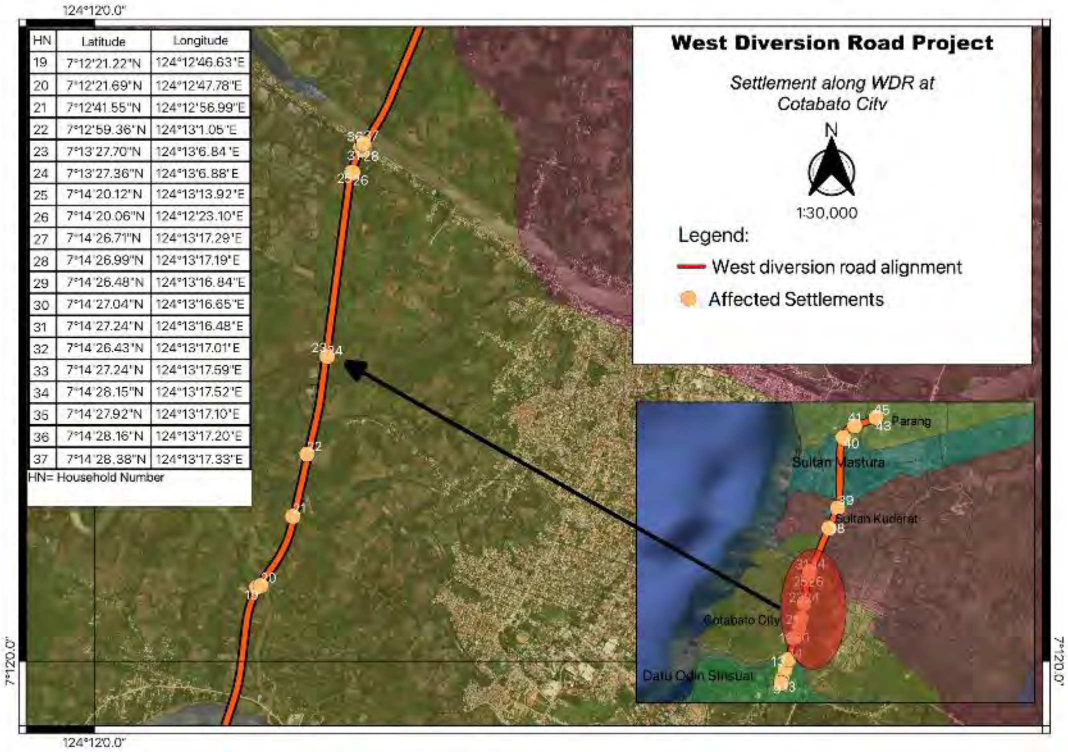
Figure 23.8-11 Settlements along WDR Alignment



HN	Latitude	Longitude
1	7°10'54.57"N	124°12'22.32"E
2	7°10'54.89"N	124°12'22.48"E
3	7°10'54.48"N	124°12'22.63"E
4	7°10'54.42"N	124°12'23.02"E
5	7°10'54.37"N	124°12'23.27"E
6	7°10'55.17"N	124°12'23.42"E
7	7°11'21.66"N	124°12'30.61"E
8	7°10'54.84"N	124°12'23.10"E
9	7°10'54.82"N	124°12'22.70"E
10	7°10'55.06"N	124°12'22.98"E
11	7°10'55.47"N	124°12'23.01"E
12	7°11'0.54"N	124°12'23.79"E
13	7°11'2.70"N	124°12'24.76"E
14	7°11'39.88"N	124°12'37.18"E
15	7°11'40.39"N	124°12'36.96"E
16	7°11'40.05"N	124°12'36.96"E
17	7°11'40.23"N	124°12'36.67"E
18	7°11'40.00"N	124°12'37.10"E

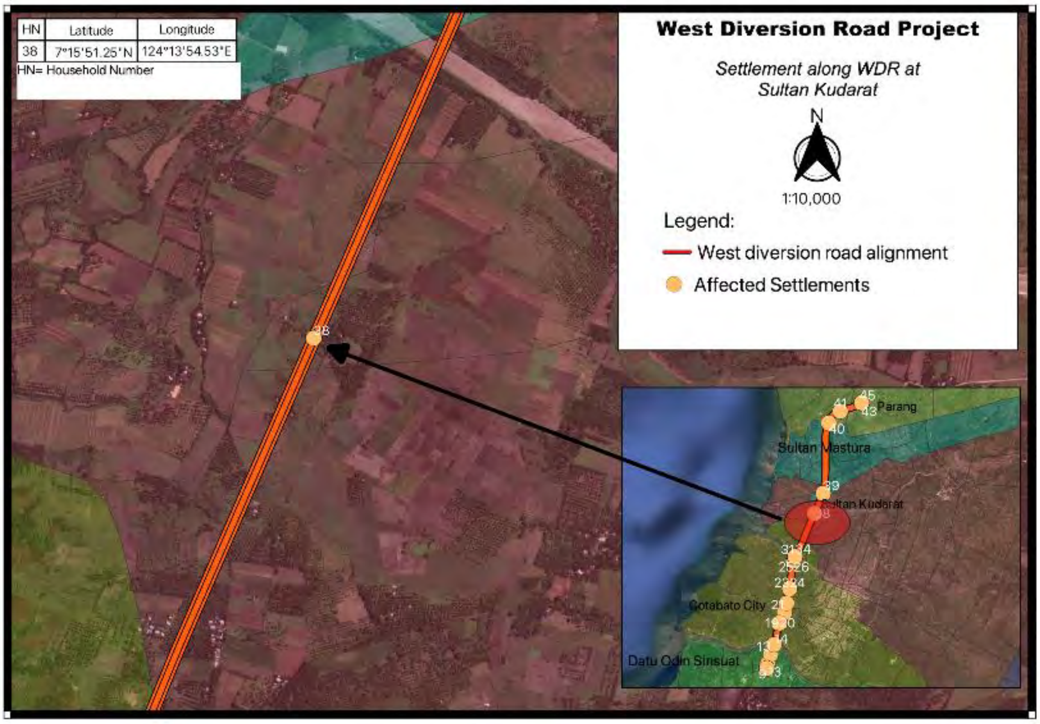
HN= Household Number

Figure 23.8-12 Settlements along WDR in the municipality of Datu Odin Sinsuat



HN	Latitude	Longitude
19	7°12'21.22"N	124°12'46.63"E
20	7°12'21.69"N	124°12'47.78"E
21	7°12'41.55"N	124°12'56.99"E
22	7°12'59.36"N	124°13'1.05"E
23	7°13'27.70"N	124°13'6.84"E
24	7°13'27.36"N	124°13'6.88"E
25	7°14'20.12"N	124°13'13.92"E
26	7°14'20.06"N	124°12'23.10"E
27	7°14'26.71"N	124°13'17.29"E
28	7°14'26.99"N	124°13'17.19"E
29	7°14'26.48"N	124°13'16.84"E
30	7°14'27.04"N	124°13'16.65"E
31	7°14'27.24"N	124°13'16.48"E
32	7°14'26.43"N	124°13'17.01"E
33	7°14'27.24"N	124°13'17.59"E
34	7°14'28.15"N	124°13'17.52"E
35	7°14'27.92"N	124°13'17.10"E
36	7°14'28.16"N	124°13'17.20"E
37	7°14'28.38"N	124°13'17.33"E

Figure 23.8-13 Settlements along WDR in the city of Cotabato



HN	Latitude	Longitude
38	7°15'51.25"N	124°13'54.53"E

Figure 23.8-14 Settlements along WDR in the municipality of Sultan Kudarat

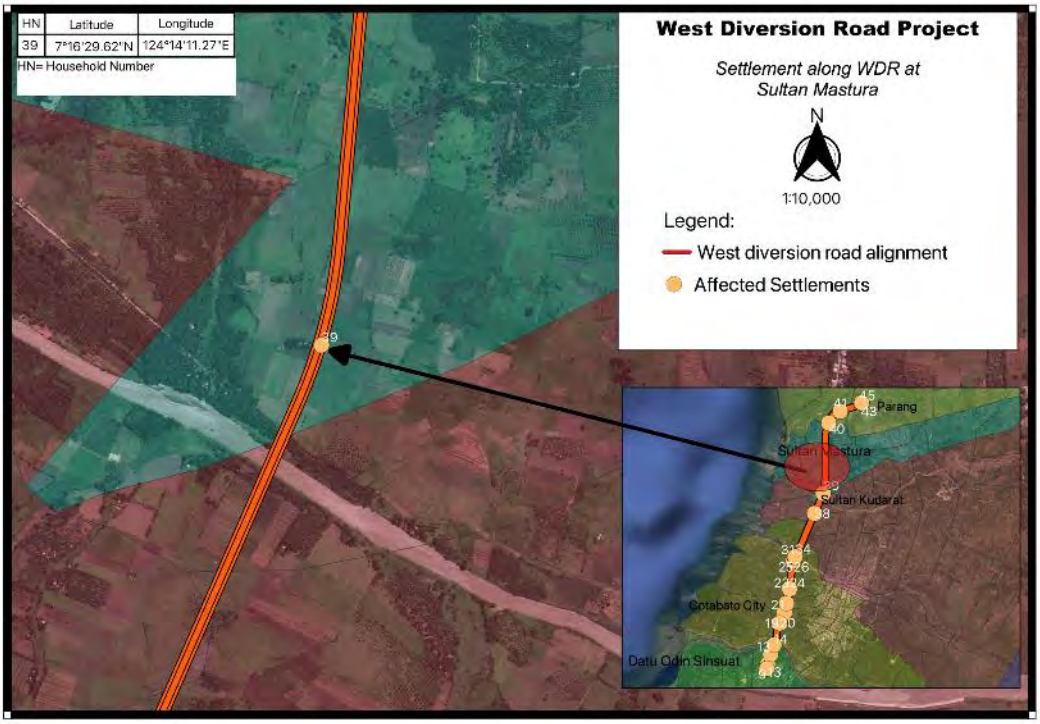


Figure 23.8-15　Settlements along WDR in the municipality of Sultan Mastura

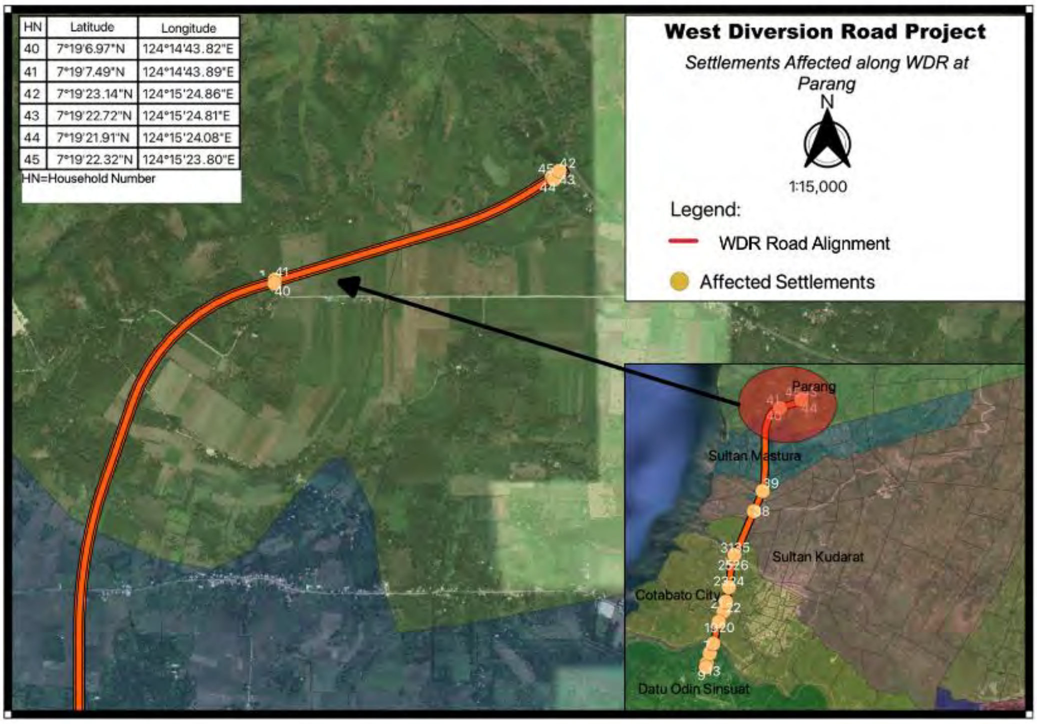


Figure 23.8-16　Settlements along WDR in the municipality of Parang

23.8.4 Stakeholders Meetings

(1) Key Informant Interview (KII)

The JICA Study Team established close coordination with the five (5) LGUs under the influence area of the road at the start of the study. The start of which was during the introduction of the study to their respective Mayor and MPDC to seek their support particularly on the collection of data and various studies which could serve as among the refence materials. During these consultation meetings which were held several times due to various topics to be covered (e.g., creation of Metro Cotabato Development Authority, land prices along the road alignment, socio-economic data on the road alignment, etc.), they expressed their support to the project and most of them mentioned that this road is necessary to spur development near the coast. Latest of these consultation meetings were held between September 2021 to October 2021 during the request for support to obtain land price to calculate road ROW acquisition. Table 23.8-27 shows the comments made by the LGUs on the road project.

Table 23.8-27 Comments from the LGUs during the Consultation Meeting

LGU	Comments
Datu Odin Sinsuat Municipality	West Diversion Road will be an additional access of our municipality to Cotabato City. So, this is a good project and we support it
Cotabato City	Aside from protecting the city from the impact of tsunami and storm surge, this project will provide access to the various areas to be developed by the City Government
Sultan Kudarat Municipality	This is a good project which could provide access to various areas of the municipality. If flood control project could be part of the road project (note: referring to the Simuay River which changed its course), this will address the recurrent flooding.
Sultan Mastura Municipality	This will spur development of the coastal area of the Municipality hence we support this project.
Parang Municipality	We support this project since it will provide additional access to Cotabato City and at the same time, it will trigger development of the coastal area. However, during the study of the final alignment, we request to be consulted again since we know the area better.

No individual consultation was held with the different Ministries of the BARMM to introduce the road project due to difficulty of arranging schedule. However, the road project was introduced to the BARMM officials led by the Chief Minister on April 27, 2021, during the presentation of the Interim Report. During the said meeting, the BARMM government expressed their appreciation that the three projects were selected for the Pre-Feasibility Study. Aside from this stated support, they also requested to consider including in the action plan study the solid waste project since this is one of the serious issues facing the city.

(2) Stakeholders Meeting (SHM)

This study so far undertook two Stakeholders Meetings. Of the two, the 2nd Stakeholders Meeting has relevance to the West Diversion Road. During the said meeting, the three candidate projects for action plan study were part of the presentation. Hence opinions from the stakeholders were received. It was held on 30 March 2021 at Pagana Kutawato Native Restaurant, Cotabato City. It was attended by a total of 76 participants (male 50 and female 26).

Table 23.8-28 Opinions and Answers

No.	Comment, Questions and Suggestion	Answers
1	**Q&A Part I** **Question:** Mr. Pete Marquez (Governor of PCCI for Cotabato City and Maguindanao) – Urban Utility Group to Mr. USUI: It was said that there is no law governing SEA in the Philippines which could be a hindrance to the implementation of the projects under the study. In the absence of such SEA law, would this not affect the plans and their implementation?	**Answer:** JST Tokyo: At the moment there is no SEA Law in the Philippines, but since this Study is funded by JICA we need to follow the requirements set by the JICA. Other donors also require the conduct of SEA. Doing the SEA allows us to identify possible environmental impacts much earlier and comply with donor requirements.
2	**Question:** Rommel Pausal – City Assessor: In the absence of a SEA law in the Philippines, what is the best option to comply with the requirements of JICA and other donors, as well as ensure environmental protection for Greater Cotabato City	**Answer:** JST Tokyo: That is a particularly important question. SEA is like an early-stage instrument to consider matters like policies, plans, and programs. There are good Philippine laws on EIA. Without SEA, it is sometimes very difficult to identify negative impacts that could confront you later at the project stage, more difficult to deal with. Thus, better to do SEA first to look at the entire life of the project and use this SEA idea or findings to conduct EIA. This is how we ensure addressing environmental considerations for the project.
3	**Question:** Nash Maulana – (Writer for the Manila Standard and Mindanao Cross) The Cotabato City port at Timako is near a coral reef, in an open sea, and it is also vulnerable to tsunami. How does the study address these concerns?	**Answer:** JST Tokyo: The City Port is a project of the Philippine Ports Authority and they have conducted the Feasibility Study. At the moment, we have yet to conduct a detailed EIA for the Cotabato Port at Timako, but it will be covered by the SEA. With the SEA, we think of environmental considerations such as the ecosystem, among others, Detailed study of possible environmental impacts on specific projects is done through the EIA
4	**Question:** Roy Fiesta - Environment Group: City Agriculture Office Head. On the proposed land use, the agricultural sector is one of the most affected sectors, did the Study consider ways to avoid/lessen conversion of agricultural lands?	**Answer:** JST Tokyo: Cotabato City Government should promote land policies to protect agricultural lands. This is quite difficult since there is a need to balance the requirement of land to support the development and then the intent to protect agricultural land. **Additional input:** Engr. Rendon: The expansion plans of the city had already been discussed when we are preparing the CLUP. Most developments are to be located inside the resettlement area that will be protected from tsunami and agricultural lands and fisheries are outside that area, thus, fewer numbers of people engaged in agriculture will get affected.
5	**Suggestion/Recommendation:** Pete Marquez – Utility Group: Cotabato City is known to be a city of rivers and creeks; we could include these water resources in the planning for transport and tourism	**Response to Pete Marquez:** Adela Fiesta (CPDO): The utilization of water bodies had already been considered There are specific projects for tourism development, but we are yet still searching for a safer place where it could be placed.

No.	Comment, Questions and Suggestion	Answers
6	**Question:** Edwin Fernandez- Utility Group: On the Institutional framework, it appears that the private sector is not included in the structure, are we not considering (People's Organization) PO's and (Non-Government Organization) NGO's in the planning and implementation of the components of the study.	**Answer:** JST Tokyo: For this study, the formal consultation with the NGOs and business sector is through the SHMs. We also understand that the City Government is in constant touch with the private sector.
7	**Q&A Part II:** **Suggestion:** Adela Fiesta to JST Tokyo: Traffic congestion is mainly caused by wrong parking, houses along the roads, wrong placement of loading/unloading in some schools; We need to put an emphasis on policies to address these obstructions.	
8	**Suggestion:** Badrudin Ali: On the approval of the implementation for the opening of traffic routes in Cotabato City. I noticed the traffic congestion in Cotabato City, particularly along Sinsuat Avenue. I suggest that the City Government implement the approved traffic routes to lessen vehicles passing through Sinsuat Avenue.	**Answer:** JST Tokyo: Good idea. Noted
9	**Suggestion:** Edwin Fernandez: Could you consider putting a skyway along Sinsuat Avenue?	**Response:** JST Tokyo: It may be too early for such an idea. Skyway/flyovers can be a 2nd phase response after we exhaust options like widening the roads and improving the flow of traffic
10	**Question:** Nash Maulana: Is there a demarcation study to consider the separation of routes for Cotabato Port and Polloc Port? Or how it can potentially connect? Polloc, Cotabato, Zamboanga, Manila.	**Answer:** JST Tokyo: We have not gone to that extent yet. Initially, Cotabato port is for the Cotabato area while Polloc is a regional port – to serve a larger area
11	**Suggestion:** Pete Marquez to LGU: Parking is restrictive, this affects the business sector and buyers now prefer other areas like Midsayap. Parking areas need to be established, as business parking structures	**Response to Pete Marquez:** JST Tokyo: It is a difficult balancing act to cater to the interest of the business sector and the transport sector – the solution could be promoting a parking business. Perhaps private investors can use lands that are not yet utilized by owners for this purpose
12	**Recommendation from Water District:** Asst. GM Villarma: Roads are important to Water District – what about the West Diversion Road, will it also be able to help the Metro Cotabato Water District (MCWD) improve its distribution system?	**Response:** JST Tokyo: Yes, for your information, the route shall cross along the Tamontaka river and it will connect the City to Datu Odin Sinsuat town, through the Southern Philippines Development Authority (SPDA) village and a bridge over the Rio Grande will link the City to Sultan Mastura town
13	**Q&A Part III** **Question:** Engr. Crisanto Saavedra: There is a need to update the data on the plan. Data on solid waste, the daily collection seems to be incomplete – we have these data now. We now have the Materials Recovery Facilities (MRFS) in all barangays – though some need to be completed. We also have a strategy to turn solid waste into fertilizers, this is under negotiation with a proponent. In addition, the presentation slides show a proposal for a sanitary landfill, what is the proposal of the JST, to place it outside or inside Cotabato City considering it is below sea level?	**Answer:** JST Tokyo: Please provide updates. Not yet sure where it is the best area to place the sanitary landfill, information on Disaster Risk could help. We believe the SLF will be in the surrounding towns, but we still need to do some investigation to validate this option/idea.
14	**Question:** Engr. Crisanto Saavedra: On the septic tanks – We can mandate the construction of proper septic tanks when firms or households apply for business permits or construction permits	**Answer:** JST Tokyo: the suggestion is well taken

No.	Comment, Questions and Suggestion	Answers
15	**Suggestion:** Badrudin Ali: on the water system, members of the Integrated Transport Group of Cotabato City Urban settlers in Kalanganan 2 applied for the water connection and it was expensive. Perhaps, MCWD can improve its distribution system in the area to lessen the cost of the water connection to Bubong area residents.	**Response:** JST Tokyo: That is a good suggestion that the MCWD may consider
16	**Q&A Part IV** **Question**: Mr. Ismael Tolentino: What will be the part of the BARMM in implementing all of these programs/projects?	**Answer:** JST Cotabato City. The aspects of the final implementation have not yet been finalized. This is a matter that can be addressed later by the Philippine government or those with authority on the subject.
17	**Question:** Nash Maulana: on the proposal to use Solar panels to augment the supply of electricity, there is a need to consider the possibility of having power surges due to lightning that can strike the system, Control system, service the current technology. Technology has evolved – a recent device has a KW meter. Did the JST already consider this possible problem?	**Answer:** JST Tokyo: Solar panels can be damaged by lightning. It really depends on the areas that have thunder and lightning. If the area does not have that much weather disturbance, then the use of solar panels is desirable. We will consider your input.
18	**Question:** Architect Rebecca Hagad: Did this Study for improving Cotabato City's power sector consider renewable energy; solar, wind, or hydro?	**Answer:** JST Tokyo: The Study is focusing on improving the supply and distribution of power. We can also look at renewable energy, like solar energy being considered by MAGELCO. We could study if there is a potential for tapping renewable energy in Greater Cotabato City.

Source: Stakeholder Consultation, 2021, JICA Study Team

23.8.5 Legal and Institutional Framework of Environmental and Social Considerations

Laws and Regulations related to environmental and social issues in the Philippines are summarized in **Chapter 7** of this report. Based on both legal frameworks in Philippines (DAO 30 s. 2003 & EMB MC No. 005 July 2014) and the JICA Guidelines for Environmental and Social Considerations, April 2010 (hereinafter, "JICA Environmental Guidelines"), Categorization of WRD Project is estimated as follows:1) Categorization of EIA in line with JICA.

Each project is classified by JICA into one of the following Environmental Categories based on the magnitude of its potential impact on the environment or society. In other words, the category indicates the level of Environmental and Social Considerations required.

Table 23.8-29 JICA Environmental Categories

Categories	Description
Category A	The project is likely to have significantly adverse impacts on the environment or society. A project with a wide range of impacts, impacts that are irreversible, complicated, or unprecedented, and impacts that are difficult to assess. A project for a sector that requires special attention (e.g., a sector that involves large-scale infrastructure development), involves activity that requires careful consideration (e.g., large-scale involuntary resettlement), or takes place inside or adjacent to a sensitive area (e.g., protected natural habitat).
Category B	The project may have adverse impacts on the environment or society, but these impacts are less significant than those of Category A projects. These impacts are site-specific; few, if any, of them are irreversible; in most cases, they can be mitigated more readily than Category A projects. Responsibilities of the project proponents include the planning and

Categories	Description
	monitoring of necessary ESC activities. ESC procedures such as Initial Environmental Examination and stakeholder participation may be required, depending on the scale and nature of the adverse impacts.
Category C	The project is likely to have minimal or no adverse impact on the environment or society.
Category FI	JICA provides funds to a Financial Intermediary, which in turn implements sub-projects that may have adverse impacts on the environment or society, but these impacts cannot be identified in detail prior to JICA's approval. If there is a sub-project that can be categorized as Category A, it needs to go through the same procedure as a Category A project including JICA's environmental review and information disclosure prior to its implementation.

Source: The Basics of Environmental and Social Considerations (Introduction to the JICA Guidelines for Environmental and Social Considerations)

Table 23.8-30 List of ECA Categories

No.	ECA Category
1	All areas declared by law as national parks, watershed reserves, wildlife preserves, sanctuaries
2	Areas set aside as aesthetic potential tourist spots
3	Areas which constitute the habitat of any endangered or threatened species of Philippine wildlife (flora and fauna)
4	Areas of unique historic, archaeological, or scientific interests
5	Areas which are traditionally occupied by cultural communities or tribes
6	Areas frequently visited and/or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.)
7	Areas with critical slopes
8	Areas classified as prime agricultural lands
9	Recharge areas of aquifers
10	Water bodies characterized by one or any combination of the following conditions: tapped for domestic purposes; within the controlled and/or protected areas declared by appropriate authorities; which support wildlife and fishery activities
11	Mangrove areas characterized by one or any combination of the following conditions: with primary pristine and dense young growth; adjoining mouth of major river systems; near or adjacent to traditional productive fry or fishing grounds; areas which act as natural buffers against shore erosion, strong winds and storm floods; areas on which people are dependent for their livelihood.
12	Coral reefs characterized by one or any combination of the following conditions: With 50% and above live coralline cover; Spawning and nursery grounds for fish; Act as natural breakwater of coastlines

Source: EMB Memorandum Circular No. 005 July 2014 Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippines EIS System
JICA Study Team, 2021

(1) Project Threshold Coverage and Categorization

According to EMB Memorandum Circular No. 2014-005 otherwise known as Guidelines for Coverage Screening and Standardized Requirements under the Philippine Environmental Impact Statement system (PEISS), the proposed road project falls under the Category B, as categorized under Project No. 3.4.1 of Annex A (Project Thresholds for Coverage Screening and Categorization) of the same revised guidelines.

Table 23.8-31 Project Threshold for Coverage Screening and Categorization under PEISS

Project/ Description	**Covered (Required to secure ECC)**			**Not covered (may secure CNC)**	**Project size parameters**
	Category A: ECP	**Category B: Non-ECP**		**Category D**	
	EIS	**EIS**	**IEE Checklist**	**PD (Part I only)**	
3.4.1 Road, new construction -West diversion road about 17.5 km length	National Road: > 20km (length w/ no critical slope) OR >10km (length w/ critical slope)	Provincial Roads & other Types of Roads: > 20km (length w/ no critical slope) OR >10km (length w/ critical slope)	All types of roads: > 2km but <20km (length w/ no critical slope) OR >2km but <10km (length w/ critical slope)	< 2 km	
Notes: ECC – Environmental Compliance Certificate CNC - Certificate of Non-Coverage PD – Project Description IEE - Initial Environmental Examination EIS – Environmental Impact Statement ECP - Environmentally Critical Project ECA- Environmentally Critical Area					

Source: EMB Memorandum Circular No. 005 July 2014 Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippines EIS System
JICA Study Team, 2021

Based on the project threshold for coverage screening and categorization, the proposed road project falls under Category B which is required to secure an ECC. Since the WDR Project is below the 20km (with no critical slope) threshold of Category B, an Initial Environmental Examination Checklist Report shall be prepared and submitted to DENR-EMB for evaluation. However, confirmation of final screening and categorization of the proposed road project with DENR-EMB shall be implemented during the F/S study.

In terms of ECA categories, the proposed West Diversion Road is considered as non-ECA project because it will not directly traverse a proposed NIPAS, which is the Timako Hill in this case (roughly 4km away from the alignment). In 2017, the DENR-Biodiversity Management Bureau (BMB) endorsed the proposal for Timako Hill to be declared as protected area (forest reserve). To date, this is yet to be approved.

Public consultation and baseline social and environmental studies are required to be conducted within the affected areas as requirements in the preparation of EIS report. Categorization shall be further studied during the Feasibility Study stage after having firm understanding of the project's impact based on socioeconomic survey and engineering survey.

Table 23.8-32 Initial Project Coverage and Categorization based on PEISS and JICA

Project Component	**Location**	**Category**		**ECA Category**
		PEISS	**JICA**	
West diversion road about 17.5 km length (new road)	1. DOS 2. Cotabato City 3. Sultan Kudarat 4. Sultan Mastura 5. Parang	B	B	None

(2) Alternative Comparison

Discussion of alternative comparison for alternative designs of WDR Project is presented in Figure 23.8-17. In terms of social impact, Alternative 1 has the least impact in terms of houses and buildings, with only 48 structures affected. Alternative 2 affects 57 structures, while Alternative 3 affects 59, the highest in terms of impact.

WEST DIVERSION ROAD (WDR)

CRITERION		ALTERNATIVE 1		ALTERNATIVE 2		ALTERNATIVE 3	
LENGTH	km	17.493		17.853		17.799	
ROUTE EVALUATION							
• Scope of Work		• Road Length = 16.523Km • No. of Bridges = 8 • Bridge Length = 970m		• Road Length = 17.183Km • No. of Bridges = 6 • Bridge Length = 670m		• Road Length = 17.079Km • No. of Bridges = 8 • Bridge Length = 720m	
• Horizontal and Vertical Alignment		• Minimum radius of horizontal curve = 700m • Vertical alignment maximum gradient = 0.96%	●	• Minimum radius of horizontal curve = 500m • Vertical alignment maximum gradient = 0.8%	▲	• Minimum radius of horizontal curve = 200m • Vertical alignment maximum gradient = 4.0%	■
• Project Cost		• Most expensive scheme due to required bridges.	■	• Least expensive scheme due to the shortest bridge length.	●	• Second most expensive scheme.	▲
• Function as a Tsunami Barrier		• Effective as a Tsunami barrier.	●	• Effective as a Tsunami barrier.	●	• Not so effective as a Tsunami barrier.	▲
• Construction Difficulty		• Higher embankment fill to address storm surge. • Several long and short bridges is needed. • Most number and longest bridge length required.	▲	• Higher embankment fill to address storm surge. • Least bridge number and length required.	●	• Least embankment fill to address storm surge. • Fewer long and short bridges is needed.	▲
• Social Aspect		• No. of houses/buildings affected = 45 • Least impact.	●	• No. of houses/buildings affected = 57 • Medium impact.	▲	• No. of houses/buildings affected = 59 • Highest impact.	▲
• Community Protection Aspect		• Function as a Tsunami barrier and widest area protected against Tsunami provided.	●	• Function as a Tsunami barrier.	●	• Function as a Tsunami barrier for only a small area..	■
• Environmental Aspect		• Affect few fishponds.	▲	• Affect several fishponds.	■	• Not affect fishponds.	●
		• Affect several tree plantations.	■	• Affect several tree plantations.	■	• Affect several tree plantations.	■
OVERALL EVALUATION							

Legend: Best Evaluation ● Better Evaluation ▲ Fair Evaluation ■

Source: JICA Study Team

Figure 23.8-17 Alternative Designs

23.8.6 Scoping and ToR for Environmental and Social Considerations Surveys

(1) Scoping

Scoping means choosing alternatives for analysis, a range of significant and potentially significant impacts, and study methods. ✓ mark is applied for environmental items which will be affected by the project or cannot be decided without additional surveys. Scoping is executed for different phases of pre-construction/construction and operation in each environmental item. Items without ✓in both two phases are not the target of following survey and evaluation if there are enough reasons that the items will not be affected by the project. The following table shows the result of scoping of WDR.

Table 23.8-33 Result of Scoping of WDR

No	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
1	Air Quality	✓	✓	[CS] Construction vehicles including fuel-fed machineries/equipment may cause air pollution temporarily during road construction. [OS] Negative impact on air quality is expected due to mobile emissions coming from the vehicles passing the new road network.
2	Water Quality	✓	✓	[CS] Construction activities (such as cutting/filling works with surface erosion), construction vehicles, camp yards may cause water pollution through drainage water and effluents. Thus, pose a concern on water quality. [OS] Drainage from road structure may cause water pollution in water bodies along the road and adjacent/nearby agricultural lands.
3	Waste	✓		[CS] Construction waste including concrete, asphalt, cut trees and soil may be generated through construction activities. Waste generated in camps and sleeping quarters may also add to the volume of waste (total garbage generation). [OS] No serious impacts are expected, because there is no plan of service / parking area which may generate waste. Users of the road are mostly just passing the area.
4	Soil Contamination	✓		[CS] There is a possibility of soil contamination by oil leakage from construction vehicles and soil generated by the project. [OS] Unlikely that there will be soil contamination when the road is fully operated.
5	Noise and Vibration	✓	✓	[CS] Construction vehicles may cause noise and vibration temporarily in sections that are near the existing residential areas. [OS] Ambient noise and vibration along proposed WDR may cause negative impact on sections nearby sensitive receptors such as residential areas/public facilities (mosques/prayer centers).
6	Ground Subsidence	✓	✓	[CS/OS] Landfilling may cause ground subsidence in the area of soft soil and other specific conditions. Also, during the road operation because of increased vehicle traffic, some of which carrying heavy loads.
7	Offensive Odor	✓		[CS] There is a possibility of offensive odor by construction activities only to residential areas that are near the road alignment. But generally, this may not pose a concern as the road sections are mostly agricultural in uses (rice fields). [OS] Unlikely that there will be offensive odor/smell when the road is fully operated.
8	Bottom Sediment	✓		[CS] There is a minimal possibility of impact on the bottom sediment (land and water bodies) by leaked oil from construction vehicles and flown soil caused by earthwork. [OS] Unlikely that there will be issues on bottom sediment when the road is fully operated.
9	Protected Area	✓	✓	[CS/OS] The project may cause impact to nearby proposed protected (Timako Hill) which is considered as forest reserve.
10	Ecosystem	✓	✓	[CS/OS] The project may cause impact such as tree-cutting and clearing activities on ecosystem including indicator species and along the project site.
11	Hydrology	✓	✓	[CS/OS] There is a possibility of changes to hydrology because the project crosses some rivers.
12	Topography and Geology	✓		[CS] Topography might change by land cutting and filling works. There may be possibilities of small land slide and soil erosion along the project roads (which mostly are rice fields/agricultural areas) due to land filling works. [OS] During road operation phase, the project may no longer cause geographical and topographical changes. FS study can clearly determine this.
13	Land Acquisition and Resettlement			[PCS] This is a new road since land acquisition is necessary. [CS/OS] Some structures were identified which need to be determined during the feasibility study if they are a house with residents.

No	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
14	Poverty			[PCS/CS] There will be no displacement of the vulnerable groups due to the road project. [OS] No adverse impact on poor and vulnerable groups.
15	Ethnic Minority and Indigenous People			[PCS/CS/OS] There may no ethnic minority and/or indigenous people affected by the project since the road project requires no displacement of people.
16	Local Economy such as Employment and Livelihood	✓		[CS] Construction activities may cause temporal inconvenience to farmers affected by the projects. There may be minimal effect on the employment and livelihood (including farming) of project affected households during construction. [OS] No additional impact is expected during operation stage.
17	Land Use and Usage of Local Resources	✓	✓	[CS] Loss of farmlands for new roads are expected. Land and other natural resources such as trees/rice paddies of project affected households may also affected by construction activities. [OS] WDR may cause some negative impact on land use such as conversion of agricultural areas and ground extraction of water resources as it now attracts settlements of people.
18	Water Usage	✓	✓	[CS] River water may be affected by earthworks. There may be changes in water usage due to construction activities. [OS] Operation of roads may cause impact on water usage as there will be high pressures for some areas to be settled by the people, who eventually will need water supply for their daily use.
19	Existing Social Infrastructure and Services	✓	✓	[PCS/CS] There may be minimal disturbances on accessing various social infrastructure services (health and educational centers) due to the road construction. [OS] Highway may bring positive impact on exiting road networks around the area. This facilitates economic progress and development of the area.
20	Social Institutions such as Socially Related Capital and Decision-making Organizations	✓		[CS] There may be adjustments and impacts to local decision-making organizational dynamics due to road constructions as some affected induvial/families may have complaints or issues. [OS] No additional impact is expected.
21	Misdistribution of Benefit and Damage			Misdistribution of benefit and damage caused by the road construction is not expected.
22	Local Conflicts of Interest	✓	✓	[CS] Because of increased land value, conflicts may arise due to various claims on lands near the road project. [OS] Because of increased land value, conflicts may arise due to various claims on lands near the road project.
23	Cultural Heritage	✓	✓	Kutawato Cave is the nearest historical/cultural/natural site in the proposed alignment (approximately 2 km from the proposed project alignment). There might be some kind of impact or threat to the heritage site. The FS study can determine this more closely.
24	Landscape	✓	✓	[CS] There is a minor possibility of disturbance of landscape by the road structures including bridges. [OS] Operation of roads may cause impact on landscape, as it attracts for new land uses and pressures for new settlement.
25	Gender	✓	✓	[CS] There may be some kind of impact on women and children that live near the road project alignment. [OS] Improved mobility when the road project operates leads to positive impact on gender and empowerment.
26	Children's Right	✓	✓	[CS] There is a possibility of occurrence of child labor. [OS] Due to the improvement of traffic flow and road openings, traveling time to institutional facilities (school and hospital) will become faster and safer. Impact would be positive in this sense.

No	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
27	Infectious Diseases such as HIV/AIDS	✓	✓	[CS] Infectious diseases (ex. COVID 19, HIV AIDS) are possible to be spread due to inflows of construction workers in the area. [OS] Infectious diseases (ex. COVID 19 HIV AIDS) are possible due to increased human travel and foot traffic.
28	Labor Environment including Safety	✓		[CS] Due to construction activities, labor environment may be affected. Incidence of unfair labor practices may happen in contracting arrangement and actual work. [OS] Operation of roads may not cause impact on labor environment both directly and indirectly.
29	Accident	✓	✓	[CS] Traffic accident related to construction vehicles and accident in construction sites are expected. [OS] Traffic accident may increase due to increased traffic volume.
30	Transboundary Impact and Climate Change	✓	✓	[CS] and [OS] Emissions of Greenhouse Gasses may increase due to construction machinery / vehicles and newly generated traffic. Movement of people and goods are expected when the road is fully operated and this may pose transboundary concerns on climate change and public health.

Note) Project stage: PCS: Pre-construction stage, CS: Construction stage, OS: Operation stage
Source: JICA Study Team

(2) ToR for Environmental and Social Considerations Surveys

Based on the scoping results in the previous section, terms of references (ToR) for surveys of necessary environmental items are developed to determine project induced impacts. Possible impact to be caused by project implementation will be evaluated qualitatively based on existing secondary data, interview to concerned parties and examining project design. Table 23.8-34 shows the ToR for environmental and social considerations survey.

Table 23.8-34 ToR for Surveys of Environmental and Social Considerations

No.	Item	Survey Item	Survey Method
1	Air Quality	(1) Relevant standards on air quality monitoring (Domestic, Japanese, WHO's, etc.) (2) Status of air quality vis-a-vis national guideline values	(1) Existing material/baseline (2) Secondary data/information from past projects nearby (3) Qualitative evaluation based on expected traffic volume and construction vehicles
2	Water Quality	(1) Relevant standards on water quality monitoring (DENR, Japanese, WHO's, etc.) (2) Status of water quality items	(1) Existing material/baseline (2) Secondary data/information from past projects nearby (3) Qualitative evaluation based on expected construction methods
3	Waste	(1) Waste (solid and wastewater) management process	(1) Secondary data/information from past projects (similar project location, scope or context) (2) Qualitative evaluation based on expected construction methods and facilities
4	Soil Contamination	(1) Protection method against oil leakage	(1) Confirmation on implementation plan of construction vehicles (2) Qualitative evaluation based on expected construction methods
5	Noise and Vibration	(1) Relevant standards on noise and vibration monitoring standards (DENR, Japanese, IFC's, etc.) (2) Status of noise and vibration	(1) Existing material/baseline (2) Secondary data/information from past projects nearby (3) Qualitative evaluation based on expected traffic volume and construction vehicles
6	Ground Subsidence	(1) Soil conditions	(1) Past study around the area (2) Qualitative evaluation based on expected construction methods
7	Offensive Odor	(1) Possible events and practices causing odor	(1) Collection of necessary information on construction method (2) Qualitative evaluation based on expected construction methods
8	Bottom Sediment	(1) Construction method causing sedimentation	(1) Collection of necessary information on construction method (2) Qualitative evaluation based on expected construction methods
9	Protected Areas	(1) Situation of registration (2) Outline of the protected areas	(1) Relevant laws and regulations (2) Past study around the area (3) Qualitative evaluation based on expected construction methods
10	Ecosystem	(1) Baseline situation of general ecosystem (2) IUCN listed species	(1) Past field surveys on occurrences of fauna and flora (2) IUCN Website etc. (3) Qualitative evaluation based on expected construction methods
11	Hydrology	(1) Situation of surface water such as river and lake (2) Impact during construction	(1) Past field surveys (2) Confirmation of construction methods (3) Qualitative evaluation based on expected construction methods
12	Topography and Geology	(1) Construction method causing changes of topography and geology	(1) Collection of necessary information on construction method (2) Qualitative evaluation based on expected construction methods

No.	Item	Survey Item	Survey Method
13	Land Acquisition and Resettlement	(1) Size of impact (only on structures) (2) Compensation policy on structures	(1) Aerial photos, design, etc. (2) Existing surveys (3) Qualitative evaluation based on expected project effects
14	Poverty	(1) Distribution of poverty groups; degree and extend	(1) Existing surveys and Statistics (2) Qualitative evaluation based on expected project effects
15	Ethnic Minority and Indigenous People	(1) Distribution of ethnic minority and indigenous people (not applicable in this project)	(1) Existing surveys and Statistics (2) Qualitative evaluation based on expected project effects
16	Local Economy such as Employment and Livelihood	(1) Local economic status	(1) Existing surveys and Statistics (2) Qualitative evaluation based on expected project effects
17	Land Use and Usage of Local Resources	(1) Land use status	(1) Existing surveys and existing maps (2) Qualitative evaluation based on expected project effects
18	Water Usage	(1) Water usage status in rivers and other resources (2) Impact during construction	(1) Existing surveys and literature material (2) Confirmation of construction methods (3) Qualitative evaluation based on expected impact on water use
19	Existing Social Infrastructure and Services	(1) Distribution of residential areas, school, hospital, and etc.	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
20	Social Institutions such as Socially Related Capital and Decision-making Organizations	(1) Social institutions and possible impact	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
21	Local Conflicts of Interest	(1) Expected conflicts	(1) Project design and distribution of interest (2) Qualitative evaluation based on expected project effects
22	Landscape	(1) Scenic areas	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected structures and topographical changes
23	Gender	(1) Impact on gender	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
24	Children's Right	(1) General situation/possibility of child labor	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
25	Infectious Diseases such as HIV/AIDS	(1) General situation/possibility of infectious diseases	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
26	Labor Environment including Safety	(1) General situation/possibility of labor environment	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects

No.	Item	Survey Item	Survey Method
27	Accident	(1) Expected increases of accident	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
28	Transboundary Impact and Climate Change	(1) Elements related to cross boundary impacts, cumulative impacts, and climate change	(1) Collect information based on highway construction and management (2) Qualitative evaluation based on expected project effects

Source: JICA Study Team, 2021

23.8.1 Environmental Management Plan (EMP)

(1) Preliminary Impact Assessment

The result of potential negative environmental and social impact assessment at action plan study is shown in the following table. In consideration of survey results, the impacts were evaluated qualitatively in each of the three stages separately, namely: pre-construction stage [PCS], construction stage [CS], and operation stage [OS]. The impacts of pollution, natural environment, and social environment were classified as A to D in accordance with the following criteria, assuming no specific measures toward the impacts are taken:

A: Significant Negative Impact   A+: Significant Positive Impact
B: Some Negative Impact   B+: Some Positive Impact
C: Impacts are not clear, need more investigation
D: No impacts or impacts are negligible, no further study required

Table 23.8-35 Result of ESIA at action plan study

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS /CS	OS	PCS /CS	OS	
1	Air Quality	✓	✓	B-	B-	[CS] In consideration of current residential land use, temporary negative impacts are expected on air quality due to exhaust gas and dust generated from construction activities. The exhaust gas such as NOx, SOx, CO TSP, PM10, PM2.5 will be generated from construction machines, equipment and traffic congestion around the construction yard due to the temporary traffic restriction. And dust will be generated by earth work including foundation excavation for piers, transporting of earth and sand, etc. [OS] Ambient air quality along the new road will be impacted by current traffic exhaust gas. Since it is expected that traffic flow will be smoother by shifting vehicles from existing road to new road, air quality along this will be improved. On the other hand, there is a possibility of increase in the number of vehicles. In that case, air quality along the road might get worse than the current condition.
2	Water Quality	✓	✓	B-	C	[CS] The project is located in mostly agricultural areas. Turbid water may be generated from excavation areas due to surface run-off. Improper stockpiling of construction materials in low -lying areas could affect the water quality of nearby bodies of water. Furthermore, there is a possibility of inadequate treatment and/or mishandling of wastewater, suspended matter, waste oil, and other chemicals, in the all-earthwork area including the main road area and borrow pit, etc. Additionally, domestic wastewater may be discharged from the labor camp. [OS] No serious impacts are expected, because there is no plan of service / parking area.
3	Waste	✓		B-	C	[CS] Construction waste including waste soil, asphalt mass and cut trees are expected at the construction site. Additionally, domestic waste (garbage) may be generated from the labor camp.
4	Soil Contamination	✓		B-	C	[CS] There is a possibility of soil contaminant by wastewater from tunneling work/piling construction/excavation process, if wastewater is discharged without adequate treatment and/or mishandling. Dumping soil and muck also can cause soil contamination if they have specific chemicals. Furthermore, there is a possibility of soil contamination due to the unexpected leakage/ mishandling of oil and other chemicals, in the all-earthwork area including the main road area and borrow pit, etc. Dumping soil and muck also can cause soil contamination if they have specific chemicals.
5	Noise and Vibration	✓	✓	B-	B-	[CS] In consideration of current land use temporary negative impacts are expected on ambient noise due to higher noise generated from construction machines and equipment. [OS] Ambient noise and vibration along existing road is already impacted by current passing vehicles. Though it is expected that traffic flow may become smooth due to the shift from existing road to new highway, noise and vibration level might increase because of the increase in traffic and travel speed of vehicles.
6	Ground Subsidence	✓	✓	C	C	[CS/OS] The extent of impact is unknown, because there is no detail amount of ground water and geographical test data, and no decided proposed ROW and tunnel excavation methodology at this moment. In case of large amount of discharge water and/or worse ground foundation than expected, there is a possibility of ground subsidence in the mountain area, due to the tunnel construction. To clarify the baseline condition of geographic mechanism including ground water level, geological test shall be conducted along the proposed alignment during the feasibility study.

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS /CS	OS	PCS /CS	OS	
7	Offensive Odor	✓		C	C	[CS] There are no direct project-related activities that can generate offensive odor due to the general road construction, however impact of construction basecamp operations may have temporary impact.
8	Bottom Sediment	✓		B-	C	[CS] There is a possibility of impact on the river bottom sediment by flown soil caused by earthwork in the river, depending on the construction methodology. In case of river crossing, when bottom sediment had already been polluted, dumping of soil in the riverbed will also also have the possibility of soil contamination when they are dumped to other places.
9	Protected Area	✓	✓	C	C	Basically, seemingly no impacts are expected at this moment, since protected areas are not within the immediate vicinity of project area. But it's something to be confirmed during the FS phase.
10	Ecosystem	✓	✓	B-	C	[CS] Construction activities and existence of road structures may have some impact (such as damage of trees and vegetation, loss of nest/feeding area/breeding area, and migration inhibition, division of the habitation area, road killing, noise/vibration due to the new traffic flow, etc.) on surrounding ecosystem along the project alignment. There is a possibility of decreasing the biodiversity and habitat around the mangrove areas where variety of sea and land species are using this as nesting, feeding and breeding place due to the implementation activities of the project depending on the final design and construction process. To evaluate the impact, seasonal flora and fauna survey and tree inventory survey shall be conducted during the feasibility study survey. In addition, coral reefs along the seashore might be affected by polluted water (turbid water) and sedimentation from rivers. [OS] Operation of roads may not cause any severe impact on ecosystem along the road.
11	Hydrology	✓	✓	B-	B-	[CS/OS] To clarify the baseline condition of geographic mechanism including groundwater level and flow, geological tests shall be conducted along the proposed alignment during the feasibility study. The amount of water uses and source during construction and operation shall be clarified during the feasibility study. And also, there is a possibility of disturbance of water flow by construction of bridge pier in the river and preventing /changing water flow by concrete structures.
12	Topography and Geology	✓		B-	B-	[CS] The project area is located in the area of high susceptibility to flooding as defined in the ECA. Topography might change by land development. There is a possibility of topsoil erosion in the construction site during rainy season (May-October).
13	Land Acquisition and Resettlement			D	D	[PCS] It is expected that only few existing structures (possibly few houses) are affected due to the implementation of the Project, based on satellite image (Google Earth) interpretation. Socio-economic survey, inventory survey and market value survey may focus on identification of landowners and compensation for the loss of trees and similar properties.
14	Poverty			C	B+	[PCS/CS] The project may bring positive impact on local economy through construction activities and rural development. Some poor families may be negatively affected by the project if their properties are affected and/or their livelihood is lost due to the project.
15	Ethnic Minority and Indigenous People			D	D	There is no ethnic minority and/or indigenous people living directly within the project site that might be affected by the proposed new road. However, it is better to confirm this during the feasibility study phase.

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS /CS	OS	PCS /CS	OS	
16	Local Economy such as Employment and Livelihood	✓		C	B+	[CS] Employment opportunity can be created due to the project construction. On the other hand, overall construction activities and traffic movement would affect local economic activities that are focused on the context of project location, particularly for the agriculture/fishery sectors. [OS] Employment and livelihood opportunities may improve during the operation stage, as local population expects improved mobility and transport for work and trading activities.
17	Land Use and Usage of Local Resources	✓	✓	B-	C	[CS] The project area is located in the prime agricultural land as defined in the ECA. Loss of farmland for new roads are expected and land use may change along the road. Land and local resources such as trees and some households are also affected by resettlement activities. [OS] Effective use of lands and local resources due to high accessibility are expected. At the same time, project-induced development may affect local resources adversely.
18	Water Usage	✓	✓	B-	B-	[CS/OS] To clarify the baseline condition of underground water use around the project area, inventory survey for wells shall be conducted during the feasibility study. Although water source during construction is not yet decided at this moment, water use permission in line with regulation shall be sought from relevant agencies prior to the construction to avoid conflict with water users. The amount of water uses and source during construction shall be made clear during the feasibility study.
19	Existing Social Infrastructure and Services	✓	✓	B-	C	[PCS/CS] [PCS/CS] There might be very few existing utilities (transmission lines, telecom lines, water lines, etc.) along the project road as the alignment is a new network. These infrastructures shall be protected and/or diverted before construction work. [OS] More convenient access to services due to new road access is expected during operation stage.
20	Social Institutions such as Socially Related Capital and Decision-making Organizations	✓		B-	C	[CS] There is a possibility of a temporary physical community division by construction yard during construction.
21	Local Conflicts of Interest	✓	✓	C	C	[OS] New alignment may cause access issues for existing communities and owners/tenants of the farmlands and their interest may cause local conflicts especially on land ownership and the like.
22	Landscape	✓	✓	B-	C	[CS] There is a possibility of disturbance of landscape by the road structures such as bridges.
23	Gender	✓	✓	C	B+	[CS]: Temporary inconvenience to nearby residents along few road sections because of construction activities. On the one hand, the Project can provide additional employment opportunities during this phase, which women can take advantage of. However, there might be gaps on working conditions such as wage between men and women when local employment is considered.
24	Children’s Right	✓	✓	B-	B+	[CS/OS] There is a possibility of occurrence of child labor.

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS /CS	OS	PCS /CS	OS	
25	Infectious Diseases such as HIV/AIDS	✓	✓	B-	C	[CS] Infectious diseases such as HIV/AIDS/COVID 19 are possible to spread due to inflow of construction workers. Furthermore, alteration of the ground by tree cutting, soil excavation and land filling may lead to the creation of habitats for mosquitos that possibly transmit dengue fever.
26	Labor Environment including Safety	✓		B-	C	[CS] Accident and harm to health for workers may happen in the construction area for bridge section; however, it will be secured in accordance with the domestic laws and regulations during construction.
27	Accident	✓	✓	B-	B-	[CS] Traffic accident related to construction vehicles and accident in construction sites are expected. [OS] Traffic accident may increase due to increased traffic volume.
28	Transboundary Impact and Climate Change	✓	✓	B-	B-	[CS] Significant distortion of landforms and degradation of agricultural lands and nearby mangroves are expected during this project phase. [OS] Increase of Greenhouse Effect Gas is anticipated as vehicular traffic in new road network causes increased emissions/pollutions.

Note:

Project stage: PCS: Pre-construction stage, CS: Construction stage, OS: Operation stage

Impact:

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

D: No impact is expected.

N/A: Impact assessment isn't conducted because the items was not checked ✓in scoping phase.

Source: JICA Study Team,2021

(2) Mitigation Measures

Items rated as A- and B- in the table of impact assessment are the target of mitigation measures. Mitigation measures should be feasible and practical. Table 23.8-36 shows mitigation measures for ABLH classified into construction and operation phases.

Table 23.8-36 Mitigation Measures

No.	Items (Impacts)	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost (PhP)
Construction Stage					
1	Air Quality	- Water sprinkling to reduce particulate matter - Routine / periodic maintenance and washing of construction machineries and vehicles to minimize air pollutants -Announcement of construction work to nearby residents (esp on start and end sections) - In the event of complaint from residents, review the additional mitigation measures including the construction schedule or location of heavy vehicles through the communication with local people	Contractor	DPWH (UPMO); BARMM-MPW	TBD
2	Water Quality	- Installing sedimentation tank to reduce discharged turbid water - Cover exposed earth especially before heavy rains are expected. - Installing septic tanks for origin of polluted water such as camp yard - Appropriate wastewater treatment such as connecting drainage system to existing sewage systems	Contractor	DPWH (UPMO); BARMM-MPW	TBD
3	Waste	-Prepare detailed waste management program in consideration with LGU's waste management system - Education on waste treatment for workers - Separation of hazardous waste and bring out to appropriate treatment facilities - 3Rs promotion to reduce waste	Contractor	DPWH (UPMO); BARMM-MPW	TBD
4	Soil Contamination	- Necessary laboratory test to identify contaminated soil and mock for special care - Find feasible treatment facilities or filling area in earlier stage of the project such as F/S	Contractor	DPWH (UPMO); BARMM-MPW	TBD
5	Noise and Vibration	- To avoid disturbance of daily life, construction time shall be set within daytime, especially near residential areas (applied in just few identified sections) - Apply low-noise vibration machineries as much as possible nearby residential areas -Provide the temporary noise barrier and/or fence around the construction yard near residential area, if necessary -Announcement of construction work to surrounding residents - In the event of complaint from residents, review the additional mitigation measures including the construction schedule or location of heavy vehicles through the communication with local people	Contractor	DPWH (UPMO); BARMM-MPW	TBD
6	Ground Subsidence	- Avoid extraction of ground water for construction	Contractor	DPWH (UPMO); BARMM-MPW	TBD

No.	Items (Impacts)	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost (PhP)
		- Applying replacement methods for soft soil areas and prevention measures for liquefaction based on further studies and discussion in F/S. - Monitoring to identify early symptoms of subsidence			
7	Offensive Odor	- Education and instruction of rules in camp yards to keep good hygiene	Contractor	DPWH (UPMO); BARMM-MPW	TBD
8	Bottom Sediment	- Installing sedimentation tank to reduce discharged turbid water	Contractor	DPWH (UPMO); BARMM-MPW	TBD
9	Ecosystem	- Avoid tree cutting to reduce impact on habitat -Relocation/replant of trees - Consider construction season and time if specific rare species' breeding points / nests / important feeding ground are confirmed in the affected areas. -Conduct awareness campaign to all relevant construction workers about the careful consideration for ecosystem -Adoption of lower noise vibration construction method and machines - Adoption of adequate pass route, based on the field survey, estimated impact and advice from biological expert, if necessary	Contractor	DPWH (UPMO); BARMM-MPW	TBD
10	Hydrology	- Avoid large amount of extraction of ground water	Contractor	DPWH (UPMO); BARMM-MPW	TBD
11	Topography and Geology	- Slope protection is required after cutting slopes especially in the period of rainy season	Contractor	DPWH (UPMO); BARMM-MPW	TBD
12	Land Acquisition and Resettlement	- Alignment discussion should be carefully done during F/S study	Consultant, Contractor, DPWH, LGUs, NHA	DPWH (UPMO); BARMM-MPW	TBD
13	Poverty	- Study the poverty profile of nearby communities	Consultant, Contractor, DPWH, LGUs, NHA	DPWH (UPMO); BARMM-MPW	TBD
14	Ethnic Minority and Indigenous People	- Just for validation, countercheck if there are indeed no IPs in nearby communities	Consultant, Contractor, DPWH, LGUs, NHA	DPWH (UPMO); BARMM-MPW	TBD
15	Local Economy such as Employment and Livelihood	- Appropriate mitigation measures in cases of negative impact on livelihood and employment during construction phase must be prepared consistent with domestic and development partner's policies with assistance for business disturbances.	Consultant, Contractor, DPWH, LGUs, NHA	DPWH (UPMO); BARMM-MPW	TBD
16	Land Use and Usage of Local Resources	- Further assessment must be prepared consistent with domestic and development partner's policies.	LGUs	LGUs	TBD
17	Water Usage	- Avoid large amount of extraction of ground water	Contractor	DPWH (UPMO);	TBD

No.	Items (Impacts)	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost (PhP)
				BARMM-MPW	
18	Existing Social Infrastructure and Services	- Appropriate / agreed compensation for owners of infrastructures to recover, divert, and replace (just in few sections).	DPWH, LGUs	DPWH (UPMO); BARMM-MPW	TBD
19	Social Institutions such as Socially Related Capital and Decision-making Organizations	- Detour for securing reasonable accessibility to social institutions	Contractor	DPWH (UPMO); BARMM-MPW	TBD
20	Landscape	- Minimize cutting trees and slopes - Installation of slope seeding / planting to recover construction areas	Contractor	DPWH (UPMO); BARMM-MPW	TBD
21	Gender	- Positive employment of women for light works in construction activities such as cleaning (in camps) with fair salary and other conditions - Prepare toilet and dressing spaces for women workers - Education on gender equality for workers	Contractor	DPWH (UPMO); BARMM-MPW	TBD
22	Children's Right	- Restrict child labor (workers under 14 years old) in contract with punishment - Report list of workers with their age information	Contractor	DPWH (UPMO); BARMM-MPW	TBD
23	Infectious Diseases such as HIV/AIDS, COVID-19	- Education on infectious diseases for workers - Vaccination of workers (COVID-19)	Contractor	DPWH (UPMO); BARMM-MPW	TBD
24	Labor Environment including Safety	- Education on occupational safety for workers - Safety patrol - Sign boards	Contractor	DPWH (UPMO); BARMM-MPW	TBD
25	Accident	- Periodic maintenance of machineries and vehicles - Sign boards - Employ enough number of traffic guards	Contractor	DPWH (UPMO); BARMM-MPW	TBD
26	Transboundary Impact and Climate Change	- Periodic maintenance of machineries and vehicles - Recommendation of idling stop activities/engine maintenance	Contractor	DPWH (UPMO); BARMM-MPW	TBD
Operational Stage					
1	Air Quality	- Strengthening of vehicle inspection	DPWH	DPWH (UPMO); BARMM-MPW	TBD
2	Noise and Vibration	- Noise barriers if the level significantly exceeds the standard - Restriction of maximum speed	DPWH	DPWH (UPMO); BARMM-MPW	TBD
3	Ground Subsidence	- Periodic observation of level changes	DPWH	DPWH (UPMO); BARMM-MPW	TBD
4	Hydrology	- Avoid large amount of extraction of ground water	DPWH	DPWH (UPMO);	TBD

No.	Items (Impacts)	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost (PhP)
		- Periodic observation of water flow / level		BARMM-MPW	
5	Ethnic Minority and Indigenous People	- Validation if indeed there are no indigenous people in and around the project areas/sections	DPWH, LGUs	DPWH (UPMO); BARMM-MPW	TBD
6	Land Use and Usage of Local Resources	- Study the prevailing legal frameworks and masterplans by LGUs	LGUs	LGUs	TBD
7	Water Usage	- Avoid large amount of extraction of ground water - Periodic observation of water flow / level	DPWH, LGUs	DPWH (UPMO); BARMM-MPW	TBD
8	Local Conflicts of Interest	- Design box culvert or any other crossing structure to secure accessibility	DPWH, LGUs	DPWH (UPMO); BARMM-MPW	TBD
9	Accident	- Sign boards - Traffic violation crackdown by police - Road safety education at schools and other appropriate facilities	DPWH, LGUs, Police	DPWH (UPMO); BARMM-MPW	TBD
10	Transboundary Impact and Climate Change	- Strengthening of vehicle inspection	DPWH	DPWH (UPMO); BARMM-MPW	TBD
				Total Cost	TBD

Source: JICA Study Team, 2021

23.8.2 Environmental Monitoring Plan (EMoP)

(1) Proposed EMoP

Table 23.8-37 presents general/typical proposed Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) for mitigating the negative impact. Feasible and specific EMP and EMoP shall be studied during the Feasibility Study.

Table 23.8-37 Monitoring Plan

No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost (PhP)
Construction Stage							
1	Air Quality	PM10, PM2.5, SO2, CO, NO2	Construction sites, major access routes to the construction sites	Once a month	Contractor	BARMM-MPW	TBD
2	Water Quality	BOD5, COD, Oil and Grease, pH, Total Coliform, Total Nitrogen, Total Phosphorous, Total suspended solids, Turbidity, Arsenic, Iron, Sulphate	Rivers, drainages, camp yards, wells, springs	Once every three-month	Contractor	BARMM-MPW	TBD
3	Waste	Types and amount of waste	Temporary waste storage	Once every three-month	Contractor	BARMM-MPW	TBD

No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost (PhP)
4	Soil Contamination	Soil quality test in accordance with the baseline survey and existing land use, Monitoring accident, maintenance record of machineries and vehicles, site observation	Construction sites and camp yards	Once a month	Contractor	BARMM-MPW	TBD
5	Noise and Vibration	Sound level and vibration.	Construction sites, major access routes to the construction sites	Once a month	Contractor	BARMM-MPW	TBD
6	Ground Subsidence	Visible observation on markers and gauges	Surrounding structures of construction sites	Once a week	Contractor	BARMM-MPW	TBD
7	Offensive Odor	Types and amount of waste, other specific cases such as oil leakage	Temporary waste storage	Once every three-month	Contractor	BARMM-MPW	TBD
8	Bottom Sediment	Visible observation of rivers and drainage from construction sites	Construction sites and rivers	Once every three-month	Contractor	BARMM-MPW	TBD
9	Ecosystem	Field confirmation by experts, number of cut mangrove trees	Construction sites and surrounding areas	Once a year	Contractor	BARMM-MPW	TBD
10	Hydrology	Visible observation, interview, measurement of water volume	Rivers, springs, wells, etc.	Once every three-month	Contractor	BARMM-MPW	TBD
11	Topography and Geology	Visible observation, reviewing of cut and fill plan, tree cutting plan with certification	Forest, hilly areas	Once every three-month	Contractor	BARMM-MPW	TBD
12	Land Acquisition and Resettlement	Internal / External monitoring report/grievance records	Project Areas	Following RAP	LGUs, NHA, other relevant bodies	BARMM-MPW	TBD
13	Poverty	Internal / External monitoring report/grievance records	Project Areas	Following RAP	LGUs, NHA, other relevant bodies	BARMM-MPW	TBD
14	Ethnic Minority and Indigenous People	Internal / External monitoring report /grievance records, IPP, if any	Project Areas	Following RAP and IPP	LGUs, NHA, other relevant bodies	BARMM-MPW	TBD
15	Local Economy such as Employment and Livelihood	Internal / External monitoring report /grievance records, income restoration program (IRP)	Project Areas	Following RAP, IRP	LGUs, NHA, other relevant bodies	BARMM-MPW	TBD
16	Land Use and Usage of Local Resources	Construction plan including lease land, grievance records	Project Areas	Once every three-month	Contractor	BARMM-MPW	TBD
17	Water Usage	Water volume, visible observation, interview, grievance records	Water usage areas	Once a month	Contractor	BARMM-MPW	TBD
18	Existing Social Infrastructure and Services	Visible observation, interview, grievance records	Project Areas	Once every three-month	Contractor	BARMM-MPW	TBD

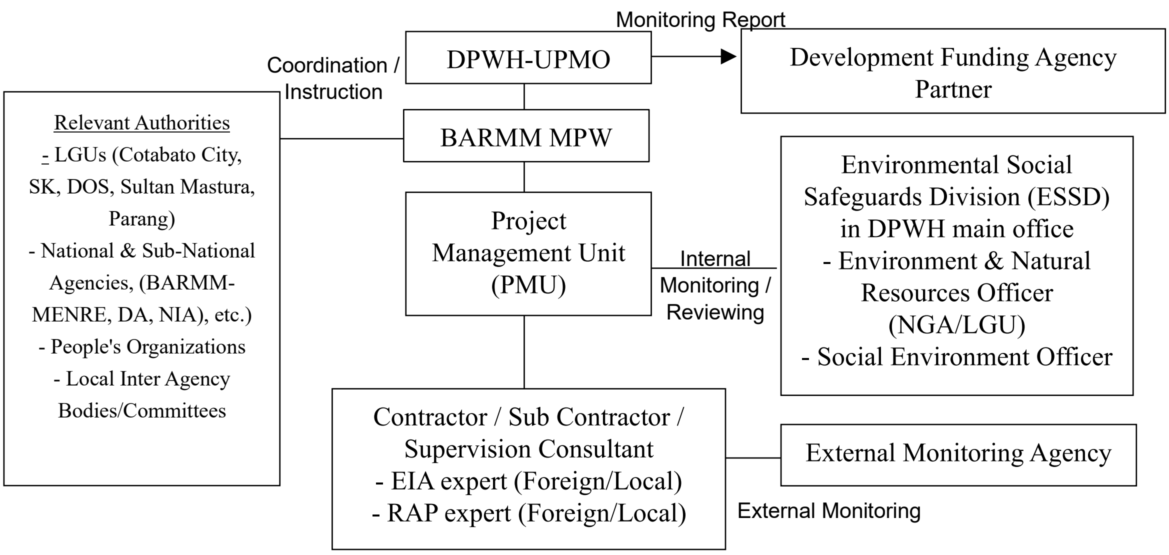
No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost (PhP)
19	Social Institutions such as Socially Related Capital and Decision-making Organizations	Visible observation, interview, grievance records	Project Areas	Once every three-month	Contractor	BARMM-MPW	TBD
20	Landscape	Visible observation, interview, grievance records	Project Areas	Once every three-month	Contractor	BARMM-MPW	TBD
21	Gender	Visible observation, interview, grievance records, list of construction worker, record of education, number of facilities for women in construction site and camp yard	Project Areas	Once a month	Contractor	BARMM-MPW	TBD
22	Children's Right	Visible observation, interview, grievance records, list of construction worker, record of education	Construction sites	Once a month	Contractor	BARMM-MPW	TBD
23	Infectious Diseases such as HIV/AIDS	Visible observation, interview, grievance records, record of education	Construction sites	Once a month	Contractor	BARMM-MPW	TBD
24	Labor Environment including Safety	Visible observation, interview, grievance records, record of education, record of safety patrol, sign boards	Construction sites	Once a month	Contractor	BARMM-MPW	TBD
25	Accident	Record of accident, record of education, sign boards	Construction sites and surrounding areas	Once a month, on demand	Contractor	BARMM-MPW	TBD
26	Transboundary Impact and Climate Change	Record of maintenance of machinery and vehicles, sign boards	Construction sites	Once a year	Contractor	BARMM-MPW	TBD
Operational Stage							
1	Air Quality	PM10, PM2.5, SO_2, CO, NO_2	Residential area, junctions, etc.	Once a year	Regional Office (RO) - DPWH	BARMM-MPW	TBD
2	Noise and Vibration	Sound level and vibration.	Junctions and residential areas	Once a year	RO	BARMM-MPW	TBD
3	Ground Subsidence	Visible observation on markers and gauges	Surrounding structures of construction sites	Once a year	RO	BARMM-MPW	TBD
4	Hydrology	Visible observation, interview, measurement of water volume	Rivers, springs, wells, etc.	Once a year	RO	BARMM-MPW	TBD
5	Ethnic Minority and Indigenous People	Interview, observation, socio-economic survey, if needed	Project Areas	Once a year	RO	BARMM-MPW	TBD
6	Land Use and Usage of Local Resources	Regional development plan, visible observation	Project Areas	Once a year	LGUs	BARMM-MPW	TBD
7	Water Usage	Water volume, visible observation, interview, grievance records	Water usage areas	Once a year	RO	BARMM-MPW	TBD

No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost (PhP)
8	Local Conflicts of Interest	Interview, observation	Project Areas	Once a year	LGUs	BARMM-MPW	TBD
9	Accident	Record of accident, record of education, sign boards	Project road and surrounding areas	Once a year	RO	BARMM-MPW	TBD
10	Transboundary Impact and Climate Change	Record of maintenance of machinery and vehicles, sign boards	Project road and surrounding areas	Once a year	RO	BARMM-MPW	TBD

Source: JICA Study Team,2021

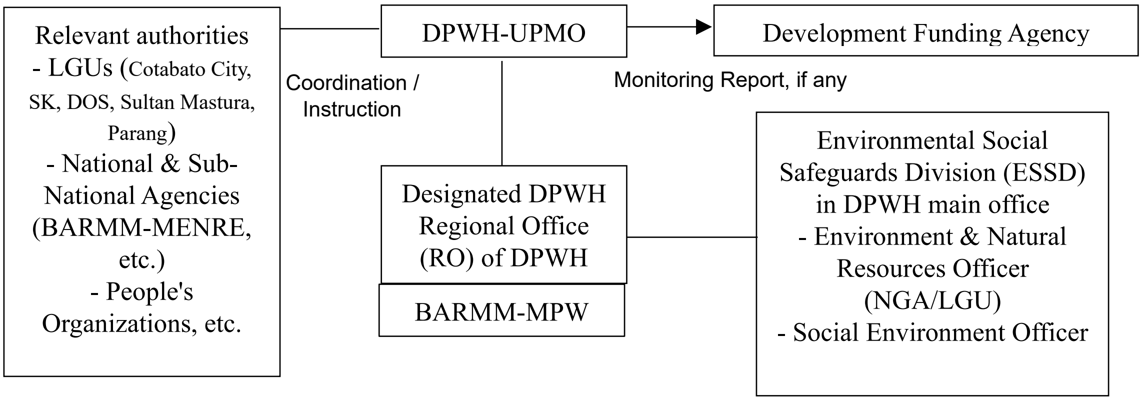
23.8.3 Implementation Structure

Implementation structure for WDR Project will be established based on local legal frameworks with reporting/discussion channels to investors/development partners. Based on project implementation structure of other projects through JICA's cooperation (such as Road Network Development Project in Conflict-Affected Areas in Mindanao or RNDP-CAAM), the proposed implementation structure of environmental and social consideration is illustrated in Figure 23.8-18 and Figure 23.8-19.



Source: JICA Study Team, 2021

Figure 23.8-18 Implementation Structure of Environmental and Social Considerations During Construction Stage



Source: JICA Study Team, 2021

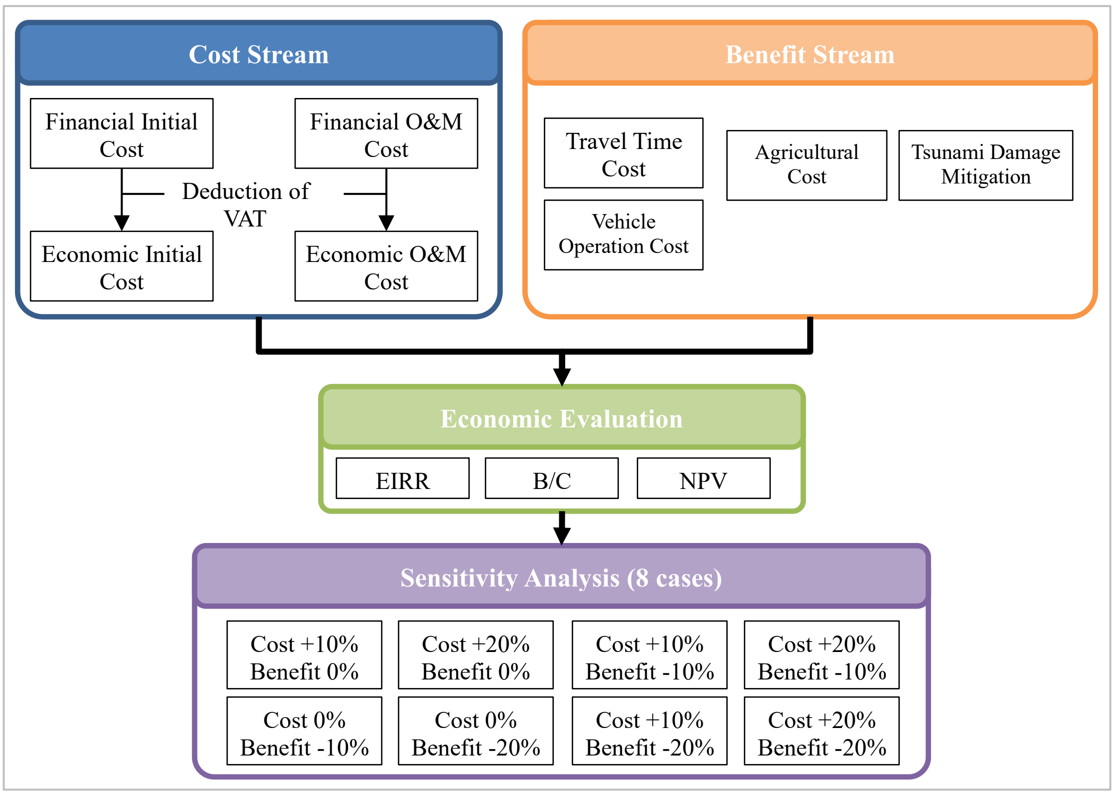
Figure 23.8-19 Implementation Structure of Environmental and Social Considerations During Operation Staget

23.9 Economic Evaluation of the Project

23.9.1 General Methodology

(1) Procedure of Economic Evaluation

The JICA Study Team conducted the economic analysis in order to evaluate the efficiency and effectiveness, and to clarify the feasibility of the proposed project. The method of economic evaluation is by applying cost benefit analysis, and discounted cash flow. Figure 23.9-1 shows the procedure of economic evaluation.



Source: JICA Study Team

Figure 23.9-1 Procedure of Economic Evaluation

(2) Economic Evaluation Indicators

The economic indicators, (i) Economic Internal Rate of Return (EIRR), (ii) Net Present Value (NPV) and (iii) Cost Benefit Ratio (B/C Ratio), were calculated for the economic evaluation using the following relationships:

Table 23.9-1 Economic Evaluation Indicators

No.	Indicator	Calculation Formula or Value
1	Project Evaluation Period	Period for 2021-2057 (37 years)
2	Discount Rate	10% is currently adopted as an opportunity cost (Benchmark for EIRR)
3	EIRR	$\sum \frac{B_n}{(1+r)^n} = \sum \frac{C_n}{(1+r)^n}$ r = satisfying B = Benefit, C = Cost
4	B/C	$\sum \frac{B_n}{(1+DR)^n} = \sum \frac{C_n}{(1+DR)^n}$ DR = Discount Rate
5	NPV	$\sum \frac{B_n - C_n}{(1+DR)^n}$

Source: JICA Study Team

(3) Implementation Schedule

The project is proposed to be implemented for the following:

Year	Subject
2023.1 - 2024.3	: Detailed Design
2024.1 - 2024.12	: Tender Assistance
2025.1 - 2027.12	: Construction for WDR (36 Months)
2036.1 - 2036.12	: Detailed Design (4 Lane Widening)
2037.1 - 2037.12	: Tender Assistance (4 Lane Widening)
2038.1 - 2040.12	: Construction for WDR (36 Months) (4 Lane Widening)

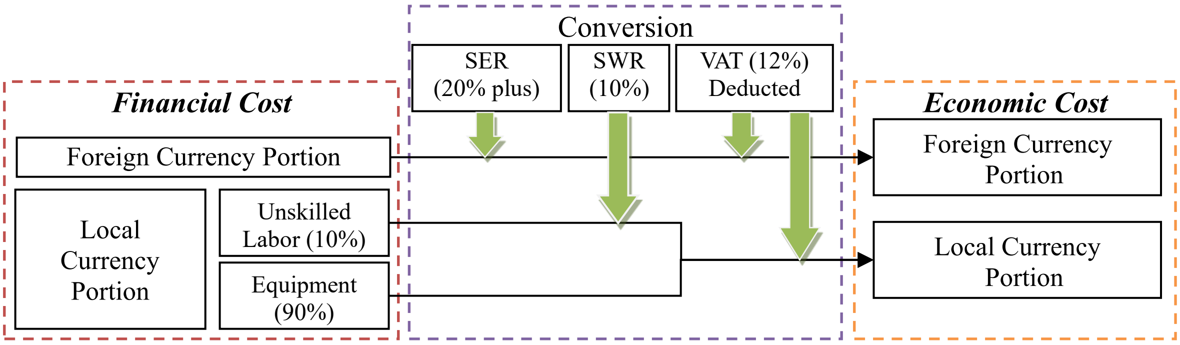
Source: JICA Study Team

23.9.2 Economic Cost of the Project

(1) Methodology of Economic Cost Estimation

The financial cost will need to be converted to an economic cost when carrying out an economic evaluation and the method of conversion from financial cost to economic cost is described below and illustrated in Figure 23.9-2.

- The Shadow Exchange Rate (SER) which is 20% higher than the official rate is used to convert the items of foreign currency portion from Dollar into Peso.
- The Shadow Wage Rate (SWR) which is 60% of current wage rate is used to convert the unskilled worker cost (10% of the local currency portion) into an economic price.
- The value of VAT (12%) is deducted from all the cost items.



Source: ICC Project Evaluation Procedures and Guidelines, NEDA Guidelines

Figure 23.9-2 Process of Converting the Initial Cost from Financial to Economic Value

(2) Project Cost

- **Initial Cost**

Financial cost and converted economic cost are shown in Table 23.9-2 and Table 23.9-3.

Table 23.9-2 Financial Cost

Unit: million PhP

Case	Construction cost	ROW Cost	Consulting Service (D/D)	Consulting Service (C/S)	Administration Cost	Total
2 Lane	9,874	301	434	608	304	11,271
4 Lane Expansion	7,329	0	323	452	226	8,330

Source: JICA Study Team

Table 23.9-3 Converted to Economic Cost

Unit: million PhP

Case	Construction cost	ROW Cost	Consulting Service (D/D)	Consulting Service (C/S)	Administration Cost	Total
2 Lane	8,568	301	440	616	304	9,979
4 Lane Expansion	6,360	0	323	452	226	7,361

Source: JICA Study Team

- **O&M Cost**

O&M costs for routine and periodic are set at 0.01% and 0.005% of construction cost in this action plan study.

23.9.3 Economic Benefit of the Project

(1) Scenario of Economic Benefit

The three main economic benefits that were considered in this project are i) Saving of VOC/ TTC, ii) Tsunami Damage Mitigation Benefit and iii) Economic Benefit to Agriculture.

(2) Estimation of Benefit for Travel Time Cost and Vehicle Operation Cost

The economic benefit to traffic was basically calculated based on the product of estimated traffic volume and unit Vehicle Operation Cost (VOC) and Travel Time Cost (TTC), respectively. Table 23.9-4 shows the unit TTC and VOC in 2017 that were estimated in the JICA Feasibility Study titled "Preparatory Survey for Road Network Development Project in Conflict-Affected Areas in Mindanao".

Table 23.9-5 shows that these units were updated to 2020 price in this project based on Annual Growth Rate (AGR) of Consumer Price Index (CPI).

Table 23.9-4 Unit VOC and TTC in 2017

	Travel Speed (km/hr)	Vehicle Type			
		Car	Jeepney	Bus	Truck
Unit VOC by Vehicle Type (PhP/veh. Km.)	20	12.06	14.12	40.28	65.29
	30	10.68	11.68	33.48	54.76
	40	9.70	9.90	28.39	47.08
	50	9.23	9.00	25.61	43.17
	60	9.03	8.57	24.08	41.27
Unit TTC (PhP/ veh. hr)		313.73	233.33	863.40	96.35

Source: Preparatory Survey for Road Network Development Project in Conflict-Affected Areas in Mindanao, JICA, 2018

Table 23.9-5 Unit VOC and TTC in 2021

	Travel Speed (km/hr)	Vehicle Type			
		Car	Jeepney	Bus	Truck
Unit VOC by Vehicle Type (PhP/veh. Km.)	20	13.93	16.31	46.55	75.44
	30	12.34	13.49	38.68	63.28
	40	11.21	11.44	32.80	54.40
	50	10.66	10.40	29.59	49.89
	60	10.44	9.90	27.82	47.68
Unit TTC (PhP/veh. hr)		362.50	269.60	997.59	111.32

Source: JICA Study Team estimated based on AGR of CPI

(3) Estimation of Tsunami Damage Mitigation Benefit

Consideration of Tsunami damage mitigation benefit for this project, JICA Study Team applied the 1) direct damage and 2) indirect damage and their unit cost are shown in Table 23.9-6 and Table 23.9-7.

Table 23.9-6 Consideration of Tsunami Damage Mitigation Benefit

Category	Detailed
Direct Damage	a) Damage to Physical Assets - Buildings, Equipment, Furniture, Movables and Inventories - Infrastructures including roads, bridges, river facilities, water supply system, electric power, etc - Agricultural production particularly crops and inland fisheries b) Damage to human lives
Indirect Damage	a) Damage to Businesses and households due to stoppage of activities during flooding. - Household economy (daily housekeeping and community activities) - Industries and other business activities - Public service due to a stoppage or slowdown of activities b) Costs due to support systems that have to be in place after a flood c) Damage due to mental distress to people affected by flood

Source: Consulting Services for the Feasibility Study and Detailed Engineering Design of the Proposed Malabang River Basin Flood and Sediment Control Project, DPWH, 2018

Table 23.9-7 Unit Cost of Affected Facilities

Assets	Building (Pesos/unit)	Depreciable Assets (Pesos/unit)	H. Effects/ Inv. Stock (Pesos/unit)	Value Added (Pesos/day)	Damageable Value (Pesos/ha)	Daily Amount (Pesos/day)
Residence						
a. Residential Unit	823,880	-	411,940	-	-	341
Industrial, Educational and Medical Facilities						
a. Manufacturing	3,378,686	11,650,643	8,891,280	33,090	-	-
b. Wholesale and Retail Trade	2,654,940	4,084,523	5,309,880	4,500	-	-
c. Hotels and Restaurants	1,421,233	1,894,977	52,873	7,050	-	-
d. Real Estate and Business Activities	1,206,005	1,608,007	309,232	40,265	-	-
e. Education	7,062,071	1,693,542	102,334	-	-	-
f. Health and Social Work	1,086,821	280,832	78,984	-	-	-
Crop Production						
a. fisheries	-	-	-	-	13,636	-
b. crops	-	-	-	-	47,219	-

Source: Consulting Services for the Feasibility Study and Detailed Engineering Design of the Proposed Malabang River Basin Flood and Sediment Control Project, DPWH, 2018

(4) Estimation of Economic Benefit to Agriculture

Economic benefit to agriculture was calculated under the following method:

- To identify the economic benefits of road improvements for agriculture, the transport demand of agricultural produce from farm to market and agricultural production inputs from market to farm are considered.
- For simplicity in the analysis, it is assumed that transport cost savings from the project are passed to the producer. The area of influence is set around the proposed road alignment, and it is also assumed that agricultural produce and agricultural production inputs in the area are transported on the improved road.
- Economic benefits of the road improvement for agriculture are estimated with regard to reduced transport costs of agricultural produce and agricultural production inputs. The unit transport cost and the average yield of crops and fish are identified based on social survey results carried out under this study (discussed in detailed in Chapter 24).
- Total cultivation area by crop type is estimated using social survey results. Areas identified on the vegetation map such as rice fields, cultivated land, plantations, scrubland, coconut, and cultivated land mixed with coconut are assumed to be under cultivation.
- A reduced rate for transport cost is set based on the appraisal and outcomes of other rural road projects in the Philippines including the Philippine Rural Development Project and the Second Rural Roads Improvement Project financed by the World Bank.

(5) Result of Economic Benefit

1) Economic Benefit to Traffic

Economic benefits to traffic in 2028 and 2040 were estimated based on the result of future traffic, unit VOC and TTC as shown in Table 23.9-8. Total benefit is calculated at PhP 367.0 Million in 2028 and PhP 559.3 Million in 2040.

Table 23.9-8 Result of Economic Benefit to Traffic

Unit: Million PhP

	VOC	TTC	Total
2028	241.0	126.0	367.0
2040	344.5	214.8	559.3

Source: Estimated by JICA Study Team

2) Economic Benefit to Tsunami Damage Mitigation

Economic benefit to Tsunami damage mitigation was estimated based on the flood area by Tsunami and unit cost for building and crops. Total benefit is calculated at PhP 294.8 Million in each year.

3) Economic Benefit to Agriculture

Based on the result of the Social/Barangay Survey and unit cost of transportation, net income among others, economic benefit to agriculture was estimated. Methodology of economic benefit to agriculture is explained in section 24.8 of Chapter 24.

West Diversion Road is traversing agricultural land however, Social Survey was not fully undertaken (just interview to limited number of LGUs and stakeholders). But comprehensive Social/Barangay Survey was undertaken for the Mindanao River Southside Road. Thus, economic benefit to agriculture along WDR was applied to estimated based on the Mindanao River Southside Road (see 24.8.3 Economic Benefit of the Project; 2) Economic Benefit to Agriculture).

23.9.4 Result of Economic Evaluation

(1) EIRR

Economic evaluation for the WMR was estimated as shown in Table 23.9-9 and Table 23.9-10. Table 23.9-9 shows that EIRR (11.3%) was greater than social discount rate (10%) and B/C (1.14) was more than 1.0. These results indicate that the construction of WMR was appropriate from economic view. On the other hand, Table 23.9-9 shows that EIRR (8.3%) was smaller than social discount rate (10%) and B/C (0.87) was less than 1.0. The cost-benefit stream of WMR is shown in Table 23.9-11 and Table 23.9-12.

Table 23.9-9 Result of Economic Analysis for 2 Lanes

Economic Benefit		
EIRR	**B/C**	**NPV (Million PhP)**
11.3%	1.14	787.6

Source: Estimated by JICA Study Team

Table 23.9-10 Result of Economic Analysis for 4 Lanes Widening

Economic Benefit		
EIRR	**B/C**	**NPV (Million PhP)**
8.4%	0.87	-823.0

Source: Estimated by JICA Study Team

Table 23.9-11 Cost Benefit Stream for WMR for 2 Lanes

Undiscounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Water Benefit	Agri Benefit	Benefit	Benefit - Cost
1	2021	0.0	0.0	0.0				0.0	0.0
2	2022	0.0	0.0	0.0				0.0	0.0
3	2023	173.5	0.0	173.5				0.0	-173.5
4	2024	474.4	0.0	474.4				0.0	-474.4
5	2025	2,644.1	0.0	2,644.1				0.0	-2,644.1
6	2026	2,644.1	0.0	2,644.1				0.0	-2,644.1
7	2027	2,644.1	0.0	2,644.1				0.0	-2,644.1
8	2028		0.7	0.7	367.0	294.8	123.5	785.3	784.5
9	2029		0.7	0.7	380.0	294.8	247.1	921.8	921.1
10	2030		0.7	0.7	393.5	294.8	411.8	1,100.0	1,099.3
11	2031		0.7	0.7	407.5	294.8	411.8	1,114.0	1,113.3
12	2032		0.7	0.7	422.0	294.8	411.8	1,128.5	1,127.8
13	2033		0.7	0.7	437.0	294.8	411.8	1,143.6	1,142.8
14	2034		0.7	0.7	452.6	294.8	411.8	1,159.2	1,158.4
15	2035		0.7	0.7	468.8	294.8	411.8	1,175.3	1,174.6
16	2036		0.7	0.7	485.6	294.8	411.8	1,192.1	1,191.4
17	2037		1.1	1.1	503.0	294.8	411.8	1,209.6	1,208.4
18	2038		0.7	0.7	521.1	294.8	411.8	1,227.6	1,226.9
19	2039		0.7	0.7	539.8	294.8	411.8	1,246.4	1,245.6
20	2040		0.7	0.7	559.3	294.8	411.8	1,265.8	1,265.1
21	2041		0.7	0.7	579.5	294.8	411.8	1,286.0	1,285.2
22	2042		0.7	0.7	600.4	294.8	411.8	1,306.9	1,306.2
23	2043		0.7	0.7	622.1	294.8	411.8	1,328.7	1,327.9
24	2044		0.7	0.7	644.7	294.8	411.8	1,351.2	1,350.5
25	2045		0.7	0.7	668.0	294.8	411.8	1,374.6	1,373.8
26	2046		0.7	0.7	692.3	294.8	411.8	1,398.9	1,398.1
27	2047		1.1	1.1	717.5	294.8	411.8	1,424.1	1,423.0
28	2048		0.7	0.7	743.7	294.8	411.8	1,450.2	1,449.5
29	2049		0.7	0.7	770.8	294.8	411.8	1,477.4	1,476.6
30	2050		0.7	0.7	799.0	294.8	411.8	1,505.6	1,504.8
31	2051		0.7	0.7	828.3	294.8	411.8	1,534.8	1,534.1
32	2052		0.7	0.7	858.6	294.8	411.8	1,565.2	1,564.4
33	2053		0.7	0.7	890.2	294.8	411.8	1,596.7	1,596.0
34	2054		0.7	0.7	922.9	294.8	411.8	1,629.5	1,628.7
35	2055		0.7	0.7	956.9	294.8	411.8	1,663.5	1,662.7
36	2056		0.7	0.7	992.2	294.8	411.8	1,698.8	1,698.0
37	2057		1.1	1.1	1,028.9	294.8	411.8	1,735.4	1,734.3
		8,580.2	23.4	8,603.7	19,253.1	8,843.6	11,899.6	39,996.4	31,392.7

Discounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Discounted	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Water Benefit	Agri Benefit	Benefit	Benefit - Cost
1	2021	1.00	0.0		0.0				0.0	0.0
2	2022	1.10	0.0		0.0				0.0	0.0
3	2023	1.21	143.3		143.3				0.0	-143.3
4	2024	1.33	356.4		356.4				0.0	-356.4
5	2025	1.46	1,806.0		1,806.0				0.0	-1,806.0
6	2026	1.61	1,641.8		1,641.8				0.0	-1,641.8
7	2027	1.77	1,492.6		1,492.6				0.0	-1,492.6
8	2028	1.95		0.4	0.4	188.3	151.3	63.4	403.0	402.6
9	2029	2.14		0.3	0.3	177.3	137.5	115.3	430.0	429.7
10	2030	2.36		0.3	0.3	166.9	125.0	174.6	466.5	466.2
11	2031	2.59		0.3	0.3	157.1	113.7	158.7	429.5	429.2
12	2032	2.85		0.3	0.3	147.9	103.3	144.3	395.5	395.3
13	2033	3.14		0.2	0.2	139.2	93.9	131.2	364.4	364.1
14	2034	3.45		0.2	0.2	131.1	85.4	119.3	335.8	335.6
15	2035	3.80		0.2	0.2	123.5	77.6	108.4	309.5	309.3
16	2036	4.18		0.2	0.2	116.2	70.6	98.6	285.4	285.2
17	2037	4.59		0.2	0.2	109.5	64.2	89.6	263.2	263.0
18	2038	5.05		0.1	0.1	103.1	58.3	81.5	242.9	242.7
19	2039	5.56		0.1	0.1	97.1	53.0	74.1	224.2	224.0
20	2040	6.12		0.1	0.1	91.4	48.2	67.3	207.0	206.8
21	2041	6.73		0.1	0.1	86.1	43.8	61.2	191.2	191.0
22	2042	7.40		0.1	0.1	81.1	39.8	55.6	176.6	176.5
23	2043	8.14		0.1	0.1	76.4	36.2	50.6	163.2	163.1
24	2044	8.95		0.1	0.1	72.0	32.9	46.0	150.9	150.8
25	2045	9.85		0.1	0.1	67.8	29.9	41.8	139.6	139.5
26	2046	10.83		0.1	0.1	63.9	27.2	38.0	129.1	129.0
27	2047	11.92		0.1	0.1	60.2	24.7	34.5	119.5	119.4
28	2048	13.11		0.1	0.1	56.7	22.5	31.4	110.6	110.6
29	2049	14.42		0.1	0.1	53.5	20.4	28.6	102.4	102.4
30	2050	15.86		0.0	0.0	50.4	18.6	26.0	94.9	94.9
31	2051	17.45		0.0	0.0	47.5	16.9	23.6	88.0	87.9
32	2052	19.19		0.0	0.0	44.7	15.4	21.5	81.5	81.5
33	2053	21.11		0.0	0.0	42.2	14.0	19.5	75.6	75.6
34	2054	23.23		0.0	0.0	39.7	12.7	17.7	70.2	70.1
35	2055	25.55		0.0	0.0	37.5	11.5	16.1	65.1	65.1
36	2056	28.10		0.0	0.0	35.3	10.5	14.7	60.4	60.4
37	2057	30.91		0.0	0.0	33.3	9.5	13.3	56.1	56.1
			5,440.1	4.1	5,444.2	2,696.9	1,568.6	1,966.3	6,231.8	787.6

Net Present Value (Million peso)	787.6
B/C Ratio	1.14
EIRR	11.3%

Source: Calculated by JICA Study Team

Table 23.9-12 Cost Benefit Stream for WMR for 4 Lanes Widening

Undiscounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Water Benefit	Agri Benefit	Benefit	Benefit - Cost
1	2021	0.0	0.0	0.0				0.0	0.0
2	2022	0.0	0.0	0.0				0.0	0.0
3	2023	173.5	0.0	173.5				0.0	-173.5
4	2024	474.4	0.0	474.4				0.0	-474.4
5	2025	2,644.1	0.0	2,644.1				0.0	-2,644.1
6	2026	2,644.1	0.0	2,644.1				0.0	-2,644.1
7	2027	2,644.1	0.0	2,644.1				0.0	-2,644.1
8	2028		0.7	0.7	367.0	294.8	80.2	741.9	741.2
9	2029		0.7	0.7	380.0	294.8	160.3	835.1	834.3
10	2030		0.7	0.7	393.5	294.8	267.2	955.4	954.7
11	2031		0.7	0.7	407.5	294.8	267.2	969.4	968.7
12	2032		0.7	0.7	422.0	294.8	267.2	983.9	983.2
13	2033		0.7	0.7	559.3	294.8	267.2	1,121.2	1,120.5
14	2034		0.7	0.7	452.6	294.8	267.2	1,014.6	1,013.8
15	2035		0.7	0.7	468.8	294.8	267.2	1,030.8	1,030.0
16	2036	104.4	0.7	105.1	485.6	294.8	267.2	1,047.6	942.4
17	2037	104.4	1.1	105.5	503.0	294.8	267.2	1,065.0	959.5
18	2038	1,683.0	0.7	1,683.7	521.1	294.8	267.2	1,083.0	-600.7
19	2039	1,683.0	0.7	1,683.7	539.8	294.8	267.2	1,101.8	-581.9
20	2040	1,683.0	0.7	1,683.7	559.3	294.8	267.2	1,121.2	-562.5
21	2041		1.2	1.2	579.5	294.8	267.2	1,141.4	1,140.2
22	2042		1.2	1.2	600.4	294.8	267.2	1,162.4	1,161.1
23	2043		1.2	1.2	622.1	294.8	267.2	1,184.1	1,182.9
24	2044		1.2	1.2	644.7	294.8	267.2	1,206.6	1,205.4
25	2045		1.2	1.2	668.0	294.8	267.2	1,230.0	1,228.8
26	2046		1.2	1.2	692.3	294.8	267.2	1,254.3	1,253.1
27	2047		1.8	1.8	717.5	294.8	267.2	1,279.5	1,277.7
28	2048		1.2	1.2	743.7	294.8	267.2	1,305.7	1,304.4
29	2049		1.2	1.2	770.8	294.8	267.2	1,332.8	1,331.6
30	2050		1.2	1.2	799.0	294.8	267.2	1,361.0	1,359.8
31	2051		1.2	1.2	828.3	294.8	267.2	1,390.2	1,389.0
32	2052		1.2	1.2	858.6	294.8	267.2	1,420.6	1,419.4
33	2053		1.2	1.2	890.2	294.8	267.2	1,452.1	1,450.9
34	2054		1.2	1.2	922.9	294.8	267.2	1,484.9	1,483.7
35	2055		1.2	1.2	956.9	294.8	267.2	1,518.9	1,517.7
36	2056		1.2	1.2	992.2	294.8	267.2	1,554.2	1,553.0
37	2057		1.8	1.8	1,028.9	294.8	267.2	1,590.8	1,589.0
		13,838.0	32.0	13,870.0	19,375.4	8,843.6	7,721.5	35,940.5	22,070.5

Discounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Discounted	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Water Benefit	Agri Benefit	Benefit	Benefit - Cost
1	2021	1.00	0.0		0.0				0.0	0.0
2	2022	1.10	0.0		0.0				0.0	0.0
3	2023	1.21	143.3		143.3				0.0	-143.3
4	2024	1.33	356.4		356.4				0.0	-356.4
5	2025	1.46	1,806.0		1,806.0				0.0	-1,806.0
6	2026	1.61	1,641.8		1,641.8				0.0	-1,641.8
7	2027	1.77	1,492.6		1,492.6				0.0	-1,492.6
8	2028	1.95	0.0	0.4	0.4	188.3	151.3	41.1	380.7	380.3
9	2029	2.14	0.0	0.3	0.3	177.3	137.5	74.8	389.6	389.2
10	2030	2.36	0.0	0.3	0.3	166.9	125.0	113.3	405.2	404.9
11	2031	2.59	0.0	0.3	0.3	157.1	113.7	103.0	373.8	373.5
12	2032	2.85	0.0	0.3	0.3	147.9	103.3	93.6	344.9	344.6
13	2033	3.14	0.0	0.2	0.2	178.2	93.9	85.1	357.3	357.0
14	2034	3.45	0.0	0.2	0.2	131.1	85.4	77.4	293.9	293.7
15	2035	3.80	0.0	0.2	0.2	123.5	77.6	70.4	271.4	271.2
16	2036	4.18	25.0	0.2	25.2	116.2	70.6	64.0	250.8	225.6
17	2037	4.59	22.7	0.2	23.0	109.5	64.2	58.1	231.8	208.8
18	2038	5.05	333.0	0.1	333.1	103.1	58.3	52.9	214.3	-118.8
19	2039	5.56	302.7	0.1	302.8	97.1	53.0	48.1	198.2	-104.7
20	2040	6.12	275.2	0.1	275.3	91.4	48.2	43.7	183.3	-92.0
21	2041	6.73	0.0	0.2	0.2	86.1	43.8	39.7	169.7	169.5
22	2042	7.40	0.0	0.2	0.2	81.1	39.8	36.1	157.1	156.9
23	2043	8.14	0.0	0.1	0.1	76.4	36.2	32.8	145.5	145.3
24	2044	8.95	0.0	0.1	0.1	72.0	32.9	29.8	134.8	134.6
25	2045	9.85	0.0	0.1	0.1	67.8	29.9	27.1	124.9	124.8
26	2046	10.83	0.0	0.1	0.1	63.9	27.2	24.7	115.8	115.7
27	2047	11.92	0.0	0.2	0.2	60.2	24.7	22.4	107.4	107.2
28	2048	13.11	0.0	0.1	0.1	56.7	22.5	20.4	99.6	99.5
29	2049	14.42	0.0	0.1	0.1	53.5	20.4	18.5	92.4	92.3
30	2050	15.86	0.0	0.1	0.1	50.4	18.6	16.8	85.8	85.7
31	2051	17.45	0.0	0.1	0.1	47.5	16.9	15.3	79.7	79.6
32	2052	19.19	0.0	0.1	0.1	44.7	15.4	13.9	74.0	73.9
33	2053	21.11	0.0	0.1	0.1	42.2	14.0	12.7	68.8	68.7
34	2054	23.23	0.0	0.1	0.1	39.7	12.7	11.5	63.9	63.9
35	2055	25.55	0.0	0.0	0.0	37.5	11.5	10.5	59.5	59.4
36	2056	28.10	0.0	0.0	0.0	35.3	10.5	9.5	55.3	55.3
37	2057	30.91	0.0	0.1	0.1	33.3	9.5	8.6	51.5	51.4
			6,398.6	4.7	6,403.4	2,735.8	1,568.6	1,275.9	5,580.4	-823.0

Net Present Value (Million peso)	-823.0
B/C Ratio	0.87
EIRR	8.4%

Source: Calculated by JICA Study Team

(2) Sensitivity Analysis

The sensitivity analyses were carried out as shown in Table 23.9-13 and Table 23.9-14. This aims to evaluate the relevance of the WMR under some risks. For example, there may be the case that, the estimated costs would be increased. Other cases would be that the expected benefit in terms of reduction of VOC and TTC may not be attained as expected. In this regard, the following nine (9) cases were evaluated.

As a result, the strictest condition which is Cost 20% Plus and Benefit 20% Less shows that the EIRR value is way lower than the social discount rate (10%). However, improvement of WDR will expect contribution to peace building and development of agriculture and fishery sector.

Table 23.9-13 Result of Sensitivity Analyses for 2 Lanes

Sensitivity Analysis		Benefit		
		0%	-10%	-20%
Cost	0%	11.3%	10.2%	9.1%
	+10%	10.3%	9.3%	8.2%
	+20%	9.5%	8.5%	7.5%

Table 23.9-14 Result of Sensitivity Analyses for 4 Lanes Widening

Sensitivity Analysis		Benefit		
		0%	-10%	-20%
Cost	0%	8.4%	7.2%	6.0%
	+10%	7.3%	6.3%	5.1%
	+20%	6.4%	5.4%	4.3%

23.10 Conclusion and Recommendation

23.10.1 Conclusion

The project is proved to be technically, environmentally and economically feasible, therefore, it is recommended that the project should be realized as soon as possible.

23.10.2 Recommendations

(1) Project Implementing Office

The project implementing office is recommended to be the DPWH Central Office. BARMM MPW should act as a co-implementing office and it should learn how to implement large scale foreign-assisted projects through implementation of this project.

(2) Conduct of the Full-scale Feasibility Study

Under this Pre-feasibility Study, some of the technical investigations were not implemented due to the nature of the pre-feasibility study. The following technical investigations should be undertaken during the feasibility study stage:

a) Topographic Survey (center-line survey, cross section survey, bridge site topographic survey)

b) Bridge site borings, Test Pitting/Auger Borings, Material/Sources

c) Traffic Count Survey should be undertaken at major locations to check if traffic behaviors are the same as the action plan study.

(3) Effects of "Tsunami"

Effects of tsunami should be examined in detail and if some countermeasures are found to be necessary, these should be included in the scope of work of the road project.

(4) Expected Role of the Road for control of unfavorable urbanization

Urbanization of Cotabato City is rapidly progressing forward in all directions including the area where its urbanization is not favorable. This road project is located at the western urbanization limit where urban development in the area between this road and the seacoast shall be strictly prohibited. This condition limiting urbanization should be included in the zoning ordinance, thus urbanization is legally prohibited.

(5) Effects on Mangrove and Fishponds

The project will affect mangroves and fishponds. Effective and acceptable countermeasures should be studied during the feasibility study stage.

CHAPTER 24
ACTION PLAN OF THE MINDANAO RIVER SOUTH SIDE ROAD

24.1 Introduction

24.1.1 Project Background

The City Government of Cotabato recognized the potential of the eastern part of the city in provision of agricultural related products. The 2016-2020 Comprehensive Development Plan (CDP) of Cotabato City states that the eastern portion of the city is the main producer of agricultural products such as rice, coconut, corn, vegetables, mango, nipa (nipa palm or mangrove palm used for roof material), among others. The CDP envisioned to increase the volume of rice production and supply of other raw materials coming from the east side of the city. To achieve such target, opening of more farm-to-market roads, establishment and promotion of urban agriculture and agricultural tourism (farm tourism), gulayan sa barangay (communal vegetable garden) and establishment of a techno-demo farm were contemplated.

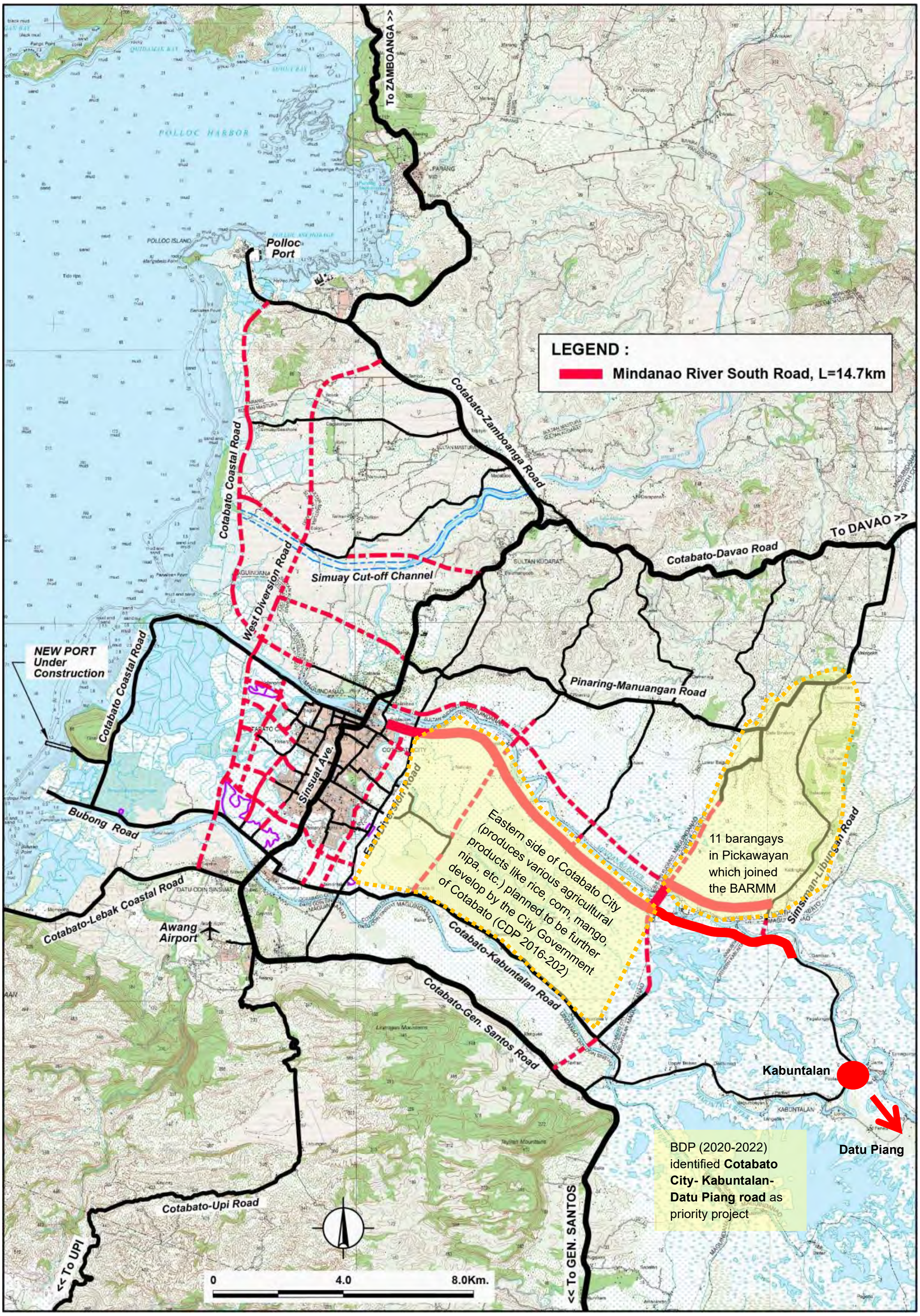
The construction of the Mindanao River Southside Road (MRSR) will enhance the realization of the plan by the City Government laid out in the CDP (Figure 24.1-1). For instance, the envisioned FMRs may be linked to the MRSR giving smooth access to various other plans of the City Government.

In the 1st Bangsamoro Development Plan (BDP 2020-2022) by the BARMM Government, the said plan emphasized "road connectivity" as one of its important targets. It states:

"The Bangsamoro government will pursue the expansion of national roads to six lanes to ensure interconnectivity of BARMM provinces and cities with other growth centers in Mindanao. Also, the BARMM will push the following priority initiatives to promote road connectivity:

- *Maguindanao- Sultan Kudarat- Cotabato Province- Davao City*
- *Maguindanao mainland corridor: Polloc Port to Maguindanao production/industrial areas (**Cotabato City- Kabuntalan- Datu Piang- Buluan**)*
- *Polloc Port to Lanao del Sur production and industrial areas*
- *Maguindanao- **Cotabato City- Kabuntalan- Datu Piang- Buluan***
- *Lanao del Sur – Lanao del Norte- Bukidnon- Zamboanga*
- *Piagapo, Lanao del Sur- Lanao del Norte"*

As presented above, the MRSR follows the Cotabato City – Kabuntalan - Datu Piang - Buluan alignment which is one of the priority projects identified by the BDP 2020-2022 (Figure 24.1-1). There exist a road connecting Cotabato City to Kabuntalan, however it is currently in poor condition and some sections have a width of just 5 m, way below the standard for city road/municipal road (6.1 m) or national road (6.7 m). In addition, the BARMM is also strengthening connection to the 63 barangays in Cotabato Province which joined the BARMM during the 2019 plebiscite. A cluster of 11 barangays which joined the BARMM will be connected by the MRSR as illustrated in Figure 24.1-1.



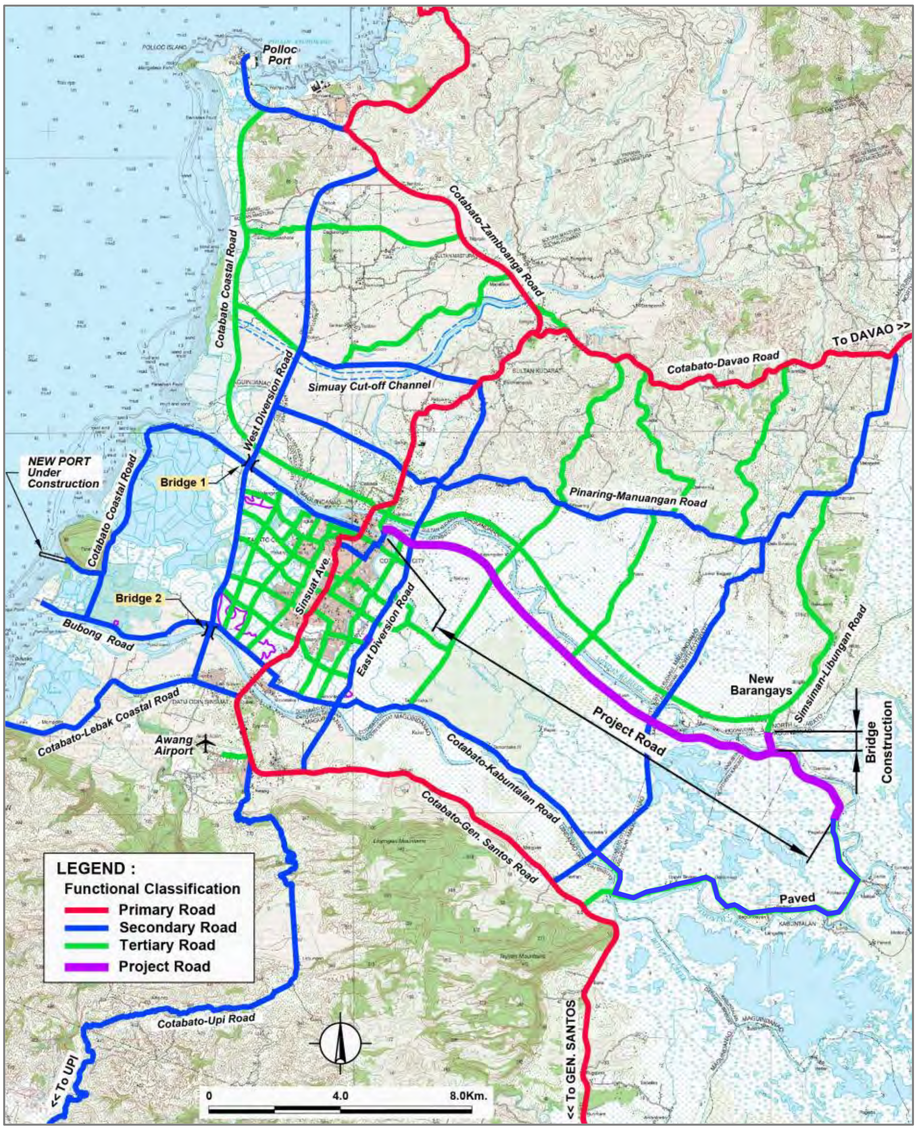
Source: JICA study team

Figure 24.1-1 Location Map of the MRSR

24.1.2 Objectives of the Project

The position of the road project in the overall future road network of Greater Cotabato Area is presented below. The objectives of the project are as follows:

- To promote agricultural development in the eastern side of Cotabato City and Liguasan marsh in general
- To complete the east circumferential road of Cotabato City
- To promote social and economic integration of the four LGUs (Cotabato City, Sultan Kudarat, Kabuntalan and Pigcawayan)
- To provide access to barangays in Liguasan marsh (currently using water transport) including the 11 barangays in Pigcawayan which joined the BARMM
- To contribute for peace building of the project area by providing easier and faster means of access



Source: JICA study team

Figure 24.1-2 Position of the MRSR in the Overall Future Road Network of the Greater Cotabato City

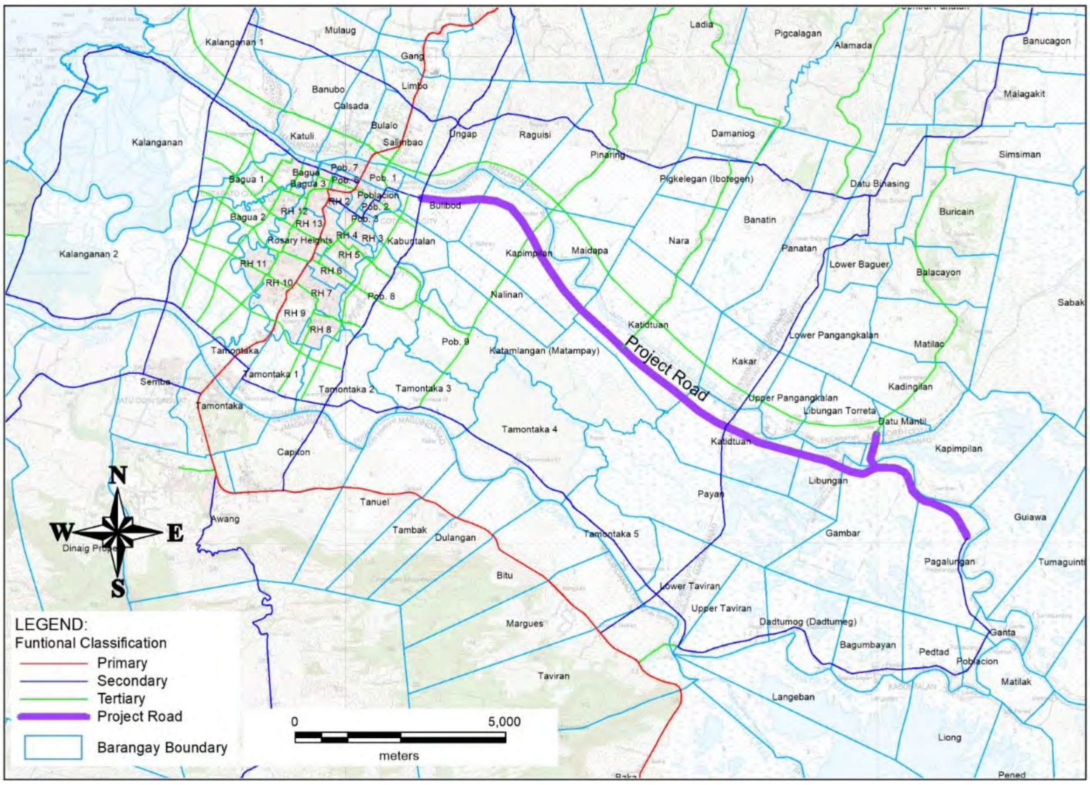
24.1.3 Necessity of the Project

The following are the major reasons for the need to construct the road:

(1) Support to Agricultural Development

The area where the road will traverse is known producers of agricultural products like palay (rice), corn, coconut products like copra among others. It also produces significant volume of vegetables like water spinach, cucumber, eggplant, pumpkin among others. Being closer to Liguasan Marsh, fish of various kind is also caught in the area. The above are thriving due to constant supply of water coming from the Liguasan Marsh. Produced products found their way mostly in Cotabato City markets.

In order to understand further the products produced in the area including their volume, a survey titled "Current Logistics System of the Agri-Fishery of the Barangays under the influence area of the MRSR" was undertaken by the JICA Study Team in June 2021. This survey covers the 23 barangays under the influence of the road as shown in Figure 24.1-3. The methodology is a mixed of face-to-face interview and telephone interview with the barangay officials using a prepared questionnaire. The primary purpose is to clarify the main products in each barangay, volume of the products, location of the market of the products, mode of transport, cost of transport, issues and problems affecting development among others.



Source: JICA study team

Figure 24.1-3 Project Road and the Barangays under Its in Fluence Area

Based on the result of the survey, the area under the influence of the project road is producing large amount of palay (rice) which is about 10,502 ton/year per harvest, corn (4,724 ton/harvest), and copra (1,441 ton/harvest). The survey revealed that other products produced by the famers in the area in high number include fruits (mango, watermelon), vegetables (cucumber, squash/pumpkin), fish of various types coming from the Liguasan Marsh among others.

Transporting these products to Cotabato City is done by motorized boats (Figure 24.1-4) which are less reliable compared with road-based transport. Motorized boats lacked top cover to shield the products from getting wet by rain. Similarly, the frequency of trips is less. In short, the level of service is poor.

In the same interview, residents said that constructing the road will increase their motivation to increase the size of their planted farmland. They mentioned as well that people who had left their barangay to pursue other means of livelihood in urban areas may come back to till their land if the road is constructed. Apparently, these people left the farming vocation because bringing their products to the market are difficult and costly, hence supporting their families to survive through farming income became difficult. Therefore, construction of the road will surely trigger further development of agriculture in the area.

Table 24.1-1 Main Products by the Barangays under the in Fluence Area of the Project Road

Main Products	Volume	Number of harvests
1. Palay	10,502 ton/harvest	2 to 3 times/ year
2. Corn	4,724 ton/harvest	1 time/year
3. Copra	1,467 ton/harvest	3 times/year
4. Mango	5,000 sacks	2 times/year
5. Fish of various type	1,500 kg	Daily

Source: Survey by JICA study team

(2) Providing the Communities Reliable Link to Cotabato City to Access Essential Services

Essential services like health, higher education, finance and banking, and various services provided by the government are mostly available in Cotabato City. The same is true for trade and commerce where Cotabato City serves as the biggest market. Hence, it is important that the communities under the influence of the road project have reliable access to Cotabato City. Currently their only means of access to Cotabato City is through motorized boats which are less reliable in terms of trip frequency, safety, exposure to sun/rain among others.

Source: JICA study team

Figure 24.1-4 Motorized Boats are the only means of transport of the Communities due to Lack of Road

The 23 barangays that will be under the influence of the project road has a total population of 42,052 based on the 2020 census data. Interview survey with the barangay officials revealed the extent of the problems faced by the communities due to the lack of road. For example, primary and tertiary education services in the barangays are affected since some teachers come from Cotabato City. This means that when the river is rough and not safe for navigation, teachers could not visit their place of assignment. The same scenario is experienced by the health sector where some of the health workers come from Cotabato City. The summary of issues/problems in the barangay related to the lack of road is summarized in Table 24.1-2.

Table 24.1-2 Identified Problems by the Communities during the Survey due to Lack of Road

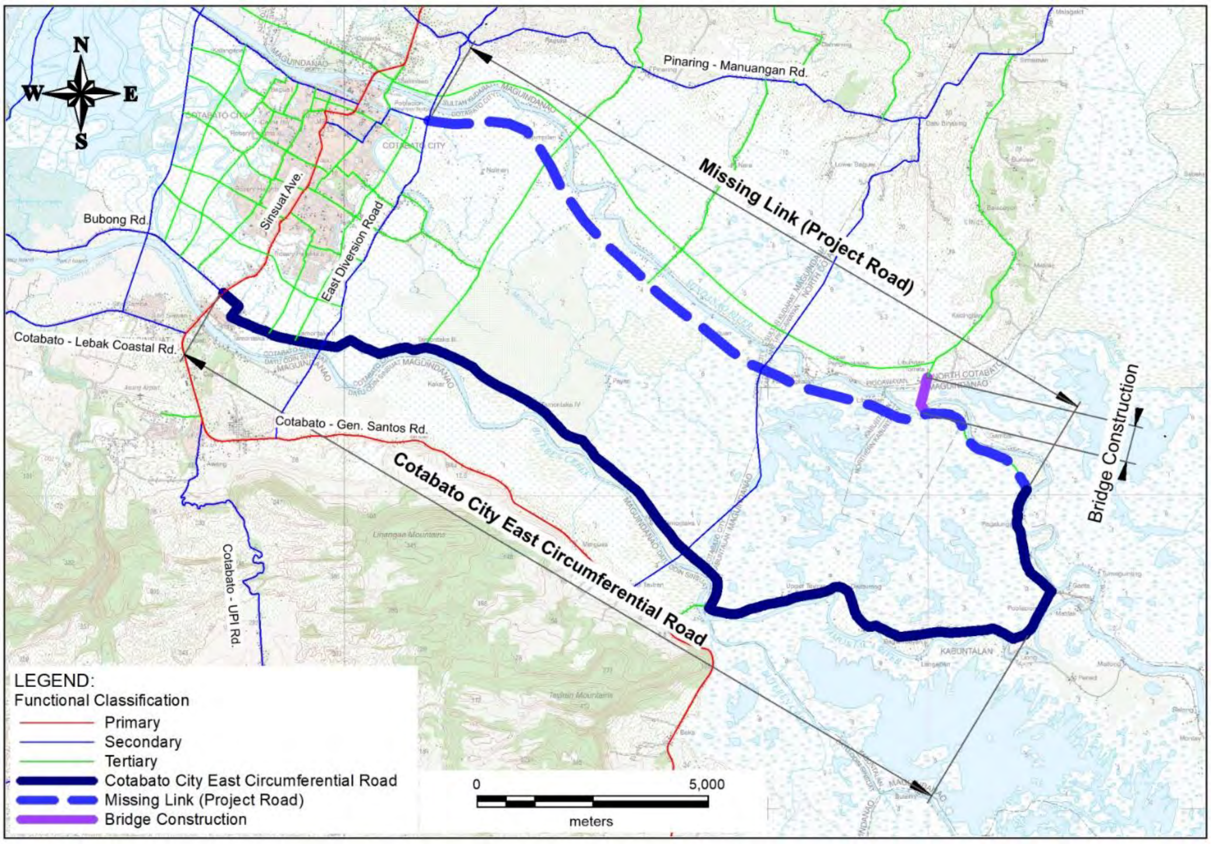
Item	Problems due to lack of road
1. Education	• Some teachers coming from Cotabato City could not serve during rainy season due to flooding and difficulty of navigating the river • Flooding, absent of teachers usually from Cotabato City (couldn't travel due to bad weather) and other factors discouraged parents to send their children to school. From their previous elementary school, it regressed to become a primary school.
2. Health Services	• Difficulty in accessing hospitals in Cotabato City during emergency due to lack of road • Some health workers coming from Cotabato City could not serve during rainy season due to flooding and difficulty of navigating the river • Barangay facilities like health center, schools are sometimes submerged by flood and bringing materials for repair is difficult due to the lack of road.
3. Agricultural products	• The lack of road makes it difficult to bring agricultural products to the markets in Cotabato City. • Some buyers come to the barangays offering cheap price. Due to difficulty of bringing products to the market, farmers are left without choice. • Transport cost by motorized boats increased by about 60% during this pandemic.
4.Other problems in the barangays	• Lack of potable water • Lack of electricity supply

Source: JICA study team

(a) **Support to the Development Plan of Cotabato City and completion of the East Circumferential Road**

The project will complete the east circumferential road as shown in Figure 24.1-5. Currently, the northern side lacks road which prevents development of the area and impedes delivery of government services.

Similarly, the City Government of Cotabato has various plans on the eastern part of the city that may be supported by the road project. In its Comprehensive Development Plan (2016-2020), it says that the barangays in the east of Cotabato City are the main producers of agriculture (rice, coconut, corn, vegetables, mango, nipa). The plan targets to increase the volume of rice production per hectare by 30%. The strategies to achieve that include (i) opening of more FMRs, (ii) establishment and promotion of urban agriculture and agriculture tourism (Farm Tourism), (iii) promotion of Gulayan sa Barangay (Communal Vegetable Garden), and (iv) establishment of a Techno-Demo Farm in the area.



Source: JICA study team

Figure 24.1-5 East Circumferential Road of Cotabato City Showing the Missing Link

The MRSR can be an anchor of these development plans. For example, the plan to open up new farm-to-market roads (FMRs) in the barangays in the eastern part of the city may link to the road project (MRSR). Similarly, having the MRSR will make it easy for tourists to visit the planned "farm tourism". In the same manner, access to the envisioned "Gulayan sa Barangay" will significantly improve through the MRSR.

In February 2021, discussion was held as well with the SC and TWG members from the City Government of Cotabato to know how the City Government would benefit from the road project. The following were mentioned as possible benefits of the road project:

- It will improve the access of the City Government in the delivery of services to the concerned barangays
- It will increase the cultivation of rice and also inland fishery activities in the area
- It could revive the poultry activities that was done by a barangay leader in Poblacion 9 (raising of chicken and converting the manure to fertilizer), as well as the tapping of Nipa for vinegar and other food products
- It could increase the activities at the fish landing located near the Delta 2 bridge
- It could increase the inflow of agricultural products to Cotabato City from areas further upstream
- It could open areas for industrial, commercial, and other uses

24.2 Existing Traffic Condition and Future Traffic Demand

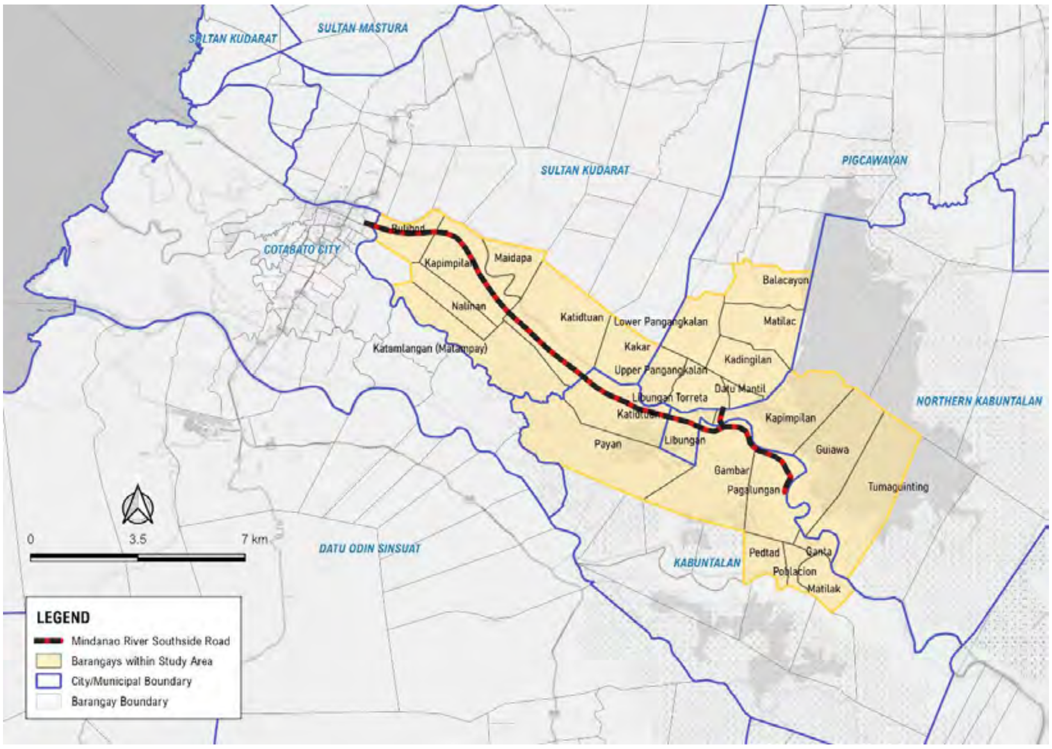
24.2.1 Barangay Interview Survey

(1) Overview

The MRSR will traverse several barangays along four municipalities east of Cotabato City: Sultan Kudarat (Nuling), Kabuntalan, Northern Kabuntalan, and Pigcawayan. A survey was conducted by the JICA Study Team to get a better understanding of the socio-economic, agricultural, and logistics situation at the barangay level. The survey covered 26 barangays within the influence area of the proposed road, as shown in Figure 24.2-1.

The primary objectives of the barangay interview survey are as follows:

- To gather baseline information on the demographics of the influence area
- To collect agricultural data including size of agricultural land, types of crops produced, and frequency and volume of harvest
- To collect logistics data including primary market for products, travel time and distance, and transport costs
- To determine the perceived benefits from establishing a new road

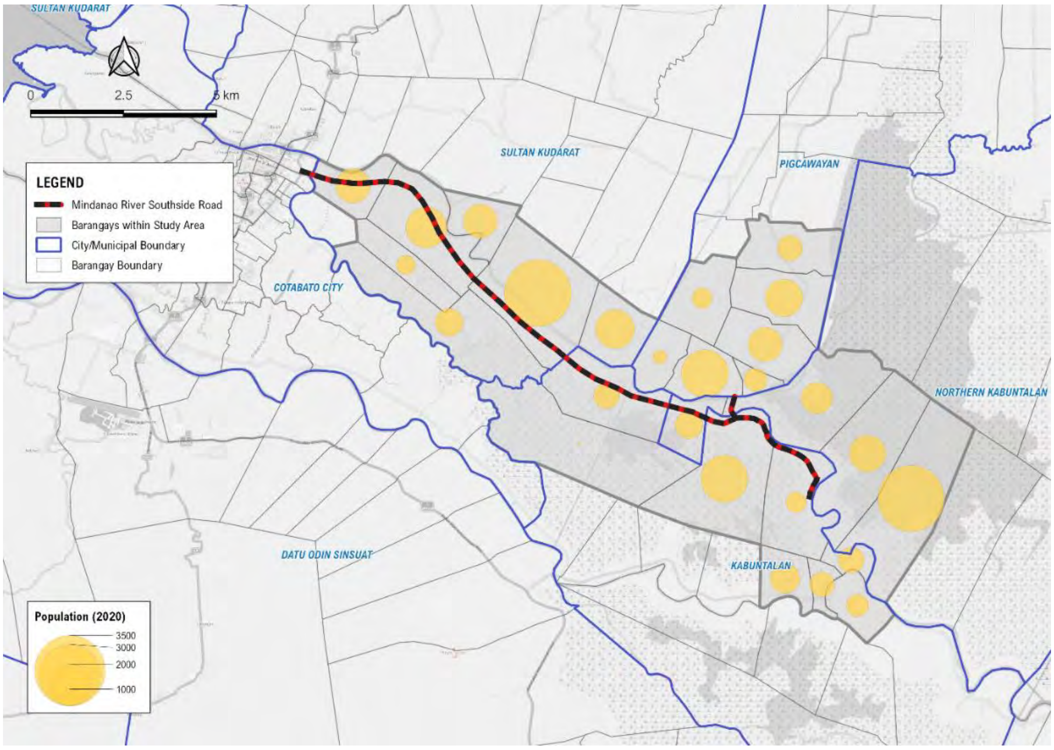


Source: JICA study team

Figure 24.2-1 Barangays Included within the Survey

(2) Population in the Study Area

The population distribution within the influence area of the proposed MRSR is shown in Figure 24.2-2 and Table 24.2-1.



Source: JICA study team

Figure 24.2-2 Population Distribution within the Influence Area, 2020

Table 24.2-1 Population within the Influence Area, per Barangay, 2020

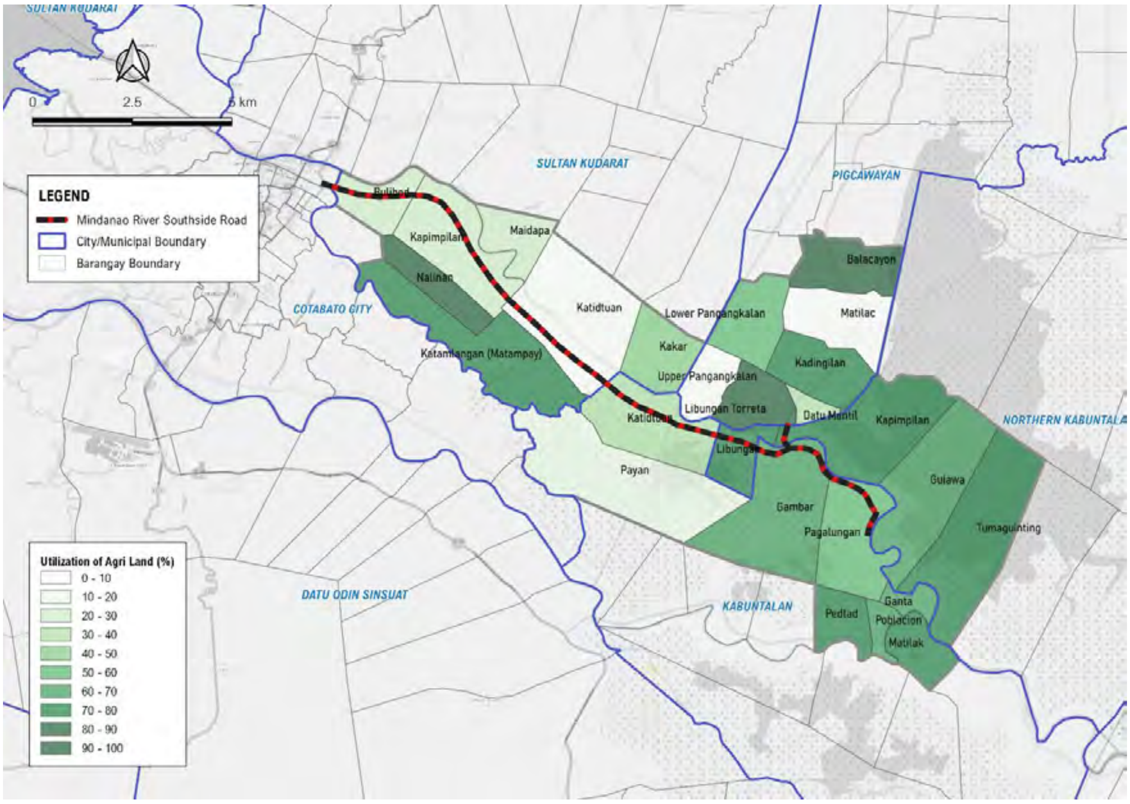
Barangay	Population (2020)	Aggregate Population (covered Barangays)	Share of Population to Total
Sultan Kudarat		**13,006**	**12.37 %**
Bulibod	1,689		
Nalinan	1,077		
Kakar	1,894		
Kapimpilan	1,978		
Katidtuan	3,307		
Katamlangan (Matampay)	1,400		
Maidapa	1,661		
Kabuntalan (Mother)		**10,678**	**41.97 %**
Gambar	2,282		
Ganta	1,331		
Katidtuan	1,319		
Matilak	1,186		
Pagalungan	1,124		
Payan	671		
Pedtad	1,480		
Poblacion	1,285		
Northern Kabuntalan		**8,018**	**30.51 %**
Guiawa	1,791		
Kapimpilan	1,556		
Libungan	1,396		
Tumaguinting	3,275		
Pigcawayan		**10,350**	**14.30%**
Balacayon	1,306		
Datu Mantil	1,220		
Kadingilan	1,683		
Libungan Torreta	2,290		
Lower Pangangkalan	1,129		
Matilac	1,817		
Upper Pangangkalan	905		
Sub-Total		**41,072**	**100%**

Source: JICA study team

(3) Land Composition in the Study Area

The estimated total agricultural land of the barangays within the influence area is 11,711 hectares, of which 45% is utilized. Table 24.2-2 shows the land profile per barangay.

The utilization of agricultural land is visualized in Table 24.2-2. Barangays adjacent to the Mindanao River (e.g., Bulibod, Kapimpilan, Maidapa, Kakar, Upper Pangangkalan) are characterized by low utilization of agricultural land (i.e., unsuitable for farming due to recurrent flooding). Currently, the dikes built to control the flow of water are damaged.



Source: JICA study team

Figure 24.2-3 Utilization of Agricultural Land within the Influence Area

Table 24.2-2 Total Agricultural Land and Area Utilized for Agricultural Production, Per Barangay

Barangay	Total Agricultural Land of Barangay [A]	Land Area Currently Utilized [B]	% of Utilized Land [B/A]
Sultan Kudarat			
Bulibod	360	100	27.78%
Nalinan	160	150	93.75%
Kakar	750	350	46.67%
Kapimpilan	900	250	27.78%
Katidtuan	-	-	-
Katamlangan (Matampay)	70	50	71.43%
Maidapa	535	150	28.04%
Kabuntalan (Mother)			
Gambar	790	550	69.62%
Ganta	260	170	65.38%
Katidtuan	553	180	32.55%
Matilak	220	170	77.27%
Pagalungan	1,241	650	52.38%
Payan	2,000	215	10.75%
Pedtad	100	80	80%
Poblacion	120	80	66.67%
Northern Kabuntalan			
Guiawa	150	100	66.67%
Kapimpilan	20	15	75%
Libungan	50	40	80%
Tumaguinting	1,000	800	80%
Pigcawayan			
Balacayon	330	300	90.91%
Datu Mantil	77	30	38.96%
Kadingilan	100	80	80%
Libungan Torreta	307	300	97.72%

Barangay	Total Agricultural Land of Barangay [A]	Land Area Currently Utilized [B]	% of Utilized Land [B/A]
Lower Pangangkalan	700	400	57.14%
Matilac	878	50	5.69%
Upper Pangangkalan	100	10	10%
Sub-Total	**11,711**	**5,270**	**45.00%**

Source: JICA study team

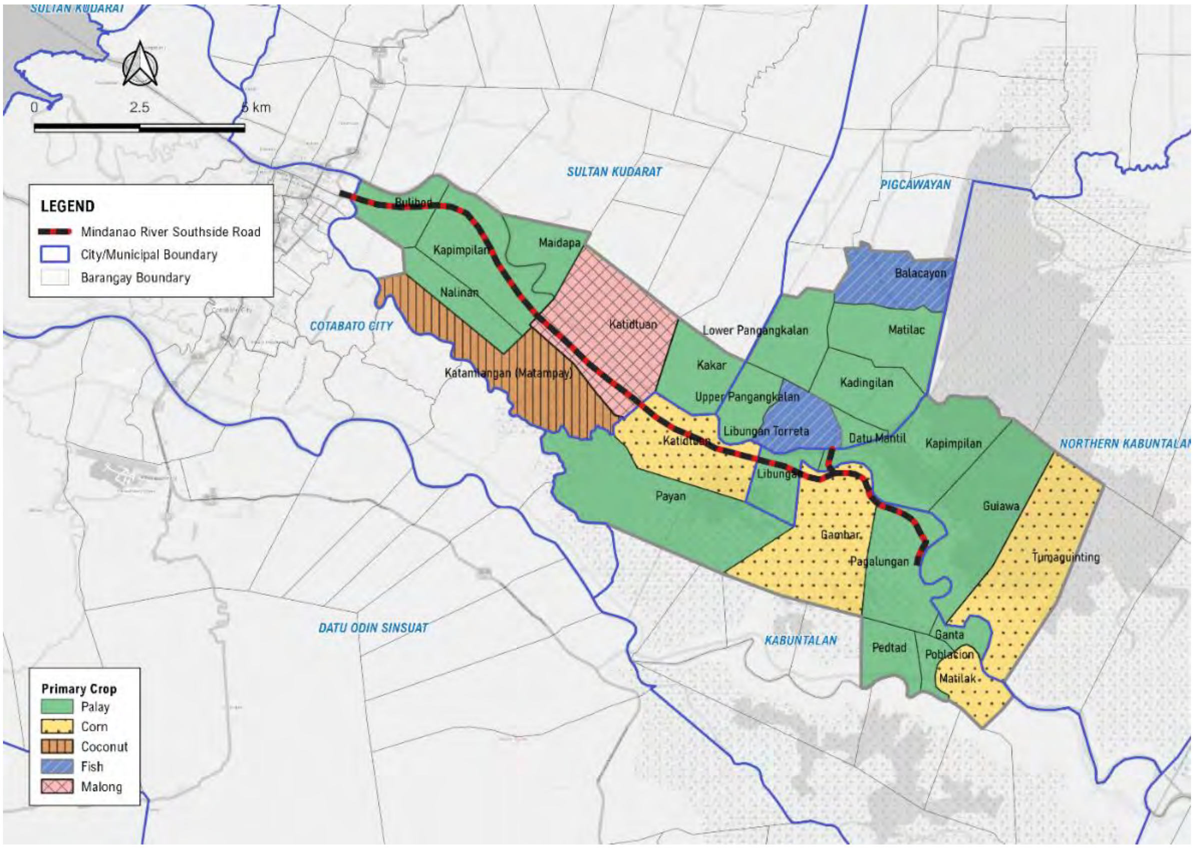
(4) Agricultural Products in the Study Area

1) Types of Crops Produced

The survey gathered information to uncover the agricultural profile of each barangay, as shown in Table 24.2-3. The following can be inferred from the results of the survey:

- Palay (rice) is the predominant crop within the influence area and is produced in at least 24 barangays. Palay serves as the main commodity in 18 of these barangays.
- Fish is an important commodity for riverside barangays such as Libungan Torreta, Katidtuan, Pedtad, and Poblacion.
- The other common crops within the influence area include corn, coconut, watermelon, and squash.

Figure 24.2-4 shows the main crop produced in each barangay.



Source: JICA study team

Figure 24.2-4 Primary Crop per Barangay

Table 24.2-3 Primary Crop and Other Products, per Barangay

Barangay	Primary Product	Land Area Utilized (ha)	Other Products
Sultan Kudarat			
Bulibod	Palay	100	-
Nalinan	Palay	140	Coconut
Kakar	Palay	200	Yellow Corn, White Corn
Kapimpilan	Palay	250	-
Katidtuan	Malong (woven cloth)	-	Fish
Katamlangan (Matampay)	Coconut	30	Palay
Maidapa	Palay	150	-
Kabuntalan (Mother)			
Gambar	White Corn	200	Palay, Coconut
Ganta	Palay	100	Yellow Corn, Mango
Katidtuan	Yellow Corn	70	Palay, Coconut
Matilak	Yellow Corn	70	Palay, Mango
Pagalungan	Palay	400	Yellow Corn, White Corn
Payan	Palay	200	Coconut
Pedtad	Palay	65	Watermelon, Squash, Fish
Poblacion	Palay	60	Watermelon, Squash, Fish
Northern Kabuntalan			
Guiawa	Palay	100	White Corn, Coconut
Kapimpilan	Palay	10	Corn, Coconut
Libungan	Palay	40	Yellow Corn
Tumaguinting	Corn	800	-
Pigcawayan			
Balacayon	Fish	-	Palay, Yellow Corn, White Corn, Coconut
Datu Mantil	Palay	30	-
Kadingilan	Palay	50	Coconut, Mango
Libungan Torreta	Fish	-	Palay, Corn, Coconut
Lower Pangangkalan	Palay	250	White Corn
Matilac	Palay	50	Yellow Corn, White Corn, Coconut
Upper Pangangkalan	Palay	10	-

Source: JICA study team

2) Frequency of Harvest and Level of Production

Table 24.2-4 shows the frequency of harvest and volume of production per barangay. The interview with barangay officials revealed the following:

- Majority of barangays plant palay (rice) during the rainy season, and corn during the dry season. The same land is generally utilized for both crops.
- Over the past three years, the volume of harvest has decreased due to unpredictable weather (i.e., sudden rainfall and increased occurrence of typhoons) and frequent flooding. For example, the usual harvest decreased from at least twice a year to only once a year. In difficult instances, there was no harvest at all.
- Barangay officials believe that the construction of adequate and well-maintained roads will improve land transportation and help alleviate the problem with flooding. According to them, this will directly increase the frequency of harvests.

Table 24.2-4 Frequency of Harvest and Volume of Production, per Barangay

Barangay	Primary Product of barangay	Volume of Harvest (kg/year)	Frequency of Harvest (per year)	Frequency of Harvest with Good Road
Sultan Kudarat				
Bulibod	Palay	360,000	2	3
Nalinan	Palay	2,016,000	2	3
Kakar	Palay	1,800,000	3	4
Kapimpilan	Palay	1,440,000	3	4
Katidtuan	Malong			
Katamlangan (Matampay)	Coconut	168,000	2	3
Maidapa	Palay	300,000	1	3
Kabuntalan (Mother)				
Gambar	White Corn	2,720,000	2	3
Ganta	Palay	720,000	2	3
Katidtuan	Yellow Corn	360,000	1	2
Matilak	Yellow Corn	532,000	1	2
Pagalungan	Palay	2,400,000	1	1
Payan	Palay	960,000	1	2
Pedtad	Palay	468,000	2	3
Poblacion	Palay	432,000	2	3
Northern Kabuntalan				
Guiawa	Palay	220,000	1	3
Kapimpilan	Palay	64,000	1	3
Libungan	Palay	224,000	1	3
Tumaguinting	Corn	1,680,000	1	3
Pigcawayan				
Balacayon	Fish	120,000		
Datu Mantil	Palay	378,000	3	4
Kadingilan	Palay	480,000	2	3
Libungan Torreta	Fish	96,000		
Lower Pangangkalan	Palay	1,320,000	2	3
Matilac	Palay	60,000	2	3
Upper Pangangkalan	Palay	54,000	3	4

Source: JICA study team

(5) Logistics System within the Study Area

The logistics profile (e.g., distance to market, travel time, and transport costs) of each barangay is summarized in Table 24.2-5.

- In general, farmers and fishermen face difficulty in selling their harvested products due to inadequate roads. In some instances, boats are initially used to transport goods, before loading into trucks which will deliver them at the destination.
- The main markets for the products include Cotabato City (for barangays in Sultan Kudarat and Kabuntalan Mother), urban towns of Pigcawayan (for barangays in Pigcawayan and Sultan Kudarat), and Datu Odin Sinsuat (for barangays in Kabuntalan Mother and Northern Kabuntalan).
- The other markets of these barangays include Midsayap, Davao City, and Upi.

Table 24.2-5 Logistics Profile of each Barangay within the Influence Area

Barangay	Primary Market/s	Distance (km)	Travel Time (min)	Transport cost for Product	Fare for Persons
Sultan Kudarat					
Bulibod	Cotabato City	3 km	10	P10/sack	P10
Nalinan	Cotabato City	6.6 km	20	P50/sack	P50
Kakar	Cotabato City & Pigcawayan	17.6 km (Cotabato); 15.5 km (Pigcawayan)	45	P10/sack	P50
Kapimpilan	Cotabato City & Pigcawayan	14.5 km (Cotabato); 20.5 km (Pigcawayan)	25 (Cotabato); 20 (Pigcawayan)	P60/sack (w/ labor)	P50
Katidtuan	Cotabato City	18.7 km	45	P50/sack	P50
Katamlangan (Matampay)	Cotabato City	18.8 km	40	P25/sack	P50
Maidapa	Cotabato City & Pigcawayan	17.6 km (Cotabato); 15.5 km (Pigcawayan)	25 (Cotabato); 20 (Pigcawayan)	P20/sack (w/ labor)	P50
Kabuntalan (Mother)					
Gambar	Cotabato City & DOS	40 km (Cotabato); 15 km (DOS)	40-60 (Cotabato); 30 (DOS)	P50/sack	P100
Ganta	Cotabato City & DOS	30 km (Cotabato); 21.2 km (DOS)	40-60 (Cotabato); 30 (DOS)	P50/sack	P70
Katidtuan	Cotabato City	20 km	30	P1/kg	P40
Matilak	Cotabato City & DOS	27.6 km (Cotabato); 19.8 km (DOS)	40-60 (Cotabato); 30 (DOS)	P50/sack	P70
Pagalungan	Cotabato & DOS	40 km (Cotabato); 15 km (DOS)	40-60 (Cotabato); 30 (DOS)	P50/sack	P70
Payan	Cotabato City & DOS	24 km (Cotabato); 15 km (DOS)	40 (Cotabato); 30 (DOS)	P30/sack	P50
Pedtad	Cotabato City	25.1 km (Cotabato)	-	-	P70
Poblacion	Cotabato City	-	-	-	P80
Northern Kabuntalan					
Guiawa	Cotabato City & DOS	25 km (Cotabato); 17 km (Pigcawayan)	60 (Cotabato); 45 (DOS)	P150/sack	P50
Kapimpilan	DOS	45 km	60	P1/ kg	P80
Libungan	Cotabato City & Pigcawayan	20 km (Cotabato); 15 km (Pigcawayan)	30 (Cotabato); 20 (Pigcawayan)	P1.50/kg (Cotabato); P2/kg (DOS)	P50
Tumaguinting	DOS	21.2 km	30	20 ¢/ kg	P50
Pigcawayan					
Balacayon	Pigcawayan	25 km	-	-	P50
Datu Mantil	Cotabato City & Pigcawayan	23.4 km (Cotabato); 8.4 km (Pigcawayan)	45 (Cotabato); 15 (Pigcawayan)	P1.50/ kg (Cotabato); P1/ kg (Pigcawayan)	P50
Kadingilan	Pigcawayan	15 km	20	P1/ kg	P30
Libungan Torreta	Midsayap & Pigcawayan	-	-	-	P50
Lower Pangangkalan	Cotabato City & Pigcawayan	32.2 km (Cotabato); 11 km (Pigcawayan)	60 (Cotabato); 90 (Pigcawayan)	P1/ kg (Cotabato); P2/ kg (Pigcawayan)	P50
Matilac	Cotabato City & Pigcawayan	23.4 km (Cotabato); 8.4 km (Pigxawayan)	45 (Cotabato); 15 (Pigcawayan)	P1/ kg	P50
Upper Pangangkalan	Cotabato City & Pigcawayan	21.9 km (Cotabato); 8.4 km (Pigcawayan)	45 (Cotabato); 15 (Pigcawayan)	P1.50/ kg (Cotabato); P1/ kg (Pigcawayan)	P50

Source: JICA study team

(6) Perceived Benefits from the Establishment of a New Road

All respondents pledged their support for the establishment of the MRSR. The barangay officials unanimously agreed that the construction of the road would bring various economic, social, and other benefits (Table 24.2-6). To specify, the perceived benefits are as follows:

- ***Better access to health services:*** There were recorded instances when patients were not immediately brought to a nearby hospital due to the lack of concrete roads. Improved road transportation within the influence area would bring better access to healthcare, especially during emergency situations.
- ***Better access to education:*** Most barangays face the recurrent threat of flooding, and in such cases, classes are often suspended. The establishment of a new road would enable better access for teachers and students going to schools. In special cases, modules can be delivered to students at a faster rate.
- ***Better access to markets:*** The project may serve as a farm-to-market road, thus enhancing entry and exit of commodities within the influence area. In addition, the cost of transport and travel time will consequently be reduced. In the long run, the road is expected to stimulate economic growth and lessen the reliance on water transport for the movement of goods.

Table 24.2-6 Perceived Benefits from Establishing the MRSR

Barangay	Support for the Project	Social Services	Economic Benefits	Other Benefits
Sultan Kudarat				
Bulibod	Yes	• Faster access in cases of emergency.	• Better access in buying and selling goods.	
Nalinan	Yes	• Better access to healthcare and education.	• Better access to markets. • For urbanization.	
Kakar	Yes	• Faster access to healthcare and in cases of emergency.	• The road may serve as a farm-to-market road which will lead to more convenient access to markets and in buying and selling of goods. • The road will enable new establishments and warehouses since the transportation costs won't be doubled. From the previous truck and pump boat costs, the transportation costs for pump boats may be eliminated.	
Kapimpilan	Yes	• Better access to education. • Better access to emergency and healthcare.	• Better access in buying and selling goods.	
Katidtuan	Yes	• Safer and more convenient to travel. • It will be helpful in accessing better education and healthcare.	• It will allow accessibility to the community like potential investors, government agencies, NGOs, and other groups. • This will lessen the transport costs since travel time will be reduced, which will eventually result to higher profit. • Better access to markets.	

Barangay	Support for the Project	Social Services	Economic Benefits	Other Benefits
Katamlangan (Matampay)	Yes	• Roads are relevant especially in cases of emergency.	• For convenience: a truck may be used as mode of transportation for the products of the barangay. From the travel time of 30-40 minutes using a pump boat, a truck may deliver it within 15-20 minutes.	
Maidapa	Yes	• Good quality education will continue in the barangay since teachers and students can go to school much easier.	• It will increase the volume of harvest. • It will help in the exchange of products from one barangay/ municipality to another.	
Kabuntalan (Mother)				
Gambar	Yes	• Better access to healthcare and education. • Faster response in case of emergency.	• Better access to markets.	
Ganta	Yes	• Better access to healthcare and education.	• For urbanization. • There's a market every Thursday in the barangay. If a road is built, there might be more sellers going to the market. This will also be convenient for the merchants to travel and bring their products.	
Katidtuan	Yes	• Better access to healthcare and education. • Faster response in case of emergency.	• Better access to markets. • For urbanization.	
Matilak	Yes	• Better access to education. • Better access to emergency and healthcare.	• Better access to markets for buying and selling goods. • For urbanization.	• The current means of transportation in the barangay is pump boat. If a road is built, they may be able to reroute their products and other activities to the road. This will also be more convenient for the people.
Pagalungan	Yes	• Better access to education. • Better access to emergency and healthcare.	• Better access to markets for buying and selling goods. • For urbanization.	
Payan	Yes	• Better access to education. • Better access to emergency and healthcare.	• The travel time to deliver goods and the transport cost of the products will be reduced.	
Pedtad	Yes	• More convenient to travel. • Better access to education. • Better access to emergency and healthcare.	• Better access to markets for buying and selling goods.	
Poblacion	Yes	• Better access to education. • Better access to emergency and healthcare.	• Better access to markets for buying and selling goods.	
Northern Kabuntalan				
Guiawa	Yes	• Better access to hospitals, schools, other barangays, etc.	• This will allow the barangay to have access on trading for the self-sustenance of livelihood of the people.	• This will help improve the peace and order in the barangay.

Barangay	Support for the Project	Social Services	Economic Benefits	Other Benefits
			• This will encourage urbanization of the barangay and the province.	
Kapimpilan	Yes	• Students can go to school safely and conveniently. • Emergency situations will be addressed faster.	• Better access to markets for buying and selling goods. • For urbanization.	
Libungan	Yes	• Better access to education. • Better access to emergency and healthcare.	• Roads will eventually lead to urbanization, welcoming new businesses. This will allow import and export of goods. • Lowers cost of goods since transportation costs will be reduced significantly.	• The road may serve as dike to control flooding.
Tumaguinting	Yes	• Better access to hospitals, schools, other barangays, etc.	• This will allow urbanization of the barangay.	
Pigcawayan				
Balacayon	Yes	① Better access to healthcare, education, and rescue in cases of emergency.	② The transportation cost for delivering the products from the farm to the market will be reduced.	
Datu Mantil	Yes	③ Better access to schools: Schools had been damaged due to earthquake. ④ Better access to hospitals: Pregnant women cannot give birth at their birthing clinic since it lacks equipment.	⑤ It will help the farmers in the barangay to conveniently buy goods and sell their products.	
Kadingilan	Yes	⑥ The road will be convenient especially for the commuters.	⑦ The road may serve as farm-to-market road.	
Libungan Torreta	Yes	⑧ Convenient and faster travel.	⑨ The road will enable investors and delivery trucks to enter the barangay. As of now, trucks may enter only up to barangay Simsiman.	
Lower Pangangkalan	Yes	⑩ The road will provide faster access in cases of emergency. Some residents in need of immediate treatment are brought to the hospital using the pump boat but some would expire during the travel time. With the provision of the road, these incidents may be prevented.	⑪ The cost of goods in the barangay will decrease since the transportation costs will be reduced significantly. ⑫ Suppliers can directly sell their products by going to the barangay.	
Matilac	Yes	⑬ Better access to healthcare, education, and rescue in cases of emergency.	⑭ The urbanization of the barangay will help in selling and buying goods.	
Upper Pangangkalan	Yes	⑮ Emergency responses will be faster. ⑯ Better access to education wherein modules can easily be delivered to students.	⑰ With a road, there can be access to different types of transportation. ⑱ It can improve the promotion of agricultural products mainly by ease in buying supplies and selling goods	

24.2.2 Traffic and Social Issues

The current transportation mode in the target area is river transport (boat). It is less safe and reliability is poor. During heavy rains, operation is normally suspended hence communities' line to Cotabato City is temporarily halted.

24.2.3 Traffic Demand Forecast

Traffic demand forecast for MRSR is conducted by 1) Estimation of diverted traffic volume from river transport and 2) Estimation of traffic volume in cases of with project and without project, as explained in Chapter 23.

(1) Diverted Traffic Volume from River Transport

Based on the social survey result, diverted traffic volume from river transport was estimated based on the following assumptions:

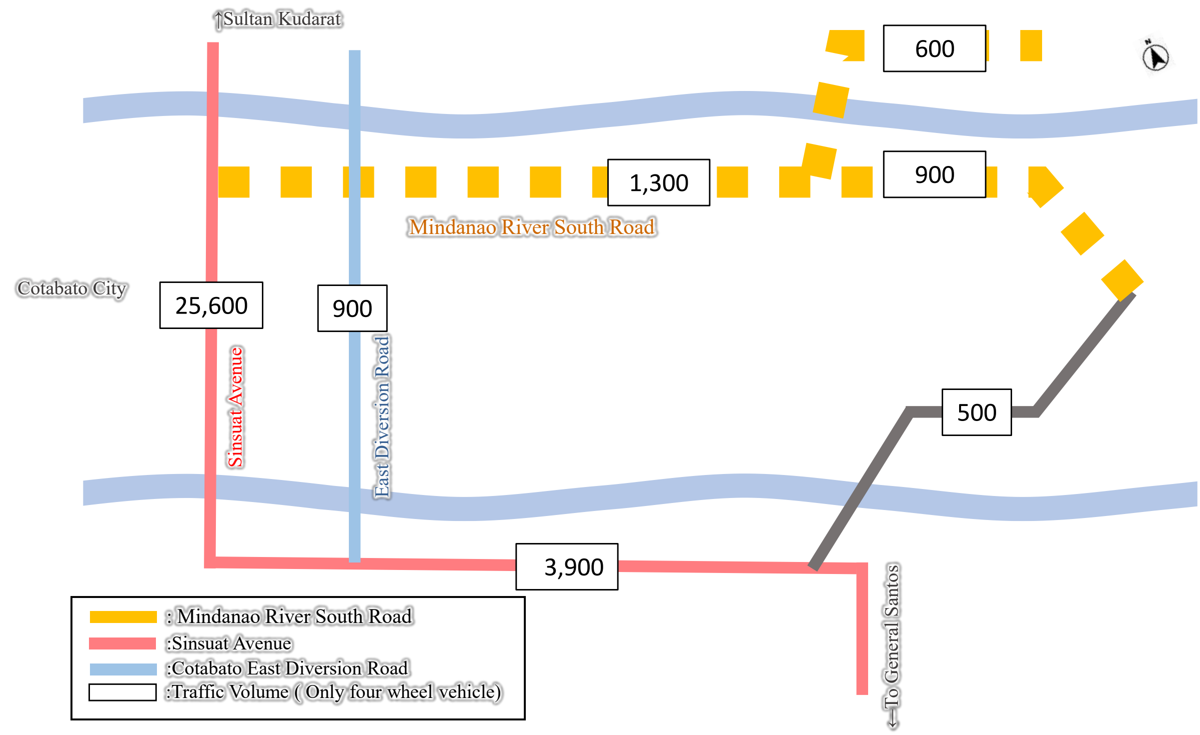
- Diverted transport is assumed from river transport (boat) which is the current transportation mode in the subject area. Thus, diverted traffic volume will be determined based only on the barangay response in the interview survey.
- Volume of agricultural products were determined in the Social/Barangay Survey and it is assumed that once road is constructed, cargo traffic will be diverted to road.
- Annual traffic volume was calculated from annual production volume and truck traffic volume and it was converted to daily traffic volume (20 sacks is converted to one vehicle trip; note: small-scale farmers use Jeepney instead of truck to transport their agricultural produces).

(2) Traffic Demand forecast by JICA Strada Model

Methodology and process of traffic demand forecast is explained in Section 23.2.4 of Chapter 23. Based on this methodology and process, future traffic volume on MRSR was estimated in the next section.

24.2.4 Future Traffic Volume

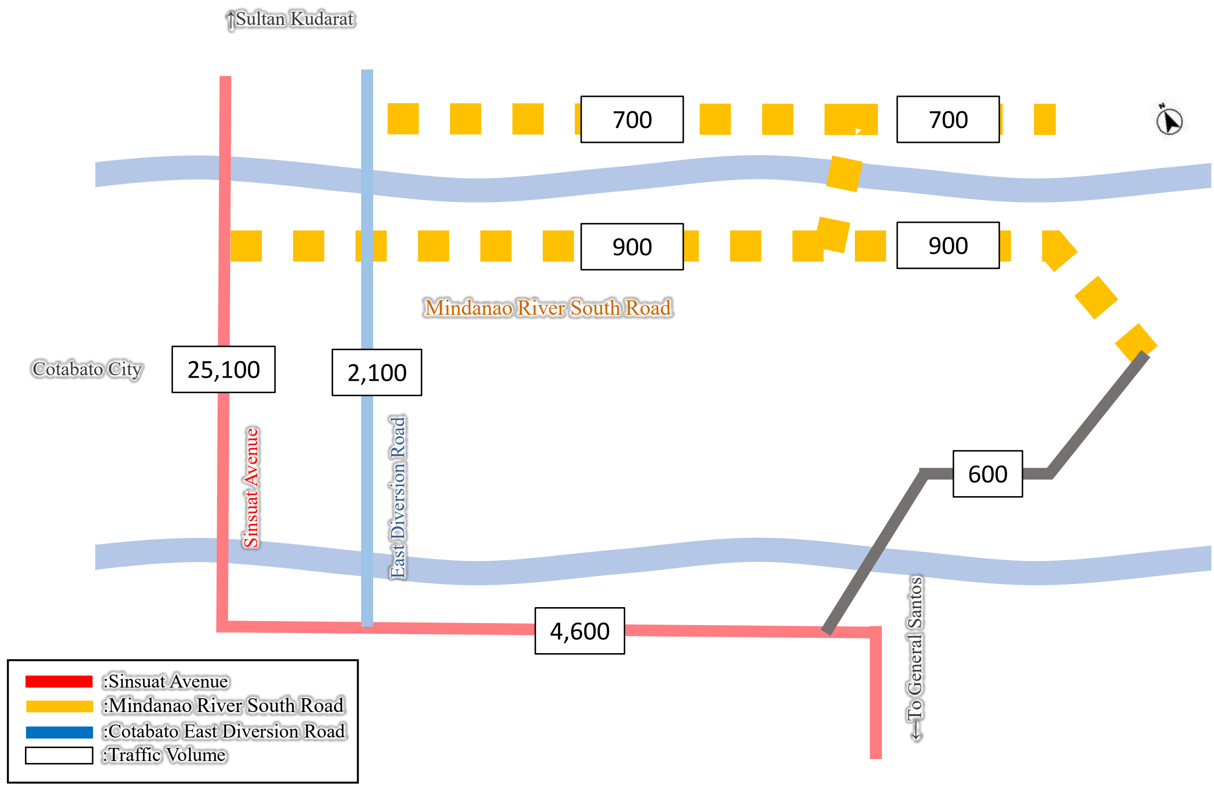
Figure 24.2-5 and Figure 24.2-6 show the estimated traffic volume along the MRSR in 2028 and 2040. The traffic volume is estimated at 600 - 1,300 vehicle/day in 2028 and 900 vehicle/day in 2040, respectively.



Note: Tricycles and motorcycles are not reflected in the above data

Source: JICA Study Team

Figure 24.2-5 Traffic Projection of Mindanao South River Road (Year 2028)



Note: Tricycles and motorcycles are not reflected in the above data

Source: JICA Study Team

Figure 24.2-6 Traffic Projection of Mindanao South River Road (Year 2040)

24.2.5 Project Impact

Table 24.2-7 summarizes the traffic assignment results and estimated diverted traffic volume for both cases: (1) without project case and (2) with project case. Comparison between with project and without project in 2040, the total travel time will be reduced by 636 PCU*hr and the total vehicle-km will be reduced by 27,085 PCU*km.

Table 24.2-7 Traffic Impact of without Project Case and with Project Case

Year	Case	Total Travel Time (PCU*hr)	Total Vehicle Km (PCU*km)	Average Travel Speed (km/hr)
2028	With	20,766	766,838	35.4
	Without	21,150	783,367	35.4
	With-Without	-384	-16,529	0
2040	With	28,028	992,489	35.4
	Without	28,663	1,019,573	35.4
	With-Without	-636	-27,085	0

Source: JICA Study team

24.3 Preliminary Design of Mindanao River Southside Road

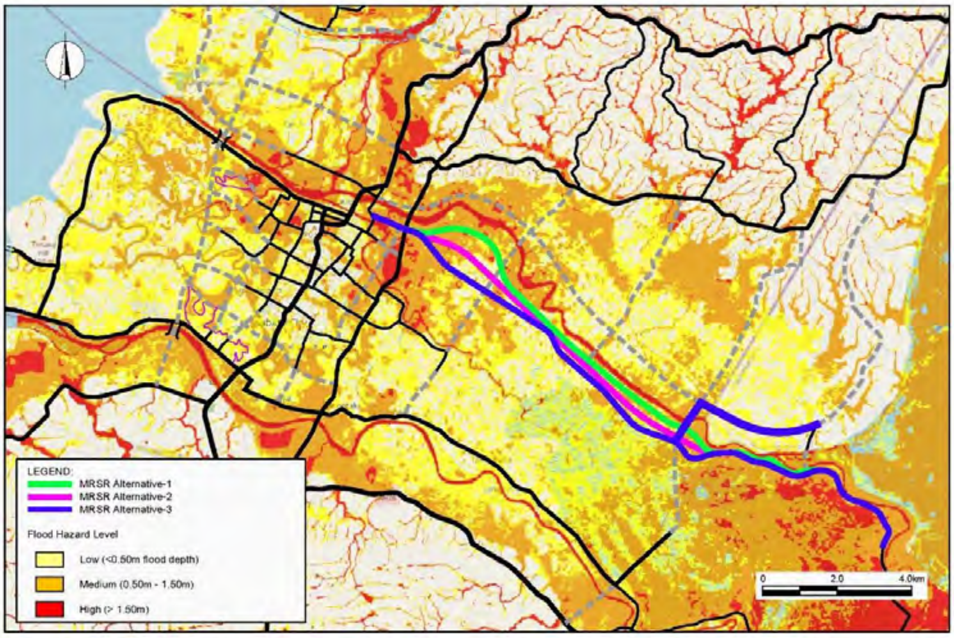
24.3.1 Development objectives of the Project

Development objectives of the project are as follows:

- To improve access to the marsh area where currently access is made by boats only.
- To promote agricultural development.
- To promote social and economic integration of the four LGUs (Cotabato City, Sultan Kudarat, Kabuntalan and Pigcawayan)

24.3.2 Flood Area at Estimated 100-year Return Period

In Figure 24.3-1 shows the flood map along the Mindanao River for the proposed project. During rainy season from June to November, low lying areas tend to be inundated with rain water, covering farmlands.



Source: Flood Hazard Map- http://noah.up.edu.ph

Figure 24.3-1 Mindanao River Southside Road Flood Hazard Map

24.3.3 Design Policies

The design policies adopted for this project for this study is to provide a road network capable of supporting the expansion of the city by developing new road network that will support future economic development. In this regard, the following are to be considered in the design.

- Connection to existing road shall be an at-grade intersection in order to capture enough traffic. It shall be strategically made to achieve an effective road network and traffic distribution.
- River crossing at Rio Grande de Mindanao and other tributary rivers shall consider navigational clearance for barges as defined by Philippine Coast Guard to be 3.75 m.
- Future land use plan is fully considered for selection of a road alignment.
- Compliance with the required parameters of the adopted design speed.
- Minimal social impact.
- Utilize and improve existing road to the required minimum design standards.
- Interconnected roads function to decongest Sinsuat Ave. which is currently the city's only main trunkline.
- Reflect the concept of the road network masterplan of Cotabato City.
- A two-lane, two-way highway for a collector-distributor road.

The preliminary design of Mindanao River Southside Road is prepared similarly as discussed for the West Diversion Road in Chapter 23 regarding:

24.3.4 Highway Classification

24.3.5 Highway Design Reference

Based on the attributes, the design speed is selected to be at 60 kph for Mindanao River Southside Road.

24.3.6 Basic Route Study

The basic route study is carried out as discussed similarly in Chapter 23.

In particular, for Mindanao River Southside Road, there are two (2) alignments that are to be studied, one section will be parallel with the river and the other section is crossing the river.

The MRSR is a two-lane, two-way road as this is an expansion to connect with similar existing two-lane roadway. It is a non-controlled access, meaning all adjacent development that are existing and future build ups shall enter or exit without toll fees or controlling access. The route possesses basically rural area due to undeveloped surroundings along the proposed route. This may be a part of National Road in the future. The terrain is a combination of flat to rolling ground. Daily traffic volume is expected to be 170 veh/day in year 2028.

24.3.7 Design Standard and Typical Cross Sections

(1) Design Standard

Proposed geometric design standards are shown in Table 24.3-1.

Table 24.3-1 Summary of Road Geometric Design Standard, MRSR (2-Lane) (Design Speed, 60kph)

Item	Unit	Standard	Remark
Design Speed	kph	60	
Design Vehicle	-	WB-19	
Stopping Sight Distance	m	85	Page 3-4, Table 3-1, AASHTO 2011
Passing Sight Distance	m	180	Page 3-9, Table 3-4, AASHTO 2011 (two-lane highways)
ROW	m	20	
Terrain Condition		Flat	
2) Cross Section Elements			
Pavement			Asphalt Concrete
Lane Width	m	3.35	Page 53, Table 16.1, DPWH Road Safety Design Manual
Median Width	m	0	Page 8-8, Figure 8-2D, AASHTO 2011
Inner shoulder Strip	m	0	
Outer shoulder Strip	m	2.5	
Number of Lanes	Nos	2	
Normal Cross Slope	%	2	Page 4-6, Table 4-1, AASHTO 2011
Maximum Super elevation	%	6	Page 53, Table 16.1, DPWH Road Safety Design Standard
3) Horizontal Alignment			
Minimum Radius	m	123	Page 3-45, Table 3-9, AASHTO 2011, e=6%
Min. Transition Curve Length	m	50	JPN

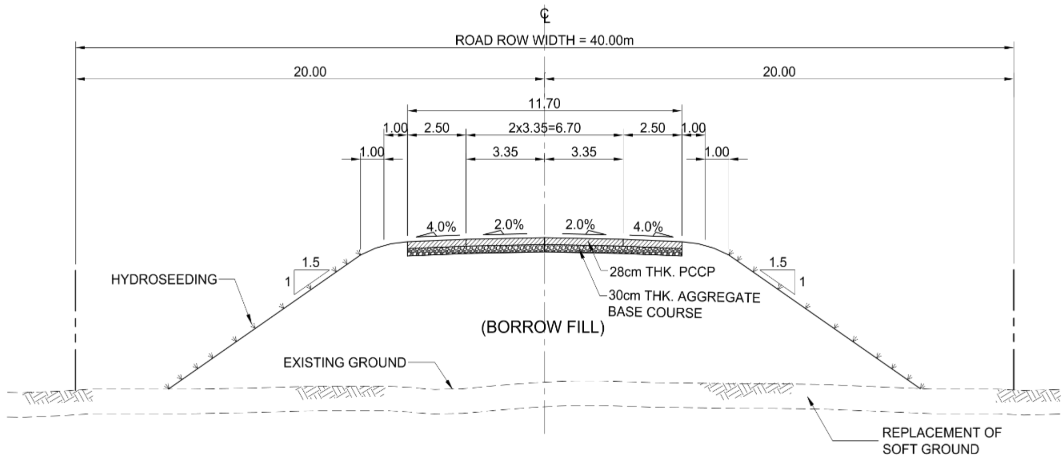
Item		Unit	Standard	Remark
Min. Radius not requiring Transition Curve		m	600	JPN
Min. Radius not requiring Superelevation		m	2000	JPN (cross slope, 2%)
		m	1440	JPN (cross slope, 1.5%)/ AASHTO, 2011
Max. Relative Slope			1/167	Page 3-61, Table 3-15, AASHTO 2011
4) Vertical Alignment				
Maximum Vertical Gradient		%	5	Page 8-4, Table 8-1, AASHTO 2011
Minimum K value	Sag		18	Page 3-161, Table 3-36, AASHTO 2011
	Crest		11	Page 3-155, Table 3-34, AASHTO 2011
Minimum Radius	Sag	m	1000	JPN
	Crest	m	1400	
Min Vertical Curve Length		m	50	JPN
5) Vertical Clearance				
Road		m	5.2	DPWH Requirement, 4.9 m (16 feet) clearance + 0.3m(Figure AC Overlay) (when needed)
Farm		m	2.5-3.0	Animal/ Cart / Tractor crossing
River		m	3.75	Philippine Coast Guard

Source: JICA Study Team

(2) Typical Cross Sections

The lane width adopted for Mindanao River Southside Road is set at 3.35 m with 2.50 m shoulders on both sides, a typical width for a two-lane, two-way highway National Road at 60 km per hour design speed. It is provided with slope protection at the locations where flood water level may be present on the embankment. A normal cross fall of 2.0% is used for the traveled way all throughout the PCC pavement and 4.0% shoulders. Verges and top slope rounding are also provided for roadside facilities and safety devices.

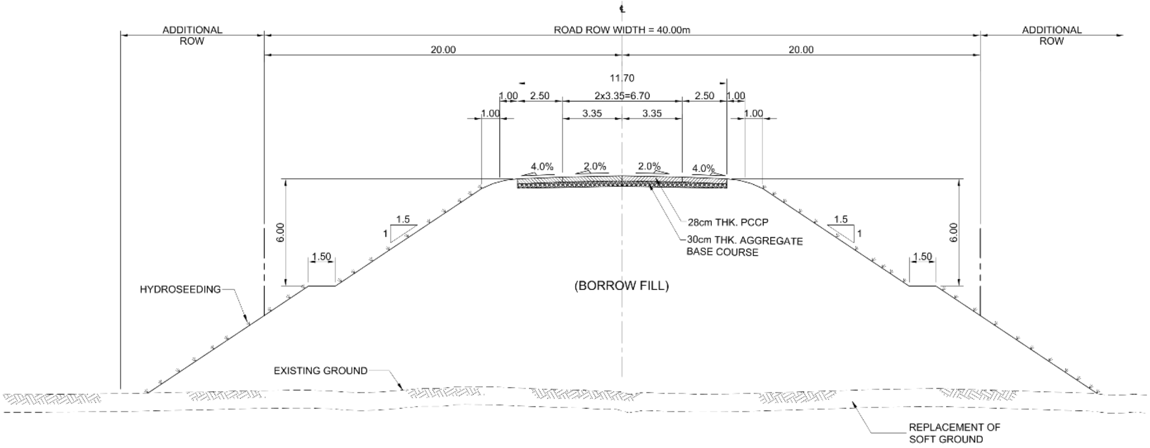
The angles of slopes are based on the stability requirements and used a slope 1.5:1 for embankment based on the standards in Japan. These typical cross-sections are shown in Figure 24.3-2 to Figure 24.3-3.



Source: JICA Study Team

Figure 24.3-2 Typical Rodway Section for Lower Embankment

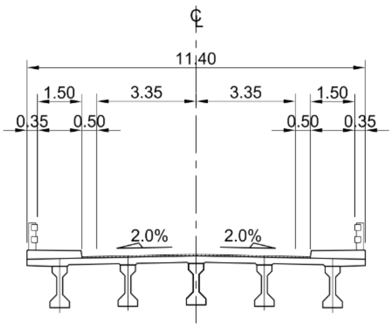
For normal embankment height, Figure 24.3-2 is applied especially at locations that have no road intersections and farm crossings.



Source: JICA Study Team

Figure 24.3-3 Typical Rodway Section for Higher Embankment

For much higher embankment height, Figure 24.3-3 is applied especially at locations that have road and farm under crossings.



Source: JICA Study Team

Figure 24.3-4 Typical Rodway Section at Bridge Section

For the bridge section, Figure 24.3-4 is applied for small to medium length of bridges. The roadway shoulder width 2.50 m is to transition before and after the bridge for its lateral clearance of 0.50m. The bridge will have a sidewalk for pedestrian to cross.

24.3.8 Alternative Alignments and Selection of Optimum Alignment

(1) Alternative Routes Evaluation and Selection Criteria

Similar process in establishing alternative alignments is done for Mindanao River Southside Road as the West Diversion Road. The route selection evaluation criteria are shown in Table 24.3-2.

Table 24.3-2 Criteria for Route Evaluation and Selection

Item	Evaluation Weight	Assessment Points	Assessment Symbol
1) Horizontal and Vertical Alignment	5	・Good ·················· 5 ・Normal················ 3 ・Not Bad··············· 1	◎ ● Δ
2) Project Cost	5	・Cheapest·············· 5 ・Average················ 3 ・Expensive ············ 1	◎ ● Δ
3) Construction Difficulty	5	・Easy ··················· 5 ・Average················ 3 ・Difficult··············· 1	◎ ● Δ
4) Social Aspect	5	・Few···················· 5 ・High··················· 3 ・Very High ············ 1	◎ ● Δ
5) Environmental Aspect	5	・Easy ··················· 5 ・Average················ 3 ・Difficult··············· 1	◎ ● Δ
Total	25		

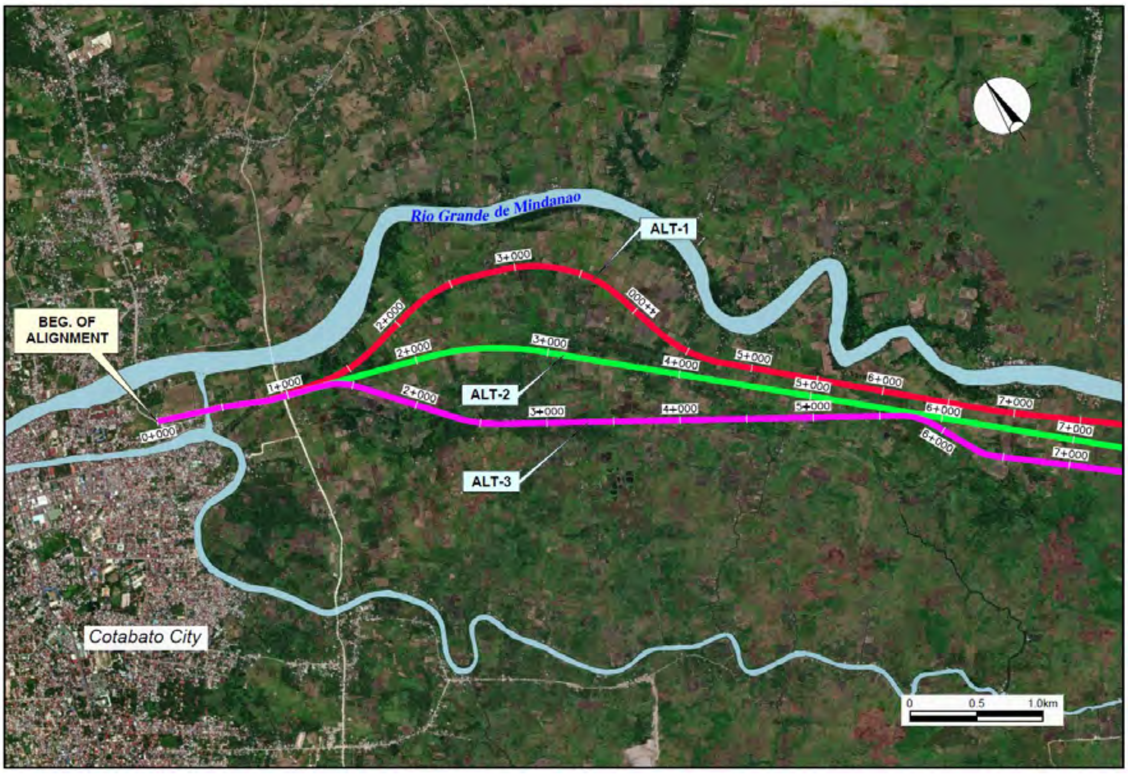
Source: JICA Study Team

Table 24.3-3 shows the comparative table by presenting the numerical data of the alternative alignment as well as the results of evaluation based on in Table 24.3-2. The alternatives are quite closely rated in terms of geometric alignment and even the scope of works. However, the potential of affecting residential houses and other building structures tends to define the overall evaluation of the alternatives. On the other hand, the total bridge length of the Alternatives is also the definitive way to determine the most economical in terms of construction. Although, Alternative 2 and Alternative 3 may have similar total bridge lengths Alternative 3 poses the most points in overall comparison.

(2) Description of the Alternative Alignments

a) STA. 0+000 to STA. 6+000

In this first six (6) kilometer route alignment study as shown in Figure 24.3-5, Alternative 1 is closest to the river. Alternative 2 is located next closer to the river and alternative 3 is the farthest from the river. For visual comparison, alternatives are shown together to see the immediate difference in geometry, its route passing thru farmlands or swampy lands. Its effect on social and environmental impacts. The terrain is considerably flat, it lies within swampy area. Existing houses are scattered in this segment.



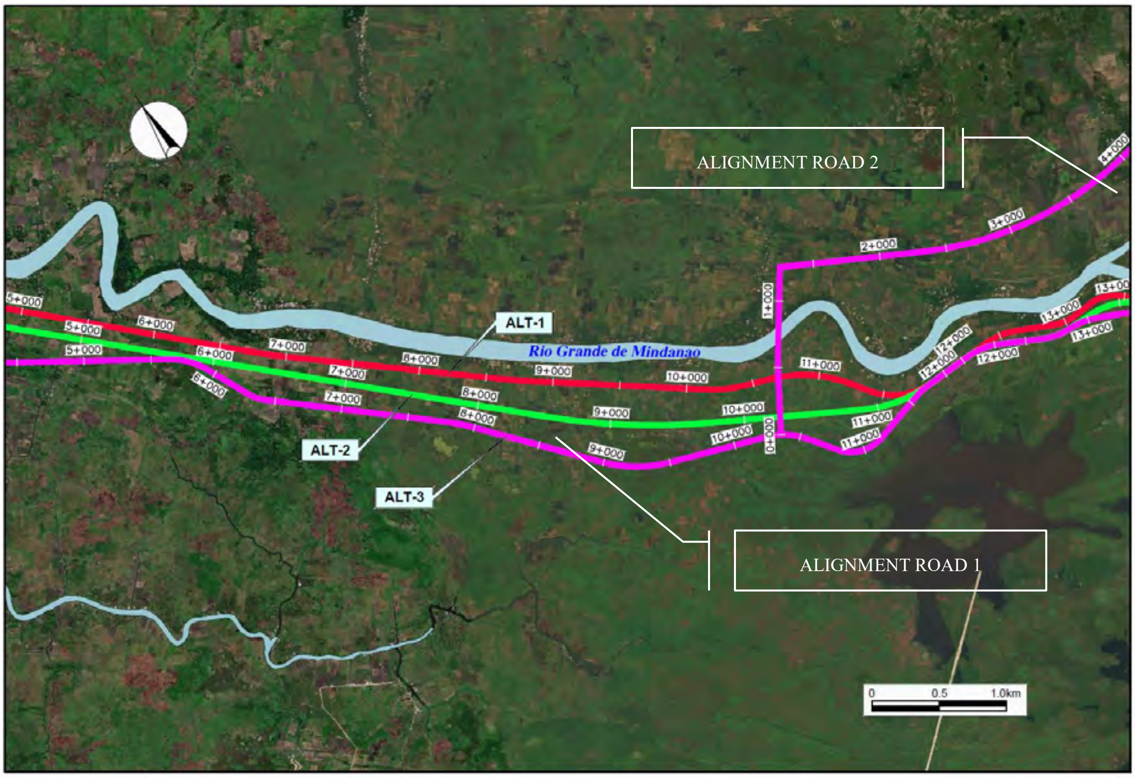
Source: JICA Study Team

Figure 24.3-5 Mindanao River Southside Road Alignment Alternatives STA. 0+000 – STA 6+000

b) STA. 6+000 to STA. 12+000

There are two (2) alignments to be studied for Mindanao River Southside Road, Alignment Road 1 is the route along the course of the river, it runs almost parallel to the river and Alignment Road 2 is a route that cross the Mindanao River and bends towards west connecting to an existing road at the other side of the river. The Alignment Road 2 will connect to the selected alternative in Alignment Road 1.

For this next 6 kilometers in Figure 24.3-6, the three alignment alternatives are proposed much closer together to avoid a large area of swampy lands. Alternative 1 still the closest to the river, next is Alternative 2 and farthest is Alternative 3, however portion of the swampy area will be crossed. During rainy seasons, much of the farmlands are inundated with water on low elevation areas. In this area, farmlands adjacent to residential house are affected. There are more house in this area as many inhabitants tend to dwell near waterways.

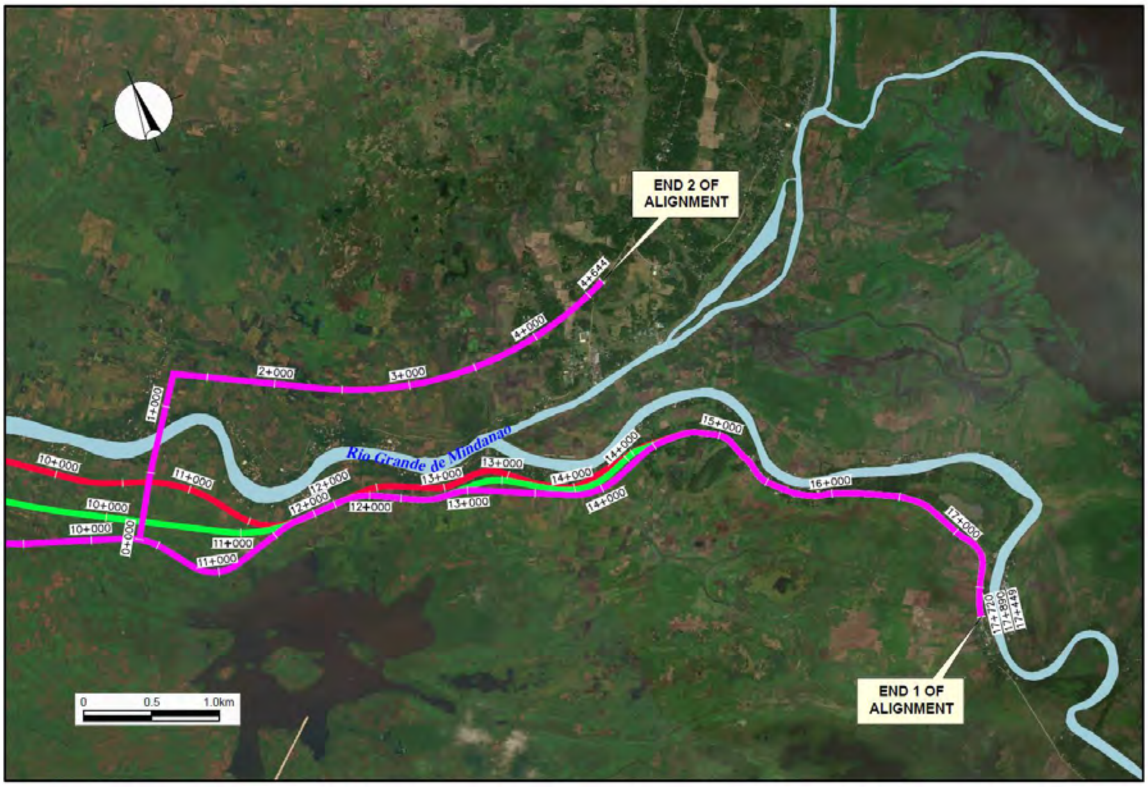


Source: JICA Study Team

Figure 24.3-6 Mindanao River Southside Road Alignment Alternatives STA. 6+000 – STA 12+000

c) STA. 12+000 to End

Figure 24.3-7 shows the last segment of alternatives and the three alignments are closest to each other. This is because all of the alternatives avoided swampy and/ or marsh land near this area. The alignment is to be connected to the existing road and to be utilized in this project. This existing road will be improved to satisfy the design standard. Raising of pavement may be needed to increase its flood mitigation. Geometrically, it will follow the form of the existing road to avoid Right-of-Way acquisition concerns.



Source: JICA Study Team

Figure 24.3-7 Mindanao River Southside Road Alignment Alternatives STA. 12+000 – End

Table 24.3-3 Comparison of Alternatives (Mindanao River Southside Road)

CRITERION		ALTERNATIVE 1		ALTERNATIVE 2		ALTERNATIVE 3	
ROUTE EVALUATION							
• Scope of Work		• Road Length Road 1 = 17.78Km Road 2 = 4.08Km Total = 21.86Km		• Road Length Road 1 = 17.36Km Road 2 = 4.38Km Total = 21.74Km		• Road Length Road 1 = 17.63Km Road 2 = 4.50Km Total = 22.13Km	
		• No. of Bridges = 5 Bridge 1 = 40m Bridge 2 = 30m Bridge 3 = 20m Bridge 4 = 20m Bridge 5 = 140m Total = 250m		• No. of Bridges = 4 Bridge 1 = 40m Bridge 2 = 30m Bridge 3 = 20m Bridge 4 = 140m Total = 230m		• No. of Bridges = 4 Bridge 1 = 40m Bridge 2 = 30m Bridge 3 = 20m Bridge 4 = 140m Total = 230m	
		Grand Total = 22.11Km		Grand Total = 21.97Km		Grand Total = 22.36Km	
EVALUATION ITEM	• Horizontal and Vertical Alignment	• Minimum radius of horizontal curve = 150m • Vertical alignment maximum gradient = 3.0% • Right angle turn at Road 2 after the bridge. Future intersection location. • Alignment is closest to the river.	◎	• Minimum radius of horizontal curve = 150m • Vertical alignment maximum gradient = 3.0% • Right angle turn at Road 2 after the bridge. Future intersection location. • Alignment is second closest to the river.	◎	• Minimum radius of horizontal curve = 150m • Vertical alignment maximum gradient = 3.0% • Right angle turn at Road 2 after the bridge. Future intersection location. • Alignment is farthest from the river.	◎
	• Project Cost	• Most expensive due to longest bridge length required.	△	• Least expensive due to least road and bridge length required.	◎	• Lesser expensive due to possible lesser height of embankment and farthest distance to the river.	●
	• Construction Difficulty	• Soft ground treatment will be required.	●	• Soft ground treatment will be required.	●	• Soft ground treatment will be required.	●
	• Social Aspect	• No. of houses/buildings affected = 35	●	• No. of houses/buildings affected = 43	△	• No. of houses/buildings affected = 22	◎
	• Environmental Aspect	• Affect no fishponds.	◎	• Affect few fishponds.	●	• Affect few fishponds.	●
		• Affect several tree plantations.	●	• Affect several tree plantations.	●	• Affect several tree plantations.	●
OVERALL EVALUATION		NOT RECOMMENDED	20 Points	NOT RECOMMENDED	20 Points	RECOMMENDED	22 Points

Source: JICA Study Team

24.3.9 Proposed Layout of the MRSR

(1) Plan and Profile

Based on the evaluation criteria, the selected alignment for the proposed MRSR is Alternative 3. Figure 24.3-8 to Figure 24.3-9 show the proposed overall plan and profile layout of the Mindanao River Southside Road. The complete basic drawings are presented in another volume.

The other section which is the Alignment 2 of the Mindanao River Southside Road that crosses the Rio Grande de Mindanao River is shown in Figure 24.3-10.

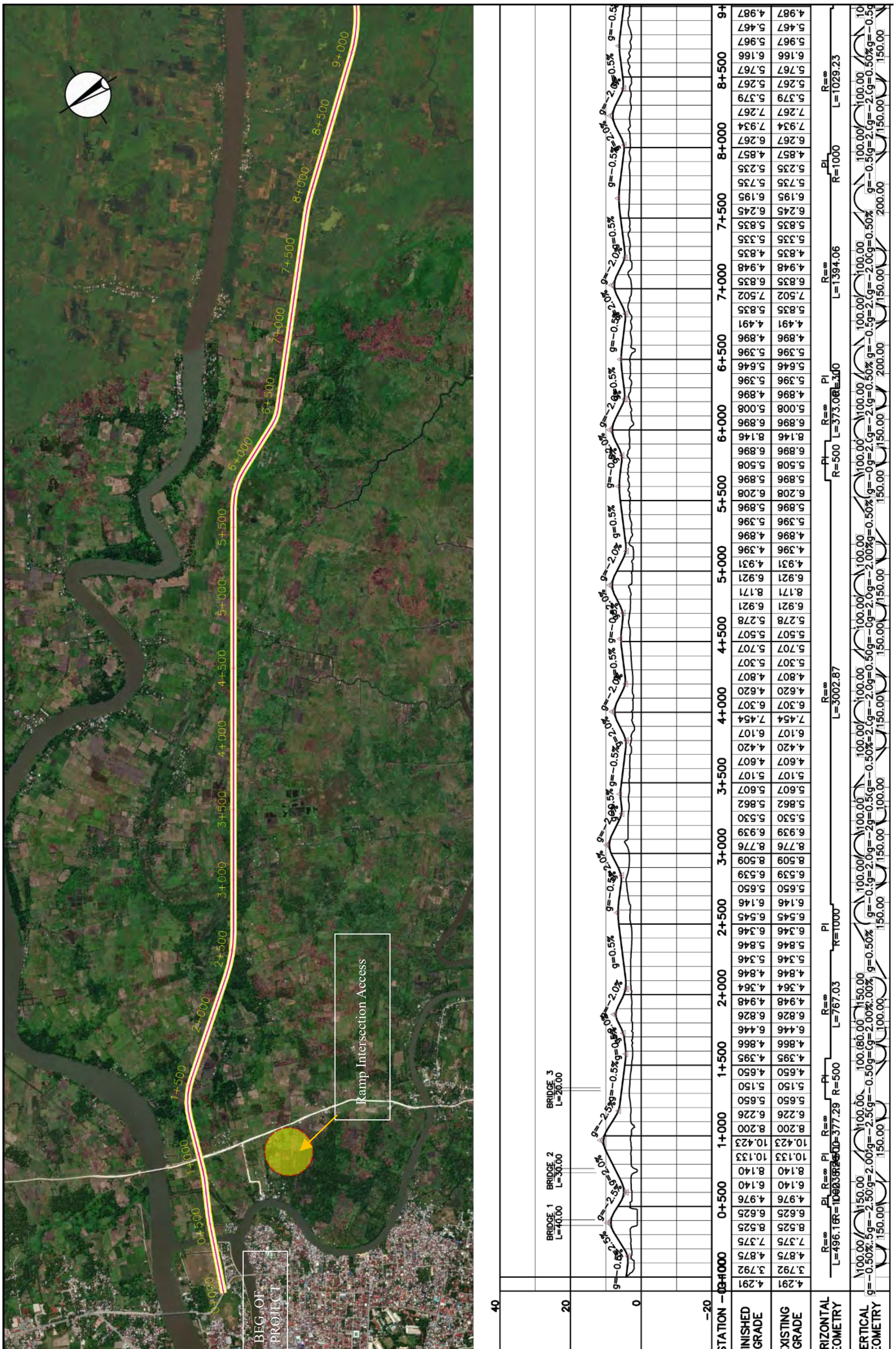


Figure 24.3-8 Plan and Profile of Mindanao River Southside Road of Selected Alignment (1 of 2)

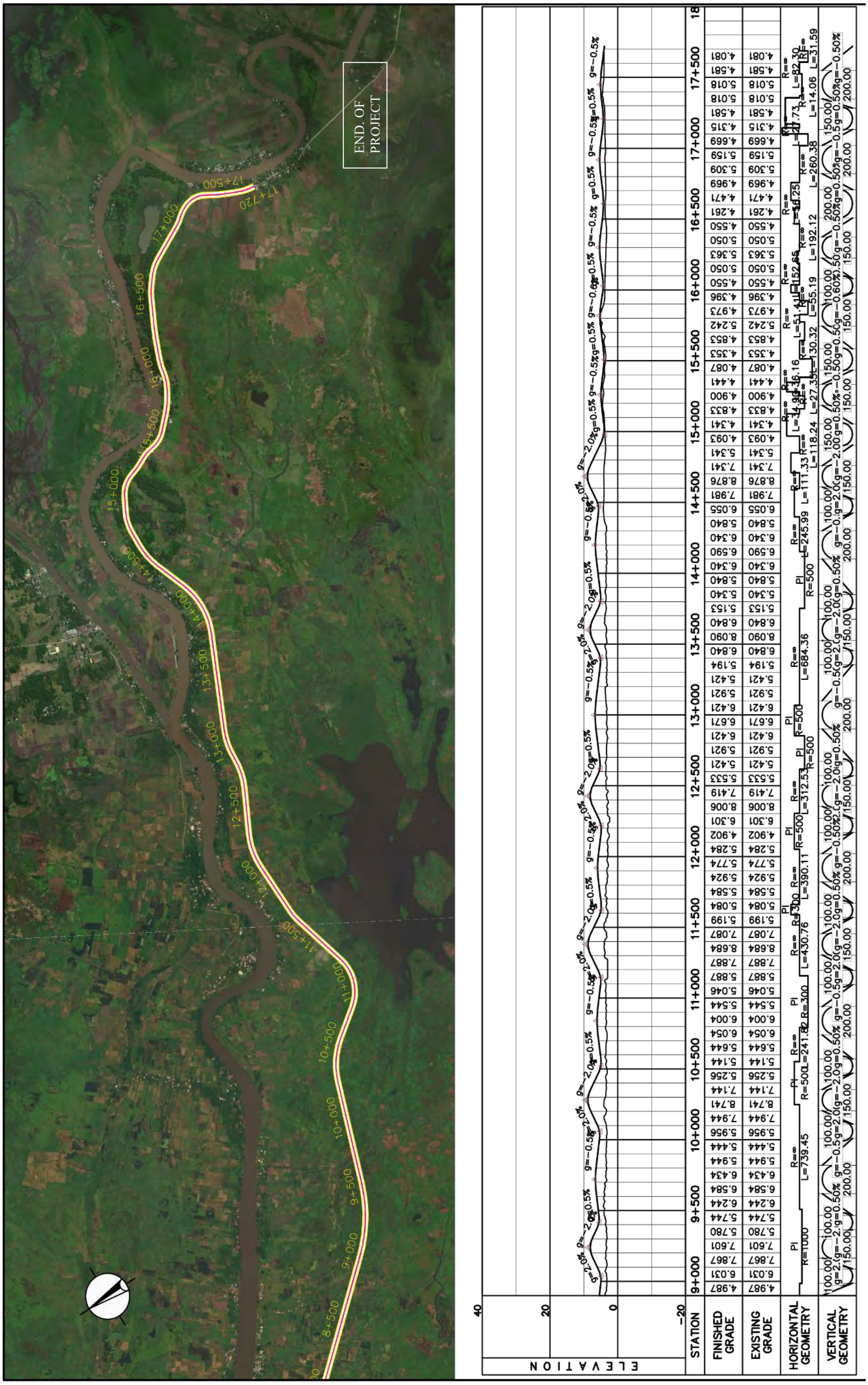


Figure 24.3-9 Plan and Profile of Mindanao River Southside Road of Selected Alignment (2 of 2)

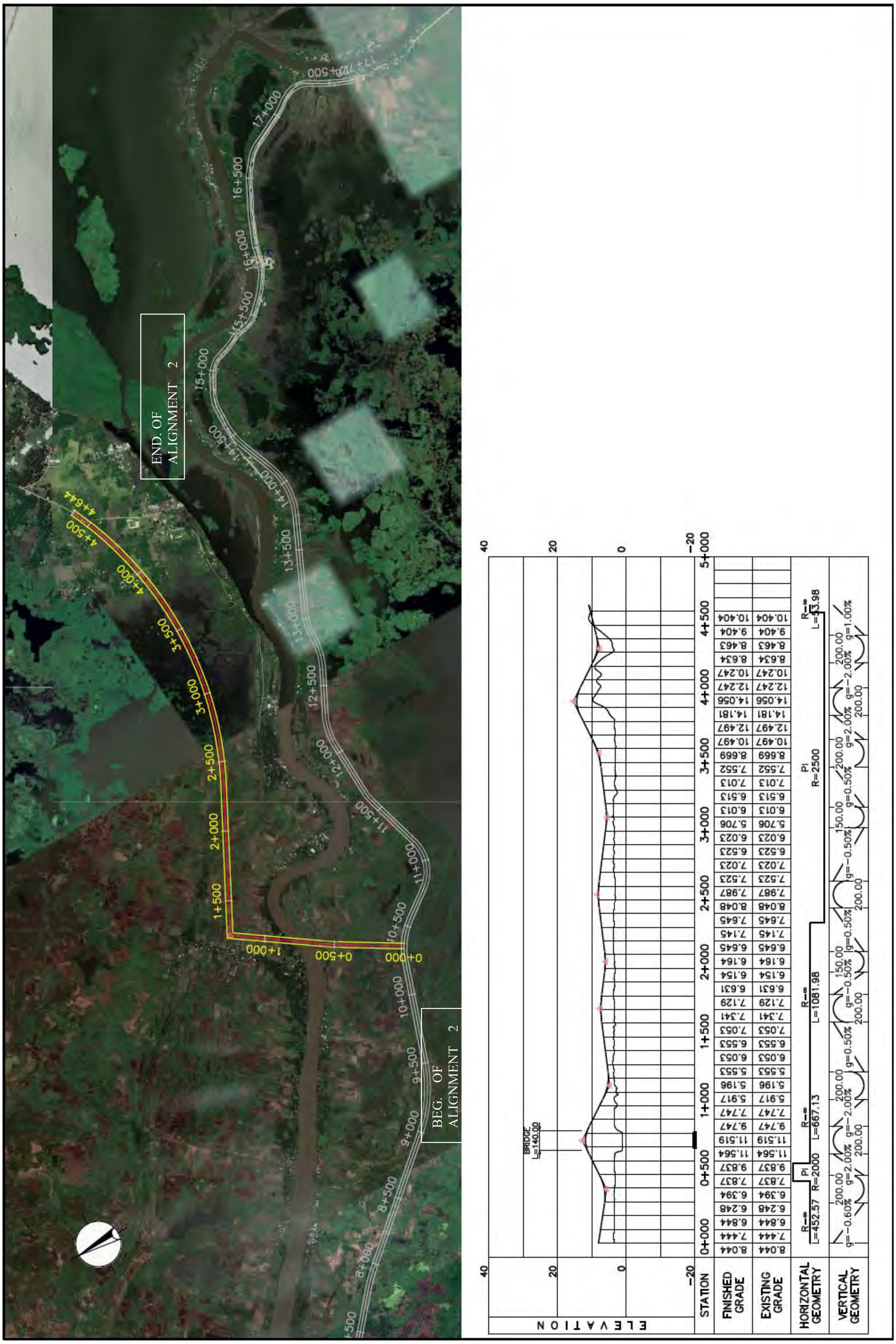


Figure 24.3-10 Plan and Profile of Mindanao River Southside Road of Alignment 2

24.4 Preliminary Bridge Study

24.4.1 Applied Design Standard and Criteria

The following Guidelines, Department Orders (DOs) and Specifications are applied for the bridge design:

1) DPWH Design Guidelines, Criteria and Standards, Volume V 2015 (DGCS)
2) DPWH LRFD Bridge Seismic Design Specifications, 1st Edition 2013 & Interim Revision 2019 (BSDS)
3) AASHTO LRFD Bridge Design Specifications, 8th Edition 2018
4) AASHTO LRFD Bridge Construction Specifications, 3rd Edition 2016
5) Japan Road Association, Specifications for Highway Bridges, Part 1 to Part 5, Nov 2017

24.4.2 Summary of Design Results

Table below shows the summary of bridges plans results.

Table 24.4-1 Summary of Bridge Plan

Classification	Type	Number	Length
Standard Bridge	AASHTO PC I-girder	4	Total:285 m 40.0m (STA.0+365 - STA.0+405) 35.0m (STA.0+735 - STA.0+770) 25.0m (STA.1+317.5 - STA.1+342.5) 150.0m (STA.0+675 – STA.0+825)

Source: JICA Study Team

24.4.3 Preliminary Design of Mindanao River South Dike Road Bridge

(1) Design Condition

1) Topographic and Geotechnical Condition

Topographic condition:

- The contour map from GIS data is used.

Geotechnical condition:

- The bearing layer and ground condition is assumed from the existing data. No geotechnical survey was undertaken.

2) River Condition

Since the hydrologic analysis for the design flood levels is not conducted for the study, the design flood water level was assumed to be the top level of the embankment.

Table 24.4-2 Design Flood Water Level

STA No. (Bridge No.)	Design Flood Water Level
STA.0+365 - STA.0+405 (Bridge No.1)	1.136m
STA.0+735 - STA.0+770 (Bridge No.2)	1.910m
STA.1+317.5 - STA.1+342.5 (Bridge No.3)	3.371m
STA.0+675 - STA.0+825 (Bridge No.4)	1.224m

Source: JICA Study Team

3) Typical Cross Section for the Bridge

The typical cross section for Bridge is planned as shown in Figure 24.4-1.

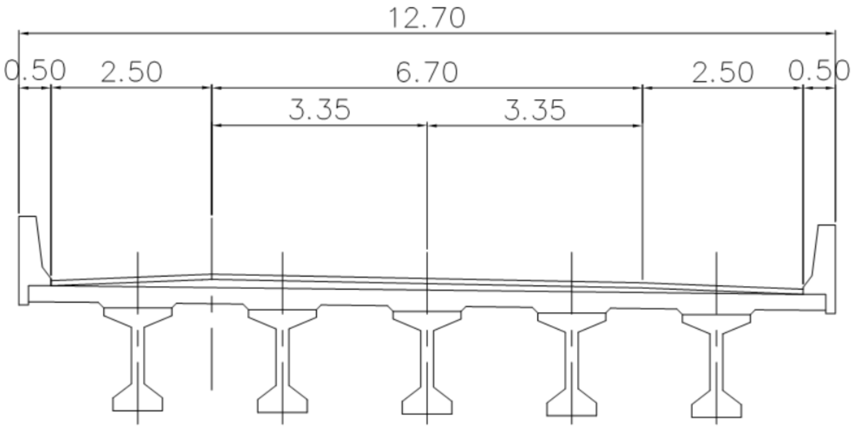
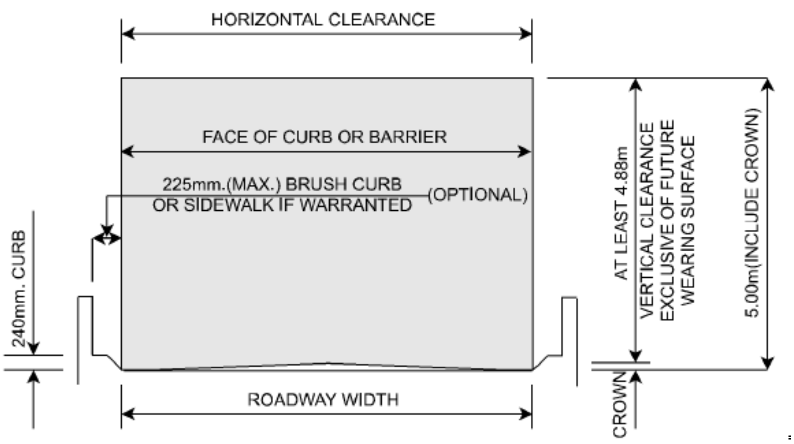


Figure 24.4-1 Typical Cross Section

4) Clearance

The vertical clearance is 5.0 m based on the DGCS that shows a minimum clearance of 4.88 m.



Source: JICA Study Team

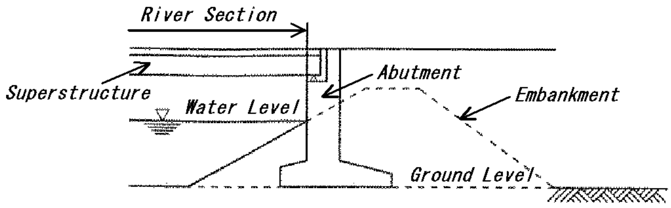
Figure 24.4-2 Bridge Clearance

(2) Study for Bridge Length and Span Arrangement

1) Abutment Location (Bridge Length)

a) Abutment Location for river condition

Abutment location shall be so selected that the current river width should be maintained, so that the river flow is not restricted even though the bridges are installed.



Source: JICA Study Team

Figure 24.4-3 Abutment Location for River

Initially, the river width /abutment location should be decided from the hydrologic analysis for the design flood levels. Since this is Prefeasibility study, the hydrologic analysis has not been undertaken, hence, abutment location is decided based on the bank elevation and river width.

The abutment location based on current river width is shown in Table 24.4-3

Table 24.4-3 Abutment Location

Bridge No		STA. No
Bridge No.1	Abutment A	STA.0+365.0
	Abutment B	STA.0+405.0
Bridge No.2	Abutment A	STA.0+735.0
	Abutment B	STA.0+770.0
Bridge No.3	Abutment A	STA.1+317.5
	Abutment B	STA.1+342.5
Bridge No.4	Abutment A	STA.0+675.0
	Abutment B	STA.0+825.0

Source: JICA Study Team

b) Bridge Length

The length for each bridge from the location for each abutment location are shown in Table 24.4-4.

Table 24.4-4 Bridge Length

Bridge No	STA. No	Bridge Length
Bridge No.1	STA.0+365.0	40.0 m
	STA.0+405.0	
Bridge No.2	STA.0+735.0	35.0 m
	STA.0+770.0	
Bridge No.3	STA.1+317.5	25.0 m
	STA.1+342.5	
Bridge No.4	STA.0+675.0	150.0 m
	STA.0+825.0	

Source: JICA Study Team

2) Pier Location

The Bridge length of Bridge No.1 to No.3 are from 25.0m to 40.0m. Therefore, AASHTO girder used generally in Philippines can be applied and the number of spans can be one (1).

On the other hand, the bridge length of Bridge No.4 is 150m and long span bridge is needed if a single span is used.

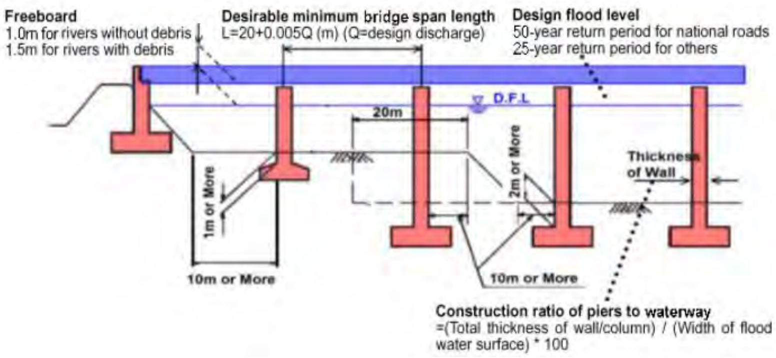
Since the landscape is not important in this site, expensive special bridge which may require a long span bridge shall not be needed.

Therefore, bridge No.4 is planned to install several piers in the river and AASHTO girder which is generally used in Philippines shall be applied.

Regarding pier location in the rivers, the following are also taken into consideration:

a) River Parameters Associated with Bridge Planning by the River

The following will be considered for pier location.

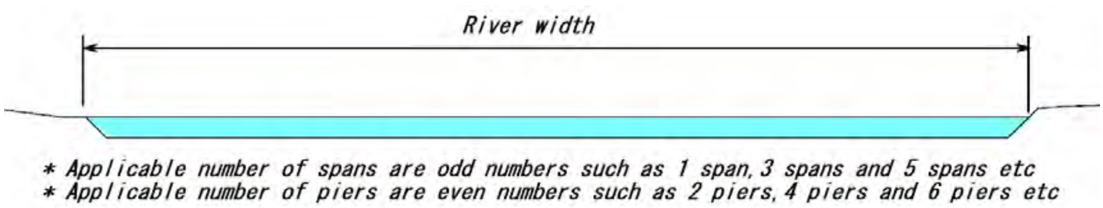


Source: JICA Study Team

Figure 24.4-4 River Parameters Associated with Bridge Planning by the River

b) Number of spans (piers) in river

According to Design Guidelines, Criteria & Standards Volume 5 (DGCS 5), the span arrangement in the river should be in odd number spans. Therefore, the number of piers should be in even numbers.



Source: JICA Study Team

Figure 24.4-5 River Parameters Associated with Bridge Planning by the River

3) Study for Span Arrangement

The Span arrangement will be considered based on the result of above bridge length and the condition for pier location.

a) Study for Conditions

In the study for span arrangement, it is necessary to satisfy the following conditions:

- Preferably no use of the Special bridge which is expensive, although it has a superior aesthetic view.
- To use the AASHTO Girder which is generally used in the Philippines
- Maximum bridge length is 150.0m
- Applicable number of spans should be odd numbers

Applicable span length of AASHTO girder is from 20.0m to 40.0m as shown in Table 24.4-5.

Table 24.4-5 Applicable Span for Each Bridge Type

Materials	Type of Bridge	Range
RC	Precast Slab, Flat Slab	6- 12m
	Concrete Deck Girder (RCDG)	13- 20m
	Box Girder	22- 30m
	Hollow Slab Bridge	10- 20m
PC	Channel beams	11- 14m
	Tee beams	15- 18m
	I-beams	21- 30m
	AASHTO girder (PSCG)	20- 40m
	Box girders	30-200m
	Hollow (voided) slab	15- 30m

Source: JICA Study Team

b) Span Arrangement

- Applicable Span Arrangement to AASHTO Girder

Considering the bridge length, number of spans corresponding with span length and whether these span lengths are applicable to AASHTO girder or not are shown in Table 24.4-6.

Table 24.4-6 Span Arrangement of Bridge No.4

Bridge Length	Number of Spans	Span Length	Applicable to AASHTO Girder
150.0 m	1 Span	150.0 m	×
	3 Spans	50.0 m	×
	5 Spans	30.0 m	○
	7 Spans	21.4 m	○
	9 Spans	16.7 m	×

Source: JICA Study Team

As the span arrangement for Bridge No.4 from Table 24.4-5, AASHTO girder is applicable to 5 spans and 7 spans.

- Cost Comparison

Cost comparison was conducted between 5 spans and 7 spans bridge to which AASHTO girders are applicable. The result of cost comparison is shown in Table 24.4-7.

Since the number of piers needed by 5 spans are less than those by 7 spans, the piers and foundations costs are low, hence, resulting to lower total cost.

Table 24.4-7 Cost Comparison

	Cost (Peso)	Rate
5 Spans	284,909,577	1.00
7 Spans	317,568,616	1.15

Source: JICA Study Team

In addition, in the point of view of river flow, it is better to have minimum number of piers installed in a river.

Therefore, we recommend 5 spans which uses AASHTO girder type 4 for Bridge No.4.

(3) Summary for the type of Superstructure, Span arrangement and Length

The summary of the type of Superstructure, Span arrangement and Length for Bridges No. 1 to No. 4 are shown in Table 24.4-8.

Table 24.4-8 Summary Superstructure Type

Bridge No.	Bridge Length	Span arrangement	Span length	Superstructure Type
Bridge No.1	40.0m	1 span	40.0m	AASHTO Girder Type 6
Bridge No.2	35.0m	1 span	35.0m	AASHTO Girder Type 5
Bridge No.3	25.0m	1 span	25.0m	AASHTO Girder Type 3
Bridge No.4	150.0m	5 spans	5 @ 30.0m	AASHTO Girder Type 4

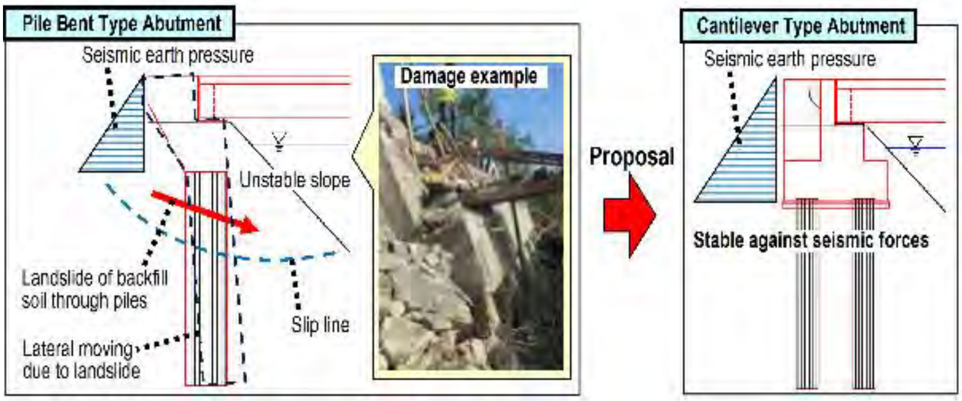
Source: JICA Study Team

(4) Study for the type of substructure and foundation

1) Substructure

a) Abutment Type

In the Philippines, pile bent type abutment is commonly used. However, its seismic resistance performance may be insufficient to resist adequately the soil slippage at the back of abutment when an earthquake strikes. As shown in Figure 24.4-6, there are many earthquake-induced damage cases happened in the Philippines. Therefore, a reverse T-shaped abutment will be proposed and utilized for this project because it will be able to resist sufficiently the soil slippage at the back of abutment during an earthquake with better seismic performance.

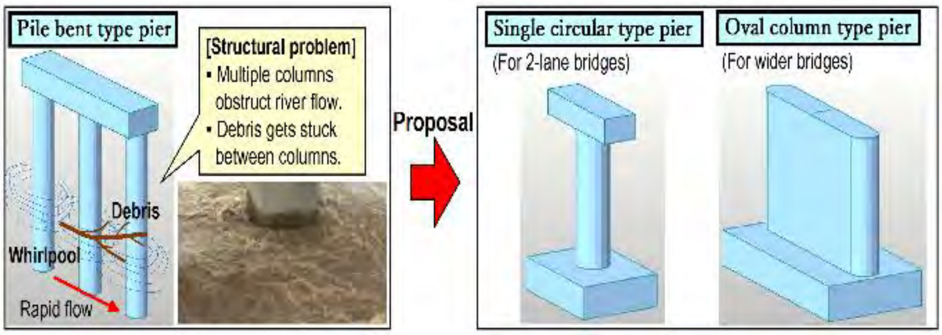


Source: JICA Study Team

Figure 24.4-6 Pile Bent Type Abutment and its Damage

b) Pier type

Similarly, in the Philippines, it is common to use pile bent type piers inside the river due to the ease of construction. This shape, however, may disturb the river flow and cause the phenomenon of scouring locally at the pier as illustrated in Figure 24.4-7. This fact leads to the adverse impact on the structural stability of the pier. Therefore, it is proposed that a pier cross section will have an oval shape or a round shape to minimize the impact from scouring and give less adverse effect to the river flow.



Source: JICA Study Team

Figure 24.4-7 Pile Bent Type Pier and Scour

2) Foundation

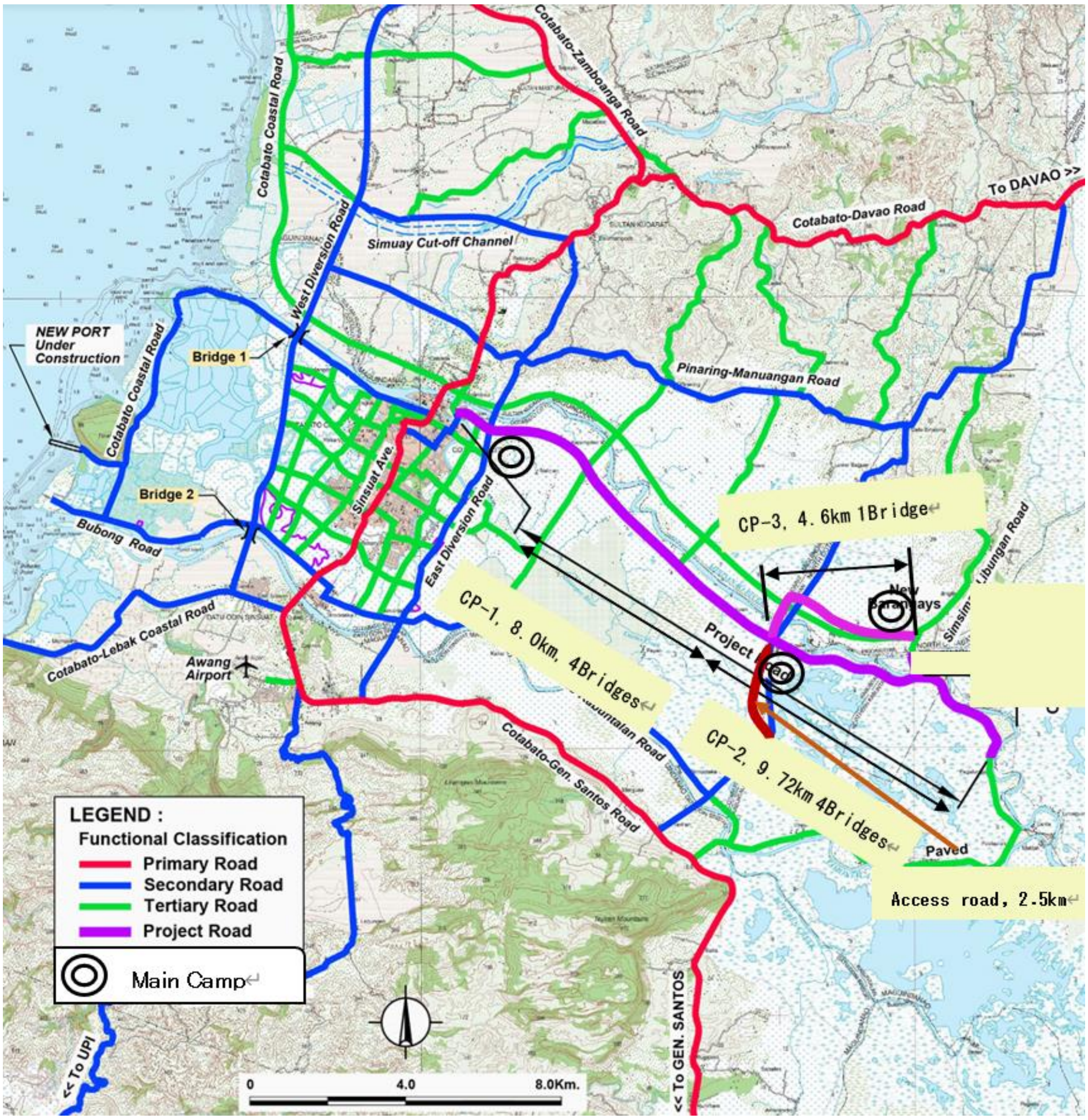
Since the location is characterized with wide soft ground, spread footing cannot be used for the foundation.

Therefore, for foundation on land, a cast-in-place pile which is generally used in the Philippines is recommended.

24.5 Preliminary Construction Execution Plan and Cost Estimate

24.5.1 Contract Packaging

Along the Mindanao River Southside Road, where the proposed road alignment is at the eastern side of Greater Cotabato City, the 17.7 km upstream road shall be designed with higher road surface elevation which can be used as temporary evacuation place during flood and tsunami events. Large scale embankment work is also required similar to the West Diversion Road. The soft soil in the low ground area, from sta.0+000 to around 6.0 km upstream along Mindanao River, shall be replaced with sandy soil for stabilized ground settlement. And the road alignment shall branch out towards north crossing over the Mindanao River and subsequently turns to the east. This portion of the road is designed 4.7 km from the junction along the right bank side of Mindanao River with three (3) short bridges designed to cross some tributaries at the downstream and one (1) bridge designed to cross the main river at the 10.4 km upstream from the begining of the main road towards the branch out section northward.



Source: JICA Study Team

Figure 24.5-1 Construction Site and Contract Packages

The construction work is divided into three contract packages, i.e., Contract Package-1 (8.0 km), Contract Package-2 (9.7 km) and Contract Package-3 (4.7 km) in due consideration of the following:

- Availability of experienced contractors, hence, the size of one contract package should be about PhP 1.5 billion or less.
- Construction material transport routes should be considered in contract packaging.
- Contract package shall be so planned that a contractor can work from three sides (i.e., from west, sta.10+400 and end point of the branch road) which will contribute to shorter construction period and faster construction.

24.5.2 Construction Plan

(1) Scope of Civil Work of MRSR

Scope of civil work of MRSR project is shown in Table 24.5-1**.**

Table 24.5-1 Scope of Civil Work MRSR Project

<table>
<tr><th colspan="2"></th><th>Contract Package-1</th><th>Contract Package-2</th><th>Contract Package-3</th><th>Total</th></tr>
<tr><td colspan="2">Road Length</td><td>8.0km</td><td>9.7 km</td><td>4.7 km</td><td>22.4 km</td></tr>
<tr><td rowspan="3">Earthwork</td><td>Clearing</td><td>15.1 ha.</td><td>18.5ha.</td><td>8.6 ha.</td><td>42.2 ha.</td></tr>
<tr><td>Replacement of Soft soil</td><td>44,700 m^3</td><td>0 m^3</td><td>3,020 m^3</td><td>185,700 m^3</td></tr>
<tr><td>Embankment by Borrow</td><td>662,700 m^3</td><td>802,100 m^3</td><td>371,000 m^3</td><td>1,835,800 m^3</td></tr>
<tr><td colspan="2">Pavement Work</td><td>PCCP (t=280mm), 59,320m^2</td><td>PCCP (t=280mm), 72,900m^2</td><td>PCCP (t=280mm), 33,780m^2</td><td>PCCP (t=280mm), 166,000m^2</td></tr>
<tr><td colspan="2">Shoulder Work</td><td>PCC shoulder (t=150mm) 43,510m^2</td><td>PCC shoulder (t=150mm) 53,4600m^2</td><td>PCC shoulder (t=150mm) 24,770m^2</td><td>PCC shoulder (t=150mm) 121,740 m^2</td></tr>
<tr><td colspan="2" rowspan="5">Bridge Work</td><td>Bridge No. 1, L=40m</td><td rowspan="5"></td><td>Bridge No. 4, L=150m</td><td></td></tr>
<tr><td>Bridge No. 2, L=35m</td><td></td><td></td></tr>
<tr><td>Bridge No.3, L=25m</td><td></td><td></td></tr>
<tr><td>Sub-total:</td><td>Subtotal:</td><td></td></tr>
<tr><td>3 Bridges, L=100m</td><td>1Bridge, L=150m</td><td>4 Bridges, L=250m</td></tr>
<tr><td rowspan="4">Drainage and Slope Protection Work</td><td rowspan="2">Road Underpass</td><td>1 Place</td><td rowspan="2"></td><td rowspan="2"></td><td>1 Place</td></tr>
<tr><td>L=32m</td><td>L=32 m</td></tr>
<tr><td rowspan="2">Farm road underpass</td><td>6 Places</td><td>7 Places</td><td>2 Places</td><td>15 Places</td></tr>
<tr><td>L=108 m -</td><td>L=127 m</td><td>L=39 m -</td><td>L=274 m</td></tr>
<tr><td>Miscellaneous</td><td>Guardrail</td><td>3,600 m</td><td>4,430 m</td><td>2,050 m</td><td>10,080 m</td></tr>
</table>

Source: JICA study team

Around 2.5 km.temporary access road shall be constructed from the end point of existing road at southeast of the junction point to the junction of the branch out road to allow early commencement of the construction of CP-2.

(2) Construction Equipment

Major construction equipment necessary for each contract package of Sub-Project 1 is shown in Table 24.5-2.

Table 24.5-2 Construction Equipment for MRSR

Category	Equipment	
Earth work	Backhoe (0.8 m^3) Bulldozer (20 t) Pay loader (1.5 m^3)	Dump truck (12yd^3) Vibratory roller (10t) Water truck (15 m^3)
Pavement work	Road grader Transit mixer (30 m^3)	Concrete screed (5.5 hp) Concrete vibrator
Bridge work	Drilling rig (300 hp) Crawler crane (190 hp)	Generator (300 kw)

Source: JICA study team

(3) Material Sources, Labor Force and Equipment

Material sources, labor Force and Equipment of each contract package is shown in. Table 24.5-3.

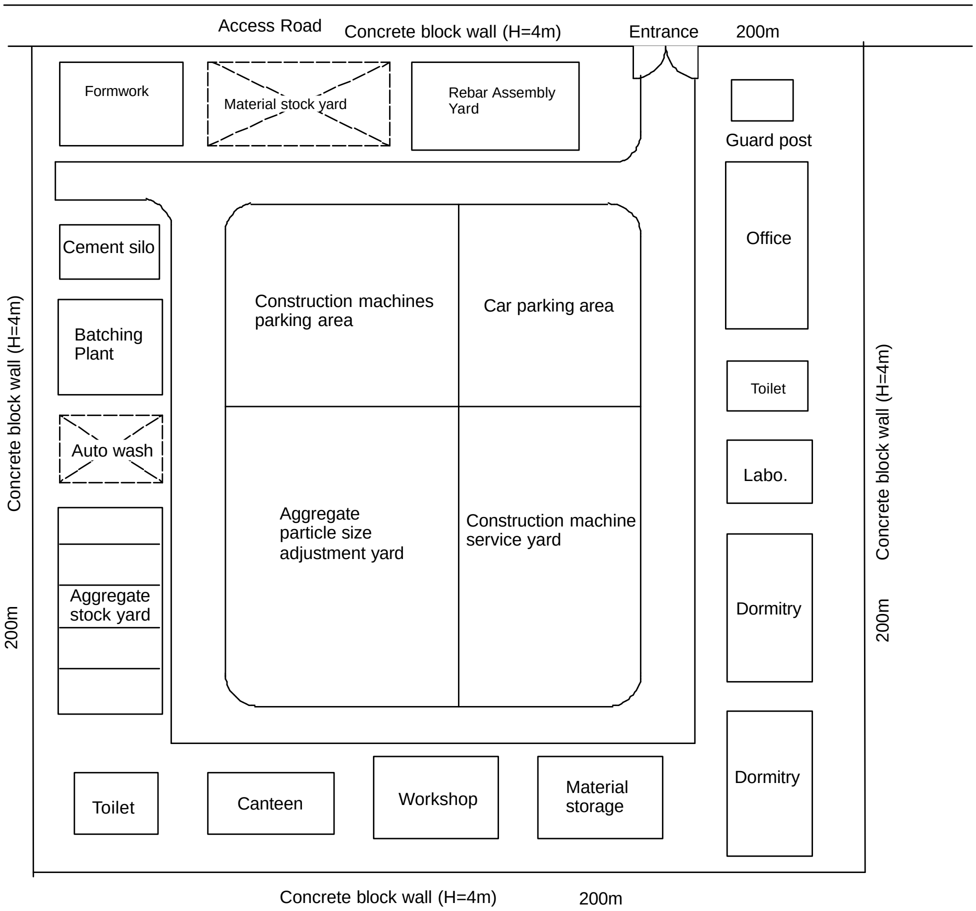
Table 24.5-3 Procurement and Employment Plan

Item	Conditions
Common Soil from Borrow	Mangit hill quarry (North side 20 km of MRSR Project) Dimapatory hill quarry (South side 20 km of MRSR Project)
Gravel & Sand	Simuay river quarry (East side 20 km of MRSR Project) Dimapatory river quarry (South side 20 km of MRSR Project)
Other materials	Cotabato City
Labor force	Skilled labor: Employed from Cotabato City and other areas of Mindanao Unskilled labor: Employed from neighbor barangays
Construction equipment	Leased from Cotabato City. If necessary, procured from other areas.

Source: JICA study team

(4) Camp Location

A main camp location is proposed at the Center/west side of Cotabato City for the Contract Package, whereas a main camp for the Contract Package-2 is proposed at the eastern side of the project as shown in Figure 24.5-2.



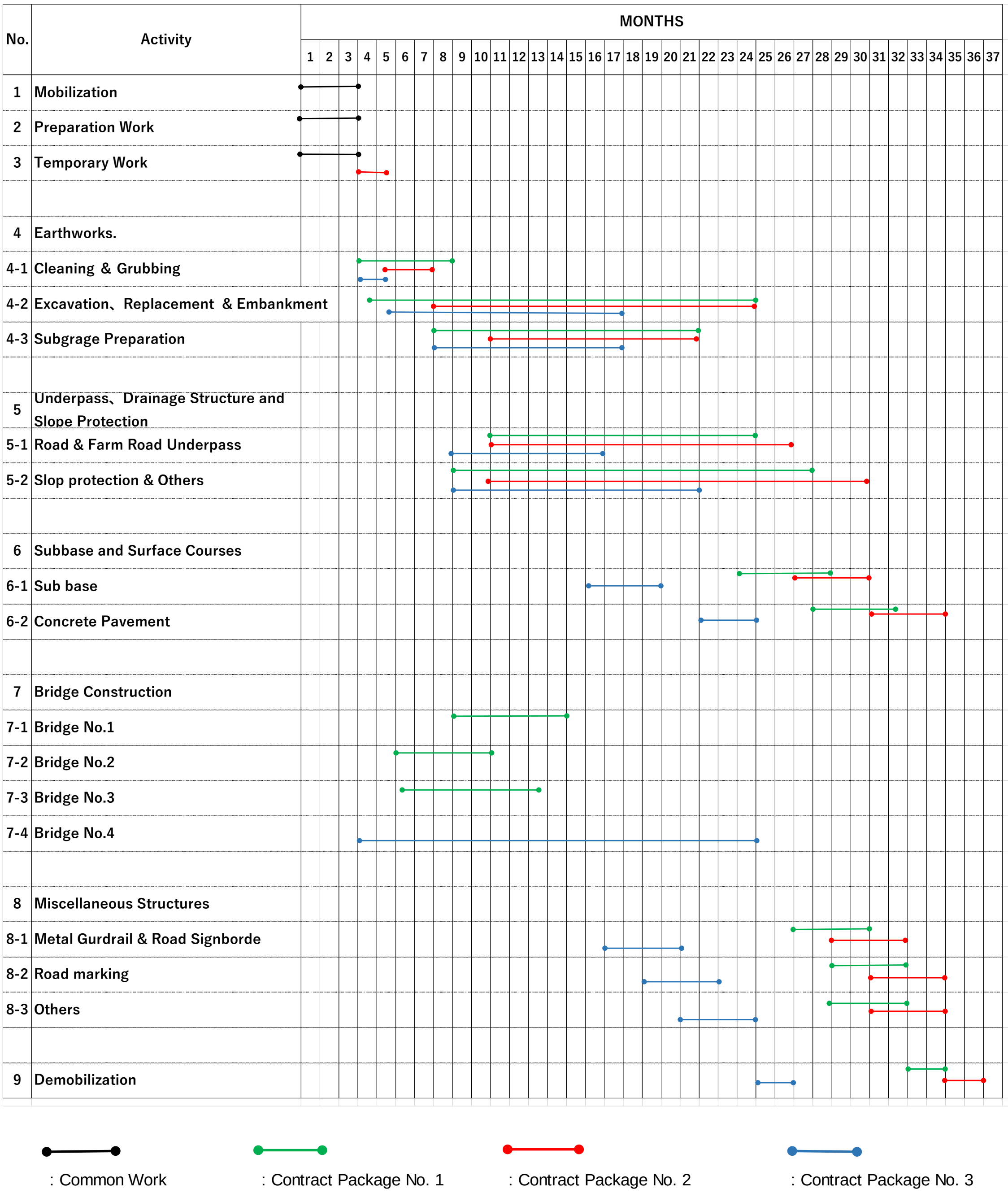
Source: JICA study team

Figure 24.5-2 Proposed Typical Main Camp Yard Layout

24.5.3 Construction schedule

Proposed construction schedule is shown in Table 24.5-4. Total construction period is estimated to be 36 months.

Table 24.5-4 Construction Schedule for MRSR Project



Source: JICA study team

24.5.4 Construction Cost Estimate

(1) Cost Estimation Component

Construction Cost estimates were prepared based on the following parameters:

Unit prices for civil work items were estimated using year 2020 market prices. Facilities for engineers and other general requirements were estimated based on previous costs of similar projects. Construction cost was composed of nine components, as follows:

A. Facilities for Engineers	E. Surface Course
B. Other General Requirements	F, Bridge Structure
C. Earth Work	G. Road and Farm Underpass, Drainage and Slope Protection
D. Subbase and Base Course	H. Miscellaneous Itemsl

(2) Methodology Adopted for Construction Cost Estimates

The unit price was applied to estimated quantity of each work item based on preliminary design, to come-up with construction cost for each work item.

While the provision of facilities and/or field office for engineers and other general requirements, such as, project billboards, occupational safety and health program, traffic management, mobilization/demobilization, etc. were based on costs of previous similar project.

(3) Procedures Undertaken to come-up with Construction Cost Estimate

The followings were used to derive the construction cost:

- Labor Costs
- Equipment Costs: Equipment lease cost indicated in Association of Carriers and Equipment Lessors, ACEL was used.
- Material Costs were based on the prices determined and announced by DPWH.

(4) Unit Price Analysis

1) Cost of Material

Cost of materials was based on the cost provided by DPWH.

Table 24.5-5 Material Unit Prices

REF. NO.	DESIGNATION	UNIT	UNIT PRICE
M200.01-0001	AGGREGATE SUBBASE COURSE MATERIAL	m3	571.00
M311.13-0013	CURING COMPOUND	L	30.00
M311.20-0020	STEEL FORMS 30 CM WIDTH	m	79.00
M404.04-0004	REINFORCING STEEL BARS DEFORMED GRADE 60	kg	60.00
M405.02-0002	COMMON NAILS ASSORTED	kg	73.00
M405.06-0006	GRAVEL G1	m3	526.27
M405.11-0011	FINE AGGREGATE	m3	434.80
M405.14-0014	LUMBER GOOD	bd-ft	10.00
M405.22-0022	PLYWOOD ORDINARY (0.0125m x 1.4m x 2.44m)	pc	165.00
M700.02-0002	PORTLAND CEMENT	bag	265.00
M900.10-0010	GREASING	L	251.00
M9000.16-0016	Asphalt Sealant	L	578.95
M9000.47-0047	Pipe Sleeve, 1" Ø	m.	41.20

Source: JICA study team

2) Cost of Equipment

The cost of equipment is based on "ACEL 2020" rental rates which include operator's wages, fringe benefits, fuel, oil, lubricants, and equipment maintenance.

Table 24.5-6 Designation

REF. NO.	DESIGNATION	NO. OF UNIT	HOURLY RATE
Eqp.1.1	Payloader, LX80-2C, 1.50 m3/1.95 yd3, 110HP	1	1,733.00
Eqp.2.1	**Plate Compactor, 400-500 Gasoline Engine, 5HP**	1	3,938.00
Eqp.7.1	One Bagger Mixer, 4-6 ft3/min	1	172.00
Eqp.7.2	Transit Mixer, 5 m3	1	1,461.00
Eqp.8.1	Dump Truck, 12 yd3, 290HP	1	1,544.00
Eqp.8.4	Water Truck/Pump (16000L), 360HP	1	2,450.00
Eqp.14.1	Concrete Vibrator, Flexible Shaft Type 2" Head dia. w/ 5 Amperes Gasoline Drive Unit	1	92.25
Eqp.14.3	Bar Cutter, 25 mm Maximum Rebar dia. (Grade 40), Single Phase	1	219.75
Eqp.15.1	Concrete Batch Plant	1	1,759.50
Eqp.19.1	Bulldozer, D6R STD, 6FR (1997-up), 165HP	1	4,159.00
Eqp.19.2	**Bulldozer w/ Ripper,D6R STD, 6FR (1997-up), 165HP**	1	4,782.85
Eqp.19.3	Motorized Road Grader, G710A, 140HP	1	2,173.00
Eqp.19.5	Vibratory Roller, SD100D, 10mt, 125HP	1	2,498.00
Eqp.19.7	**Backhoe (Caterpillar), 318C, BTG(2003), 0.88 m3/1.16 yd3, 94HP**	1	2,304.00
Eqp.19.8	**Backhoe (Caterpillar) w/ Breaker, 318C, BTG(2003), 0.88 m3/1.16 yd3, 94HP**	1	2,995.20
Eqp.19.10	Concrete Screeder, Wacker Truss Screed, 5.5HP	1	545.00
Eqp.19.17	**Chainsaw, HUSQVARNA 2100 CD w/ CR22, 7 ft Reach, 9 in Standard Blade**	1	70.73
Eqp.19.18	**Concrete Saw, 14" Balde Ø w/ 4 3/4" Cutting Depth, 7.50HP**	1	176.64

Source: JICA study team

3) Cost of labor

Labor costs used in the analysis are the wages authorized by the Department of labor and Employment. All fringe benefits such as vacation and sick leaves, Workmen's Compensation Act, GSIS and SSS contributions, allowance, and bonus, are taken into account.

Table 24.5-7 Labor Rates

Resource Code No.	Description	Rate per Month	Rate per Day	Rate per Hour
L-4	Foreman	1,444.39	1,031.71	128.96
L-5	Leadman	1,301.53	929.66	116.21
L-6	Heavy Equipmentt Operator	1,178.66	841.90	105.24
L-7	Highly Skilled Operator	1,178.66	841.90	105.24
L-8	Light Skilled Operator	1,136.75	811.96	101.50
L-9	Driver	1,054.84	753.46	94.18
L-10	Skilled Laborer	1,054.84	753.46	94.18
L-11	Semi-skilled Labor	972.93	694.95	86.87
L-12	Unskilled Laborer	849.11	606.50	75.81

Source: JICA study team

(5) Estimated Construction Cost

Construction cost of Sub-Project 1 was estimated based on the above parameters and procedures. The summary of civil work cost is shown in Table 24.5-8.

Table 24.5-8 Summary of Construction Cost (Mindanao River Southside Road Project

ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	153.3	3.7%	6.9	-
B	Other General Requirement	L.S.	1	100.2	2.4%	4.5	-
C	Earth Work	L.S.	1	2,269.8	54.7%	101.5	-
D	Subbase and Base Course	L.S.	1	113.6	2.7%	5.1	-
E	Surface Course	L.S.	1	402.7	9.7%	18.0	-
F	Bridge Structure (Total)	m	250	553.5	13.3%	-	2.2
	Bridge-1	m	40	85.8	-	-	2.1
	Bridge-2	m	35	81.1	-	-	2.3
	Bridge-3	m	25	61.7	-	-	2.5
	Bridge-4	m	150	324.8	-	-	2.2
G	Box Culvert、Drainage and Slope Protection	L.S.	1	283.0	6.8%	12.7	-
H	Miscellaneous Item	L.S.	1	273.2	6.6%	12.2	-
Grand Total				4,149.1	100.0%	160.8	

Summary of Construction Cost (MRSR CP-1)

ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	53.4	3.5%	6.7	-
B	Other General Requirement	L.S.	1	34.6	2.2%	4.3	-
C	Earth Work	L.S.	1	855.4	55.6%	106.9	-
D	Subbase and Base Course	L.S.	1	40.6	2.6%	5.1	-
E	Surface Course	L.S.	1	143.9	9.3%	18.0	-
F	Bridge Structure (Total)	m	100	228.7	14.9%	-	2.3
	Bridge-1	m	40	85.8	-	-	2.1
	Bridge-2	m	35	81.1	-	-	2.3
	Bridge-3	m	25	61.7	-	-	2.5
G	Box Culvert、Drainage and Slope Protection	L.S.	1	99.6	6.5%	12.4	-
H	Miscellaneous Item	L.S.	1	83.7	5.4%	10.5	-
Grand Total				1,539.8	100.0%	163.9	

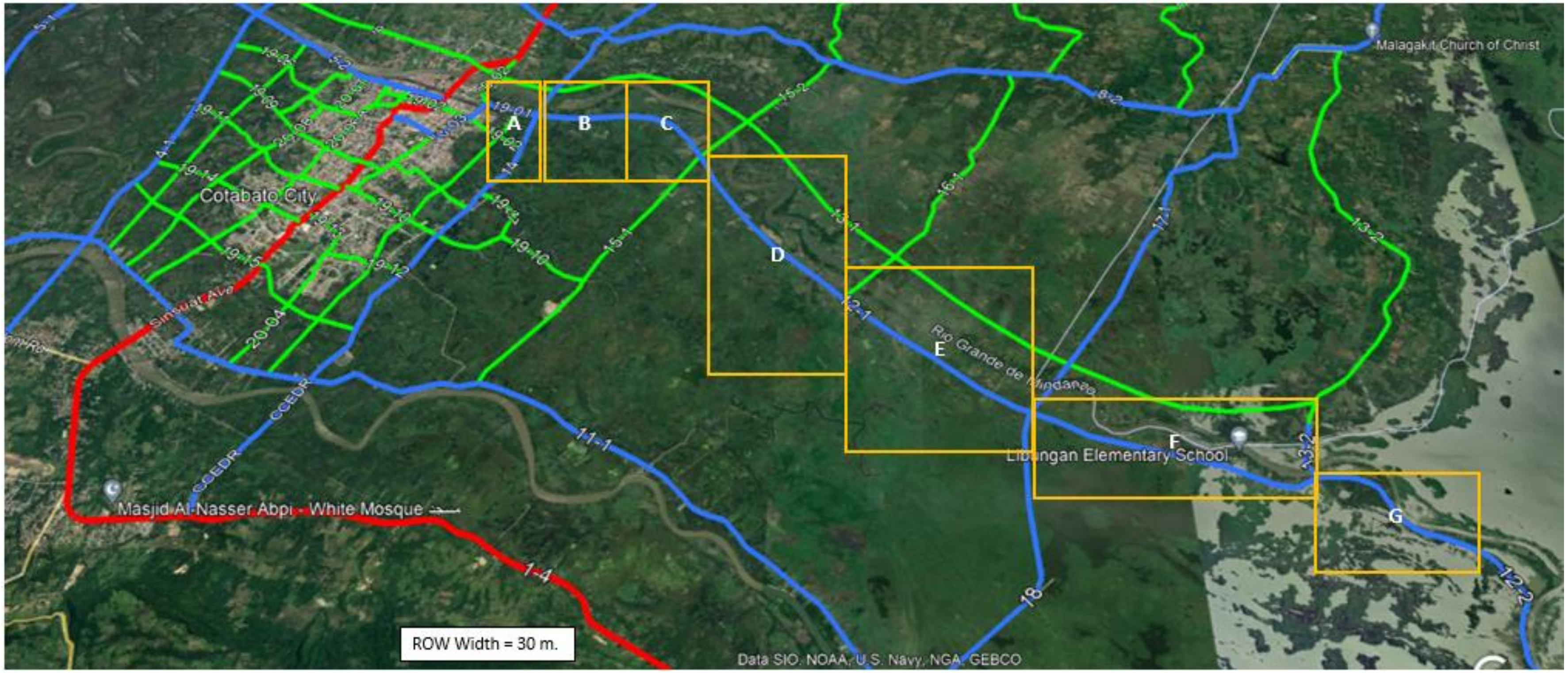
Summary of Construction Cost (MRSR CP-2)

ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	53.4	3.6%	5.5	-
B	Other General Requirement	L.S.	1	34.6	2.3%	3.6	-
C	Earth Work	L.S.	1	963.6	64.3%	99.1	-
D	Subbase and Base Course	L.S.	1	49.9	3.3%	5.1	-
E	Surface Course	L.S.	1	176.8	11.8%	18.2	-
F	Bridge Structure (Total)	m	0	0.0	0.0%		-
G	Box Culvert、Drainage and Slope Protection	L.S.	1	90.1	6.0%	9.3	-
H	Miscellaneous Item	L.S.	1	129.5	8.6%	13.3	-
Grand Total				1,497.9	100.0%	154.1	

Summary of Construction Cost (MRSR CP-3)

ID	Contents	Unit	Quantity	Cost (Million PhP)	% Share (%)	Cost per km (Million PhP)	Bridge per m (Million PhP)
A	Facilities for Engineer	L.S.	1	46.4	4.2%	10.0	-
B	Other General Requirement	L.S.	1	31.0	2.8%	6.7	-
C	Earth Work	L.S.	1	450.8	40.6%	96.7	-
D	Subbase and Base Course	L.S.	1	23.1	2.1%	5.0	-
E	Surface Course	L.S.	1	81.9	7.4%	17.6	-
F	Bridge Structure (Total)	m	150	324.8	29.2%	-	2.2
	Bridge-4	m	150	324.8	-	-	2.2
G	Box Culvert、Drainage and Slope Protection	L.S.	1	93.3	8.4%	20.0	-
H	Miscellaneous Item	L.S.	1	60.0	5.4%	12.9	-
Grand Total				1,111.4	100.0%	168.7	

Source: JICA study team



A	Km 0+000 – Km 0+950	L = 0.95 km	A = 950 x 30 x Php 500 = 14.25 M. Php
B	Km 0+950 – Km 3+000	L = 2.05 km	A = 2,050 x 30 x Php 400 = 24.60 M. Php
C	Km 3+000 – Km 4+000	L = 1.00 km	A = 1,000 x 30 x Php 300 = 9.00 M. Php
D	Km 4+000 – Km 6+000	L = 2.00 km	A = 2,000 x 30 x Php 200 = 12.00 M. Php
E	Km 6+000 – Km 10+340	L = 4.34 km	A = 4,340 x 30 x Php 200 = 26.04 M. Php
F	Km 10+340 – Km 14+000	L = 3.66 km	A = 3,660 x 30 x Php 200 = 21.96 M. Php
G	Km 14+000 – Km 17+720	L = 3.72 km	A = 3,720 x 30 x Php 200 = 22.32 M. Php
H	The other side of River	L = 4.64 km	A = 4,640 x 30 x Php 200 = 27.84 M. Php
			Total = 158.01 M. Php

Source: JICA study team

Figure 24.5-3 ROW Acquisition

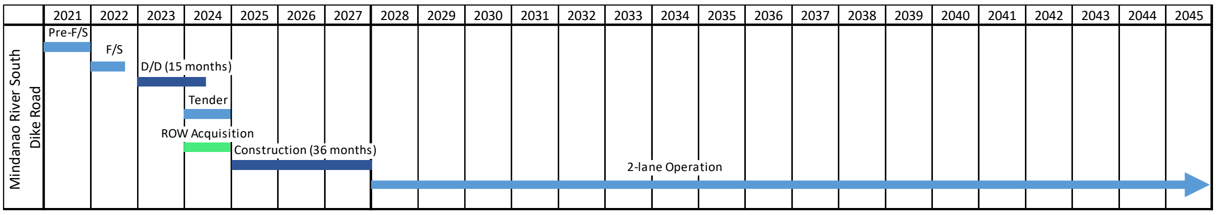
24.6 Proposed Implementation Plan

24.6.1 Proposed Implementation Schedule

This road is proposed to run along the south bank of Mindanao River to complete the Liguasan Marsh Circumferential Road and also to provide another transport link to Davao City. In order to support the agricultural development of the Liguasan Marsh area, the development of this road is needed. Overall implementation schedule is shown in Table 24.6-1. Pre-feasibility Study is completed by the end of 2021. The Feasibility Study (FS) needs to be undertaken in 2022. Soon after completion of the FS, it is expected that the project is appraised by the lending institution within 2022.

The detailed design is proposed to be undertaken in 2023 and 2024. Tendering for selection of a contractor is proposed to be completed in 2024. Road right-of-way acquisition is to be completed within 2024. It is estimated that the construction period of 36 months is needed. The project will be completed in 2027 and the Road will be opened to traffic in 2028.

Table 24.6-1 Overall Implementation Schedule: Mindanao River South Diversion Road



Source: JICA study team

24.6.2 Project Implementing Organization

The project will be similarly implemented as the West Diversion Road. The Department of Public Works and Highways will be the implementing office. Whereas, the Ministry of Public Works of the BARMM will be the co-implementing office. The same organization as the West Diversion Road implementation team will be organized.

24.6.3 ROW Acquisition

ROW Acquisition will be implemented as explained in Section 23.7.2. Project Implementing Organization.

24.7 Environmental and Social Considerations

The level of environmental and social consideration for the Mindanao River Southside Road (MRSR) Project as part of the Urban Infrastructure Development in Greater Cotabato City Study is at "pre-feasibility study level. Environmental and Social considerations is essential as an integral part of project development from the earliest stages such as pre-feasibility study level, to provide information about the general environmental and social setting of the project area. Through the preliminary environmental and social impact assessment (ESIA) during the action plan study, potential environmental and social issues shall be sorted, and recommendation for deep study in the F/S shall be pointed out, based on the secondary existing data, the site visit and opinions from relevant stakeholders. The result of preliminary ESIA during actioin plan study stage shall be utilized for EIA contents during the F/S.

Hence further study and evaluation shall be implemented during the Feasibility Study (F/S) stage in the future.

24.7.1 Project Component

MRSR, is a two-lane, two-way road that will complete the east circumferential road of Cotabato City and open up the agricultural potential of the eastern part of the city. The route possesses basically rural area due to undeveloped surroundings along the proposed route. In time this may be converted as national road. The terrain in the proposed alignment is a combination of flat to rolling ground.

This is a pre-feasibility study without fixed conditions, such as associated projects by other proponents, relevant activities including soil borrow pits, quarry pits, construction roads, camp yards etc., and pre-acquired land for the project, therefore, further study and confirmation shall be implemented during the next phase which is the F/S. As far as the action plan study in this survey is concerned, implementation timing is not yet decided, and other specific plans or reasonably defined developments are not yet identified. Therefore, the survey focuses on direct impact caused by the project determined during action plan study stage, and understanding the possibility of cumulative impact will be considered during the F/S.

The project involves the construction an elevated 17.7 km (Road 1) and 4.5km (road 2) and four (4) bridges. These access roads are important components of the project to increase the influence (service area) of the road.

24.7.2 Environmental Study Area

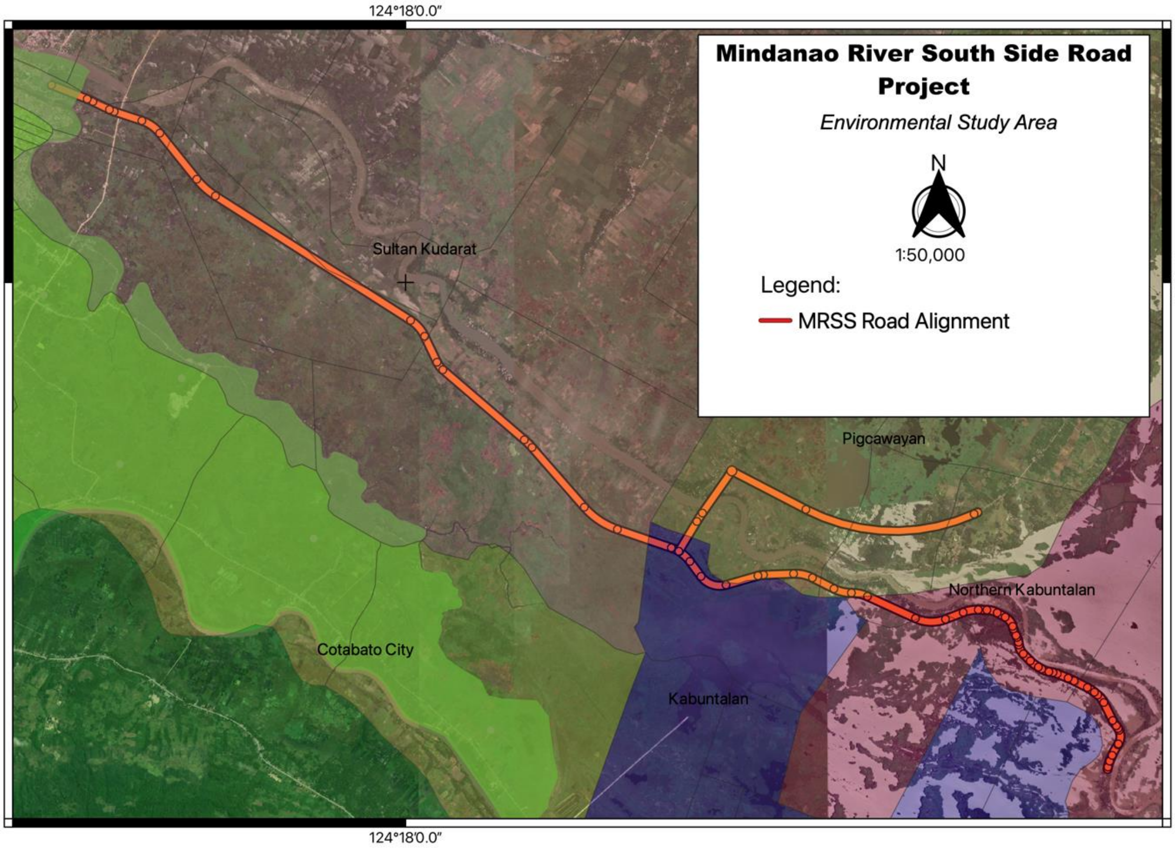
In order to conduct initial environmental and social impact assessment at action plan study, LGUs in and around the proposed project area are selected as the study area. The Project will traverse Cotabato City and four municipalities as shown in Table 24.7-1. The study area for secondary data collection of environmental and social baseline covers the geographic jurisdictions of the entire alignment.

The study area involving site visits, public consultations and initial environmental and social impact assessment at action plan study covers the entire section of the Project.

Table 24.7-1 LGUs in the Proposed Project Area

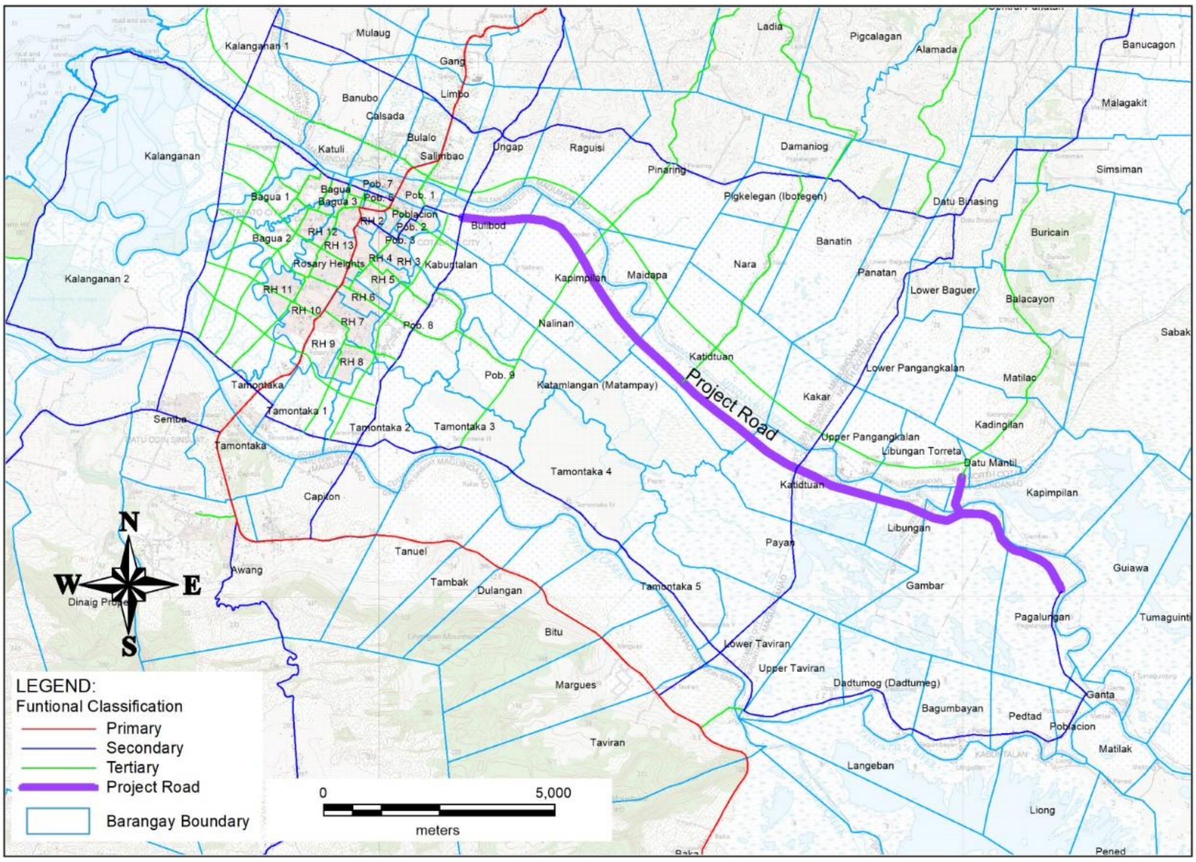
Island	Region	Province	Municipality/ City	Barangays	Length of the Project Alignment
Mindanao	BARMM	Maguindanao	Cotabato City	Poblacion 1	Project Alignment (Road 1=17.7km) Project Alignment (Road 2= 4.5km)
				Poblacion	
			Municipality of Sultan Kudarat	Bulibod	
				Nalinan	
				Kakar	
				Katidtuan	
				Katamlangan	
				Maidapa	
				Kapinpilan	
			Kabuntalan	Gambar	
				Ganta	
				Katidtuan	
				Matilak	
				Pagalungan	
				Payan	
				Pedtad	
				Poblacion	
			Northern Kabuntalan	Guiawa	
				Kapimpilan	
				Libungan	
				Tumaguinting	
	Region XII	North Cotabato	Pigcawayan	Balacayon	
				Datu Mantil	
				Kadingilan	
				Libungan Torereta	
				Lower Pangangkalan	
				Matilac	
				Upper Pangangkalan	

Source: Socio-Economic Profile of LGUs; JICA Study Team, 2021



Source: Study Team, 2021

Figure 24.7-1 Environmental Study Area



Source: Socio Economic Profile of LGU's; JICA Study Team, 2021

Figure 24.7-2 Project Road and the Barangays Under its Influence Area

24.7.3 Baseline of Environmental and Social Conditions

The following descriptions are collected information on pollution items, natural environment, reserved areas for natural protection and cultural heritage sites, land use, living areas of indigenous people, and social conditions of land acquisition and involuntary resettlement.

24.7.4 Natural Environment

(1) Air Quality

Air quality data that can represent the project site are the ones conducted for Cotabato City. Based on the air quality monitoring in January-February 2018 at Cotabato Station conducted by EMB Region XII, PM10 parameter was within the National Ambient Air Quality Guideline Values (NAAQGV) of the DENR. PM10 is the only parameter being monitored regularly by the station. Other parameters, such as Sulphur Dioxide (SOx), Nitrogen Dioxide (NOx), Carbon Monoxide (CO), Ozone (O3) and Lead (Pb) were not regularly monitored.

Table 24.7-2 2018 Air Quality Indices (PM10, 24-hour)

Air Quality Levels	Ug/Ncm
Good	0 - 54
Fair	55 - 154
Unhealthy for Sensitive Groups	155 - 254
Very Unhealthy	255 - 354
Acutely Unhealthy	355 - 424
Emergency	425 - 504

Source: DENR-EMB NAAQGV, Philippine Clean Air Act of 1999

Table 24.7-3 PM10 Air Quality Monitoring

Station Number:	COTABATO STATION								
Address:		Cotabato City							
SAMPLE CONDITION:									
A									
		Sunny							
A		B			C		D		
No unusual		Sand/Dust			Construction		Farming Operation		
Condition					Nearby				
E		F			G		H		
Fire Nearby		Sampler			Rain		Others		
		Malfunction							
REMARKS		Results relates only as samples as collected.							
Result of Sampling				PM 10		SO_2		NO_2	
PM10	SO2	NO2		26.3	Ug/Ncm		ppm		ppm
(PASSED)									
SAMPLE COLLECTION DATA									
	DATE			TIME		TEMP	PRESSURE	FILTER	VOL.
	YEAR	MONTH	DAY	HOUR	MIN.			WEIGHT (mg)	STD
FINISH	2018	Feb.	1	0640H		29.2	0.990	147.298	17.510
START	2018	Jan.	31	1130H				146.849	

Source: EMB Region XII, 2018

(2) Noise and Vibration

Studies on noise and vibration are always done for certain project, in short site-specific. For reference, this report will take the case of the Road Network Development Project in Conflict-Affected Areas in Mindanao (RNDP-CAAM) Project (2019) to represent somewhat similar case of the project alignment. Local people expressed increase of noise problem due to construction and eventually operation of new roads. Monitoring data along the project sites are not measured at the time of action plan study. National standard of NPCC and IFC/WB are shown in Table 24.7-4 and Table 24.7-5.

Table 24.7-4 NPCC Noise Standard

Category	Maximum Allowable Noise (dBA) by time periods		
	Daytime (9:00 AM – 6:00 PM)	Morning/Evening (5:00 AM to 9: AM/ 6:00 PM to 10 PM)	Nighttime (10:00 PM to 5:00 AM)
AA	50	45	40
A	55	50	45
B	65	60	55
C	70	65	60
D	75	70	65

- Class AA – a section of contagious area which requires quietness, such as areas within 100 meters from school site, nursery schools, hospitals and special house for the aged
- Class A - a section of contagious area which is primarily used for residential area
- Class B - a section of contagious area which is primarily a commercial area
- Class C - a section of contagious area reserved as light industrial residential area
- Class D - a section which is primarily reserved as heavy industrial area

Source: DENR-EMB

Table 24.7-5 IFC/WB's EHS Standard (Noise)

Receptor	One Hour LAeq (dBA)	
	Daytime 07:00 -22:00	Nighttime 22:00 – 07:00
Residential; industrial; educational	55	45
Industrial; commercial	70	70

Source: International Finance Corporation

(3) Odor

There are observed offensive odor in the area close to existing dumping site of the Cotabato City. Figure 24.7-3 present the location of the facility and its distance to the city core.

Figure 24.7-3 Location Map -Solid Waste Management Facility of Cotabato City

Figure 24.7-4 Zoom in Photo - Solid Waste Management Facility of Cotabato City

(4) Water Quality

Baseline information on water quality is mostly conducted in Cotabato City for a number of reasons. First, it hosts the larger share of population being the regional center and thus, the demand for water supply to population is high. Naturally, various studies are needed to regularly monitor the state of water quality. The Metro Cotabato Water District covers three LGUs as its service areas, namely the City of Cotabato, the Municipalities of Sultan Kudarat and Datu Odin Sinsuat (DOS).

Studies on water quality in Cotabato City and its environs are very critical in shaping policies and legislations in line with the maintenance of the river and in keeping the health and sanitation of the communities mostly along and within the river system. The water may become contaminated with coliform bacteria which may lead to various public health concerns. In a study conducted by Notre Dame University (NDU) in 2012, data were generated to come up with the physico-chemical and bacteriological analyses of the waters in the major rivers of Cotabato City. The study covers the following rivers: Rio Grande de Mindanao along Quirino Bridge and Matampay Bridge, Rio Grande de Tamontaka, and Esteros river.

Table 24.7-6 Key Findings (NDU Study)

Parameters	Results
1.Depth	The depth of the rivers ranges from 45.0 – 53.7 m. The river along Esteros is the shallowest (29.4 m) while the deepest is along Quirino (53.7 m).
2.Temperature	Water temperature was measured in situ at 9 -10 AM. The water temperature of the four rivers ranges from 29–30 0C.
3.pH	The pH of the rivers ranges from 7.35 – 7.54 which is considered to be slightly alkaline.

Parameters	Results
4.TSS	Tamontaka river has 18mg/L total suspended solids, Rio Grande has 28 mg/L, Esteros has 37 mg/L, and Matampay has 39 mg/L. It shows that Matampay river has the highest TSS and Tamontaka has the lowest.
5.Turbidity	The turbidity value of Matampay river is 40.8 NTuS, Esteros with 10.4 NTuS, Quirino with 5.7 NTuS and Tamontaka with 1.2 NTuS. Among the four rivers, Matampay river is most turbid and Tamontaka is least turbid.
6.Salinity:	The rivers along Quirino and Matampay have the salinity value of 0.2 ppt while, Esteros and Tamontaka do not contain dissolved salts.
7.Dissolve Oxygen	The rivers have high DO values (Quirino, Matampay, Esteros and Tamontaka is 6.23 mg/L, 5.9mg/L, 5.0 mg/L, and 6.06 mg/L respectively). This means that there is adequate amount of oxygen necessary to support aquatic life.
8.Biological Oxygen Demand	The BOD values of the rivers show that these rivers are not considered to be polluted The BOD values of Quirino, Matampay, and Esteros rivers is 3.33 mg/L while in Tamontaka river is 3.0 mg/L.
9.Coliform bacteria	Coliform bacteria are present in all water samples.

Source: Water Analysis of Cotabato City Rivers and its Implication to Human and Aquatic Life, July 2012, Corcoro, Alombro, Herrera, NDU-CAS

Table 24.7-7 Water Quality Monitoring Results for Cotabato Rivers, 2012

Parameters	Unit	Results: Cotabato City Rivers (see above table)	Guidelines*	WHO's Global Overview of National Regulations and standards for Drinking-Water Quality (2018)	Remarks
pH	-	7.35 – 7.54	**6.5-9.0**	6.5 - 8.5	Above the standard
DO	mg/L	6.23 mg/L, 5.9 mg/L, 5.0 mg/L, and 6.06 mg/L	**minimum 5**		Above the standard
BOD	mg/L	3.33 mg/L	7		Below the standard
Total Suspended Solids (TSS)	mg/L	18mg/L; 28 mg/L; 37 mg/L; 39 mg/L	80	-	Below the standard
Total Dissolved Solids (TDS)	mg/L	6.23 mg/L, 5.9mg/L, 5.0 mg/L, and 6.06 mg/L	-	-	Good quality
Fecal coliform	MPN/ 100 mL		200	Must not be detectable in any 100 ml sample (recommended median value – 0 per 100 ml)	Present in all study sites
Nitrates	mg/L		7	50 mg/l	
Phosphates	mg/L		0.5	-	
Surfactants as MBAS	mg/L		1.5	-	
Oil and Grease	mg/L		2	Non set (recommended median value - 0.1 mg/l)	
Ammonia	mg/L		0.05	Non set (recommended median value - 0.2 mg/l)	

Notes: * DAO 2016-08 (Water Quality Guidelines and General Effluent Standards for Class C waters).
** Method Detection Limit - No specified standards/values/unit
Bold font – Values are not consistent with the guidelines
Source: DENR-EMB and JICA Study Team 2021

On the other hand, Pigcawayan Water District has a total of 623 water connections with 543 domestic connections or residential connections and 80 commercial connections. Domestic/residential connections were from four barangays namely, Poblacion 1,2,3 and Bulucaon. The water demand is at 1,082.4 cubic meter every month. Out of this total demand, 283.35 cubic meters of which is for domestic/residential use and 799.05 cubic meters of water are supplied for commercial use.

Despite having its water district, still many households in the municipality rely as their sources of water from shallow wells which are more affordable to put up than electric pumps. Level 2 type water system is also common in some barangays, example of which are the tap stands. These are distributed in different barangays as alternative sources of water supply. For bigger barangays, the water district, which is a Level 3 category, serves four barangays, namely Poblacion 1,2,3 & Bulucaon and the Public Market.

Table 24.7-8 Level 3 – Local Waterworks System by Type and Number of Consumers and Average Water Consumption, Year 2010

	Type of Consumer				
	Domestic	Commercial	Industrial	Others	Total
No. of Connections	543	80	None	None	623
Average Water Consumption	283.35 cu.m.	799.05 cu.m	None	None	1082.4 cu. m.
Barangays Served	4	1	None	None	5

Source: Pigcawayan Water District, 2010, LGU-MPDO

(5) Hydrology

Geographically, Cotabato City is situated in low-lying delta. The city being surrounded by two major rivers, the Rio Grande de Mindanao and Rio Grande de Tamontaka makes it a delta. Given this case, most parts of the city is susceptible to flooding especially with the occurrence of flash floods and heavy rainfall. Low lying areas of the city remain to be underdeveloped. Social and environmental vulnerability is high in these areas of the city. Aside from the two major rivers, the city is also crisscrossed by meandering and braided creeks and minor rivers like the Matampay, Parang, Timako, Esteros and Miwaruy. These water bodies serve as sources of water for agricultural, industrial and domestic uses and supplied most of the rural barangays.

In Municipalities of Sultan Kudarat, Kabuntalan, Pigcawayan and Northern Kabuntalan, marshes/swamps can be found in the southern portion which serve as fishing grounds for local fishermen. The area provides livelihood for local residents since it's the source of abundant freshwater fishes. The swampy/marshy areas have a vast production of freshwater fishes such as mudfish (halu-an), catfish (katipa), tilapia, gourami, popoyo and many more.

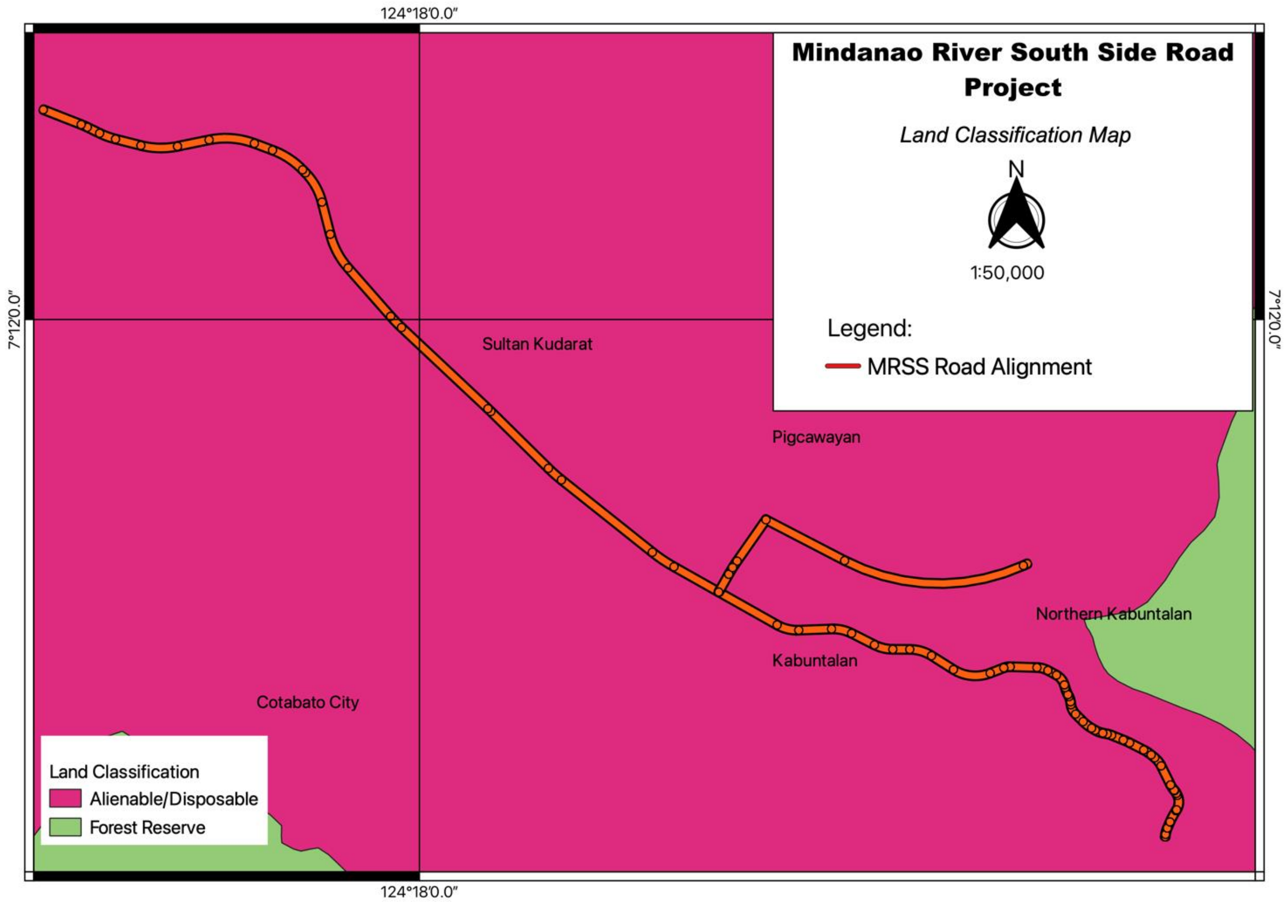
The Municipality of Kabuntalan is surrounded by bodies of water namely, (1) Rio Grande de Mindanao which traverses the barangays of Katidtuan, Gambar, Pagalungan, Ganta, Matilak and Maitong. (2) Tamontaka River which passes through barangays of Payan, Lower Taviran, Upper

Taviran, Bagumbayan, Dadtumeg, Pedtad, Poblacion Langeban, Liong, and Pened and (3) Butilen Creek which is located in Barangay Butilen. With limited road networks and openings, these rivers serve as means of transportation for the residents. The challenge however is when the river is not safe for navigation during the typhoon season. Thus, this highlights the necessity for the development and expansion of more road networks to improve the local mobility and transport of goods in the area.

(6) Land Classification and Cover

Under the 1987 Constitution lands are classified either as public domain or private lands. Public Domain are considered lands for public use or for government use and those which are unappropriated. Unappropriated use is further classified into Non-Disposable and Non-Alienable; and Alienable and Disposable (A & D). Alienable and disposable lands refer to those lands of the public domain which have been the subject of the present system of classification and declared as not needed for forest, mineral purposes or national parks.

The project area covering four (4) municipalities (Sultan Kudarat. Pigcawayan, Kabuntalan and Northern Kabuntalan) and one (1) city (Cotabato City) is under A & D land classification (Figure 24.7-5). The location of the MRSR alignment where project component will be undertaken is within A & D or private land. A & D land includes those land for agriculture, residential use, institutional use, educational use, commercial use and industrial areas.



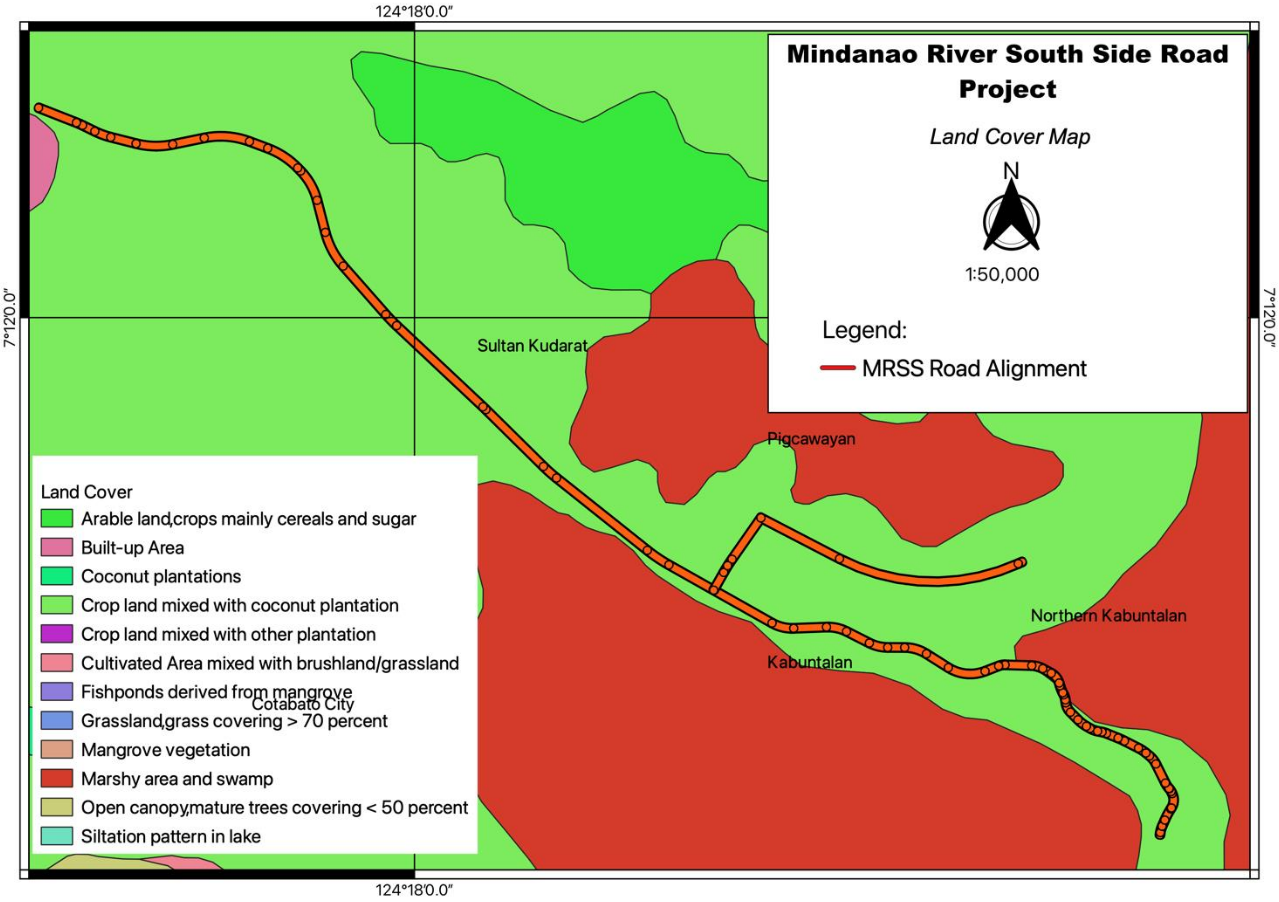
Source: Study Team 2021

Figure 24.7-5 Land Classification Map (NAMRIA, 2015)

In terms of land cover, project area is primarily covered by cropland mixed with coconut plantation from Sultan Kudarat to Northern Kabuntalan. Marshy and swamp area are also prevalent within the surrounding of the proposed alignment.

Based on satellite image interpretation, it is expected that some existing natural resources and few structures (in areas with residential communities) are affected due to the implementation of the Project.

As secondary impact of the project, development along the project area may cause adverse impact on land use and local resources, such as agriculture, forestry and water.



Source: Study Team 2021

Figure 24.7-6 Land CoverMap (NAMRIA, 2015)

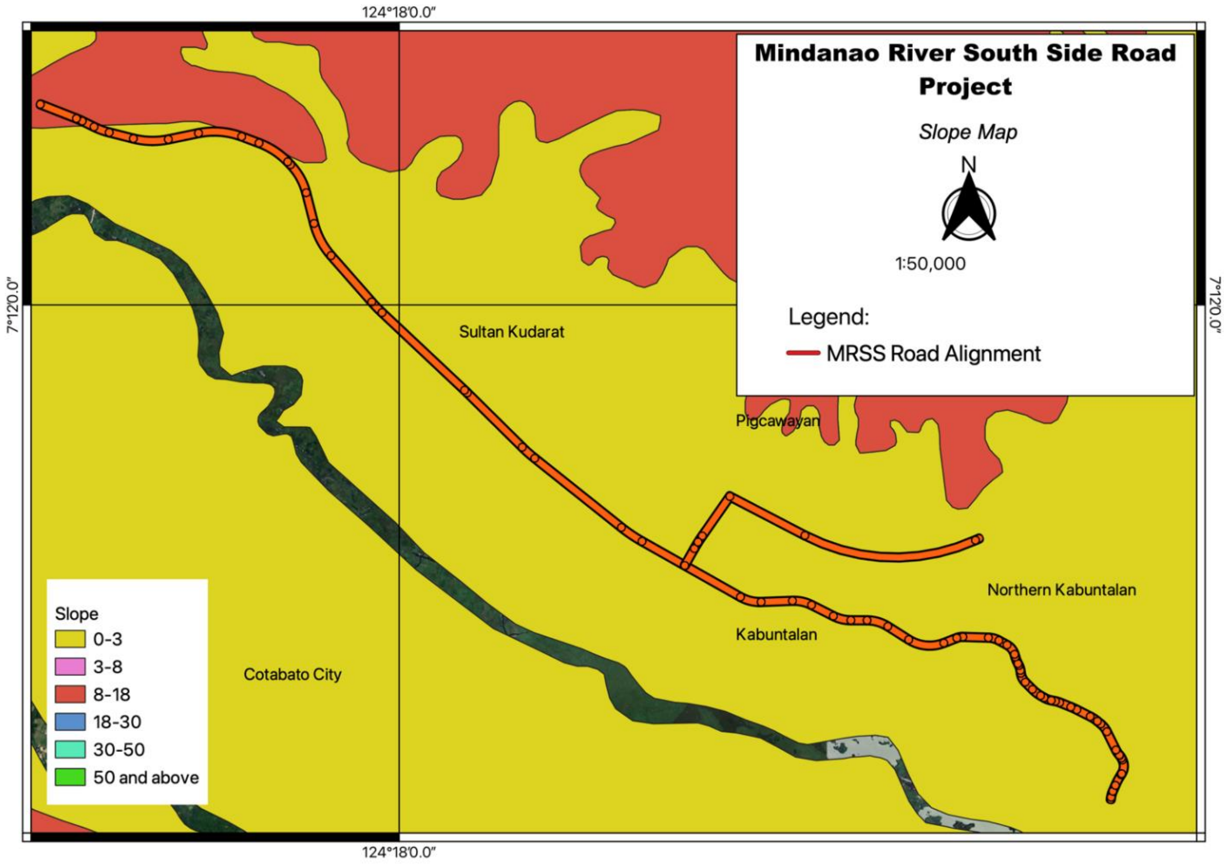
(7) Topography and Geology

The LGUs covering the proposed new road alignment is mostly characterized by a landscape of flat, level to nearly level, very gently sloping to gently undulations to moderately sloping or rolling. This area (Cotabato City and nearby localities) basically is a delta formed by two big rivers, the Tamontaka River and the Rio Grande de Mindanao. About 70% of its total land area is below sea level. There are only 2 existing elevated areas near the proposed new road, the PC Hill and the Timako Hill with an altitude of 90 and 150 feet, respectively.

Concentration of settlements and other urban uses are in the central portion while the southwestern and southeastern portion have mixed uses of agricultural land settlements. Cotabato City is crisscrossed by meandering and braided creeks and rivers like the Matampay, Parang, Timako, Esteros and Miwaruy.

These water bodies serve as sources of both agricultural, industrial and domestic water requirements of some rural barangays. These rivers also serve as the natural drainage flow of the city's wastes.

Figure 24.7-7 presents the slope characterized by the project area. It shows that the proposed project component as well as the MRSR alignment does not fall under critical slope areas. Slope of the project area ranges to level to nearly level (0-3%).



Source: Study Team 2021

Figure 24.7-7 Slope Map

(8) Ground Subsidence

Cotabato City has been identified to be within the earthquake belt. This was clearly demonstrated during the 1976 earthquake that caused vast destruction of lives and properties.

The susceptibility of the soil in the area to be eroded were those that are Erosion Potentials located along the banks of the Matampay River, Tamontaka River and the Rio Grande de Mindanao. Barangays located along low-lying areas occasionally experience flash floods brought about by heavy rains. It is also noted, however, that more than half of the city's land area is below sea level, thus seemingly an appropriate drainage system could prevent flooding and clogging of waterways. Potential flooding areas are those found in almost all four directions in the north, south, east and west. The meandering and occasional braided courses of rivers like Rio Grande de Mindanao, Tamontaka River, Tarbung, Kakar, Matampay, Miwaruy, Masukul, Manday, Lugay-lugay, Bagua and Kalanganan Rivers and Pagalamatan Creek could aggravate the flooding hazards of the area where these rivers are found especially during rainy season. Approximately, 85% of the soil in the area have good external and internal drainage while the other 15% have poor external and internal drainage.

Over in the Municipality of Kabuntalan, generally there is no incidence of apparent erosion. However, stream bank erosion and meandering were observed along the banks of Rio Grande de Mindanao. Water courses deviate often causing substantial erosion threatening settlements along the riverbank areas.

(9) Bottom Sedimentation

Broadly, there are three (3) soil types present in the area. The most dominant soil type found in Cotabato which make up 80% of the total land area or 14.079 hectares is the Faraon clay type. These are moderately good lands suitable for limited cultivation and less appropriate for urban development due to soil characteristics. Urban development would require very careful, and complex soil utilization practices. This type is found in the innermost portion of the area, the Tamontaka clay type found in the areas along Rio Grande de Mindanao on the north and south directions total to 2,640 hectares or 15% of the city's total land area. This type of soil has high fertility level, good lands which can be cultivated and suited for urban development but requires carefully planned erosion control measures. The third type of soil embracing an area of 880 hectares or barely 5% of the city's total land area is where settlements and other urban uses are highly concentrated. These are very good lands which can be cultivated safely and require very simple soil management practices and with high density for urban development.

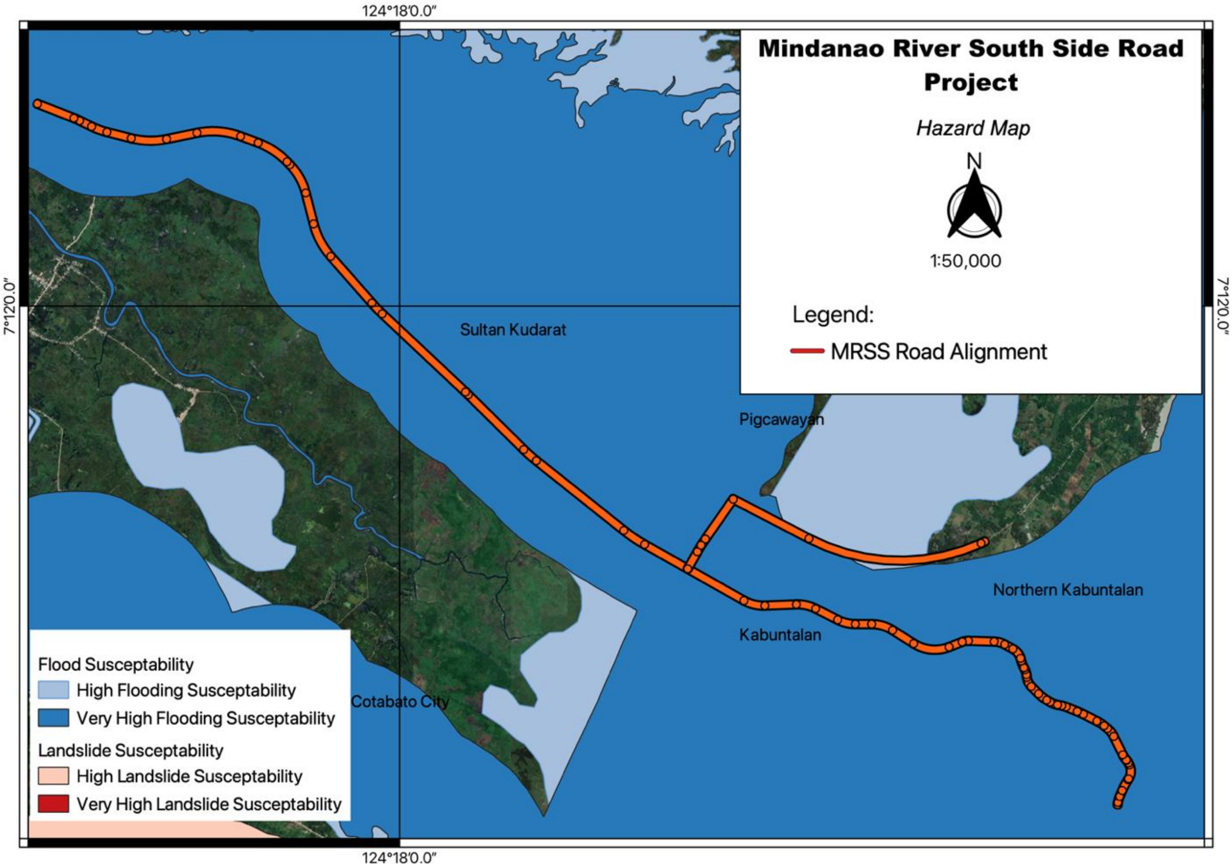
Specifically for Municipality of Kabuntalan, undeferential soil is the most dominant among the types of soil, followed by clay loam, hydro soil and the marshy soil.

(10) Hazards and Disaster

Rio Grande de Mindanao River, part of the considered the biggest river basin in Mindanao, the Cotabato-Agusan River Basin is currently heavily silted so much so that the capacity of the river to contain the flow is greatly diminished resulting sometimes to over spilling of water to low leveled barangays of the city. The government has put efforts to improve the situation. Periodic dredging of silt from Rio Grande de Mindanao has greatly improved the situation.

The occurrences of flooding were attributed to the city's geographical characteristic that is being a delta and the drainage outlet of Liguasan and Agusan Marshes, Pulangi and Allah Rivers, and other major rivers located upstream and flow towards the sea. This has made Rio Grande de Mindanao and Tamontaka River heavily silted thus, causing flooding in the low-lying areas of the city. This situation was further aggravated with the periodic presence of water hyacinth along the Rio Grande de Mindanao. In the last two (2) years, the city has experienced three (3) flooding occurrences and has affected 89% of the city's total barangays. Incidences of flooding in the city is also attributed to the off-course overflowing of Simuay River towards Rio Grande de Mindanao which has contributed greater volume of water to the already limited drainage outflow capacity of the said river due to heavy siltation. The recurring incidences of flooding has resulted to a lot of damages to the daily activities of the residents of the city notwithstanding the emotional anxiety every time there is a heavy downpour

Figure 24.7-8 shows the very high and high susceptibility to flooding and landslide at the project area.



Source: Study Team 2021

Figure 24.7-8 Hazard Map

(11) Environmental Sensitive Area

Ecosystem

The coastal and marine ecosystem of Cotabato City was once rich with biotic and abiotic components. Mangrove trees extend inland providing a fine habitat to different wildlife. Various species of egrets wander freely, crustaceans and mollusk abound and fishes as well. Niches were rich and diverse complementing each other and ensured their survival. Gradually, anthropogenic activities cross the threshold and sluggishly destroyed the ecological balance that once existed. Some mangrove stands were unsustainably cut to give way to settlements and fishponds, some were even cut for fuel or building materials, all for economic reasons.

Exploitation of the coastal and marine resource took its toll and slowly destroyed the coastal ecosystem. Inevitably, the gradual destruction of the coastal ecosystem shape also the integrity of the marine ecosystem, marine life is dependent also on the condition of the coast. Loss of mangroves equates to loss of juvenile fishes, mollusks, crustaceans and other organism. Loss of mangroves is also a loss of nutrients much needed by coastal and marine life. Loss of mangroves also negates the filtering of waste from inland consequently polluting the sea.

Ancestral Domain

The project will not encroach any ancestral domain or lands, territories, and resources of indigenous peoples (Figure 24.7-9).

Protected Area/Key Biodiversity Area (KBA)

Geographic Location

The Mindanao River Southside Road (MRSR) appears to be at the fringe of Liguasan Marsh. The marsh is a conglomeration of three marshes: the LMWBR proper, the Libungan Marsh, and the Ebpanan Marsh. It is part of the larger Mindanao River Basin, the second largest river basin in the country and located in three provinces (Maguindanao, North Cotabato and Sultan Kudarat covering Cotabato City) and is estimated to occupy 288,000 ha and is the largest wetland in the country, comprising about ten percent of the Mindanao River Basin.

Proposed Key Biodiversity Area (KBA)

The Ligawasan Marsh Development Master Plan (1999-2025), formulated by NEDA Region XII in 1998 recommended the inclusion of Ligawasan as a protected area (PA) under the National Integrated Protected Area System (NIPAS). However, there were not enough scientific bases to support the recommendation. To embark on science-based approaches of assessing further the proposal, the Philippine Government, with the funding support of the Global Environmental Facility (GEF)-World Bank, had undertaken two studies: (i) the Protected Area Suitability Assessment (PASA) Study, completed in 2001, and (ii) the Wetland Biodiversity Component for Ligawasan Marsh Study, completed in 2004. Both studies gathered the required scientific information to support the proposal. The results of both studies indeed indicated a strong consensus among the stakeholders that Ligawasan Marsh should be proclaimed as a "Protected Area (PA)" under the NIPAS Act. It should be noted however that the proposed area for PA is not the entire marsh but portion of it where biodiversity conservation activities are deemed critical based on the PASA. The MRSR is almost certain to be outside this area. But to date, this effort to declare the marsh as PA has not progressed for number of reasons and circumstances.

The DENR however through the Biodiversity Management Bureau (formerly called Protected Areas and Wildlife Bureau or PAWB) designated portion of Ligawasan Marsh as Key Bio-Diversity Area No. 198 with the KBA being 39,424.12 hectares[1].

Meeting of the JICA Study Team with MENRE to confirm KBA

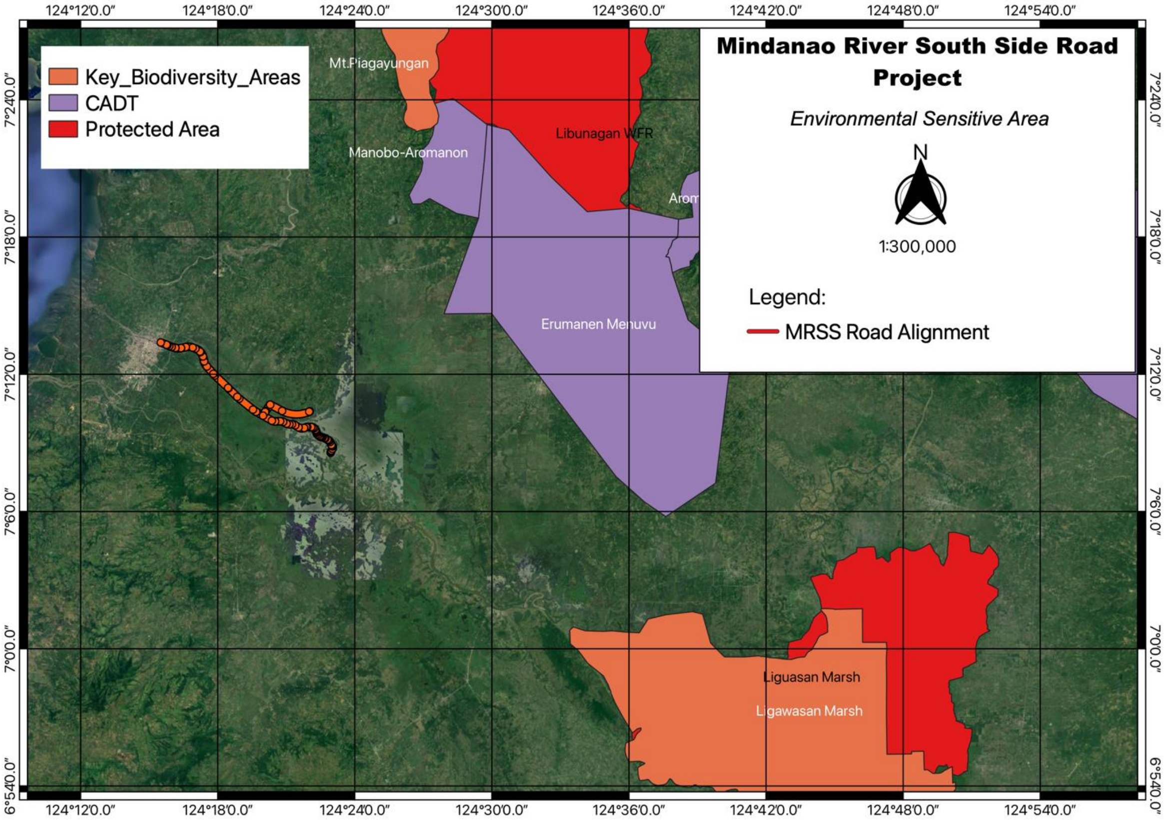
A meeting with MENRE was sought by the JICA Study Team on October 21, 2021 to further understand the designation of Ligawasan Marsh. It was learned that jurisdiction over Ligawasan Marsh was transferred from DENR Region 12 to MENRE just this January 2021. Delineation map of the KBA was requested to overlap the MRSR but the KBA map is not yet available from MENRE. Using two reference studies/documents as reference, the JICA Study Team estimated the location of the KBA is far from the proposed MRSR.

Location of Ligawasan Marsh based on (NAMRIA and Geoportal.gov.ph)

An Environmental Sensitive Area map of the MRSR was generated using the data from National Mapping and Resource Information Authority (NAMRIA) and Geoportal. NAMRIA is mandated to provide the public with mapmaking services and to act as the central mapping agency, depository, and distribution facility for natural resources data in the form of maps, charts, texts, and statistics) On the other hand. Geoportal.gov.ph is used to find and access geospatial data and services. The Geoportal Philippines also advocates the use of standard multiscale basemaps that serve as tools for strategic planning, decision making, situational analysis and other common requirements).

Based on the Environmental Sensitive Area map as presented in Figure 24.7-9 the proposed MRSR project is not within the Ligawasn Marsh or Liguasan Marsh. However, further verification shall be done during the F/S study.

[1] Philippine Clearing House Mechanism Partnership to showcase Philippine Biodiversity



Source: Study Team 2021

Figure 24.7-9 Environmental Sensitive Area at the Project Site (NAMRIA, and Geoportal.gov.ph)

(12) Socio-Economic Conditions

Based on the 2020 statistical survey, the total population of the city and municipalities in the influence area of the study is about 554,287 as shown in Table 24.7-9. Some barangays of Cotabato City were identified within the influence area of the road project. These are considered direct impact area for the road alignment. The said road project will also traverse four other municipalities, namely Sultan Kudarat, Kabuntalan, Northern Kabuntalan and Pigkawayan, which is already part of North Cotabato province.

Table 24.7-9 Population of the Proposed Project Area

Municipality/ City	Area (km^2)	Population (2020)	Population Density (Person/km^2)
Cotabato City	176.00	325,079	1,800
Sultan Kudarat	712.91	105,121	147
Kabuntalan	371.08	25,439	69
Northern Kabuntalan	106.77	26,277	246
Pigcawayan	340.11	72,371	213
Total	1,706.87	554,287	325

Source: Socio-Economic Profile of LGUs; JICA Study Team, 2021

1) Socio-economic Profile of the Project Area

a) Cotabato City

Population and Demography

The city has a land area of 176.00 square kilometers or 67.95 square miles. Its population as determined by the 2020 Census was 325,079. This represented 6.63% of the total population of the SOCCSKSARGEN region. Based on these figures, the population density is computed at 1,847 inhabitants per square kilometer or 4,784 inhabitants per square mile.

Existing Social Infrastructures and Services

- **Education**

Education has always been regarded as an important priority in governance. Regardless of cultural diversity and traditions, it is made accessible to all. The government is driven to make education a priority as it contributes to peace building and economic development.

Overcrowded schools are a serious problem in Cotabato City school systems student-to-classroom ratio is a concern over the past years. As a result, students find themselves trying to learn while jammed into spaces never intended as classrooms, such as libraries, gymnasiums, laboratories, lunchrooms, and even open spaces. This somehow have an impact in the quality of learning among students.

There are still barangays in the city that have no presence of public schools. Out of the 37 barangays of Cotabato City, 11 do not have any public schools that will cater to the growing number of school-going population. By Year 2030, the school age population projection will reach up to 297,610 individuals.

Aside from lack of classrooms, most of these public elementary schools in the city are currently in need of basic school facilities such as computer rooms, comfort rooms, libraries, home economics buildings, and water system. Except for Central Pilot Schools, not all has laboratory facilities and clinics to cater to the medical and first aid needs of the pupils.

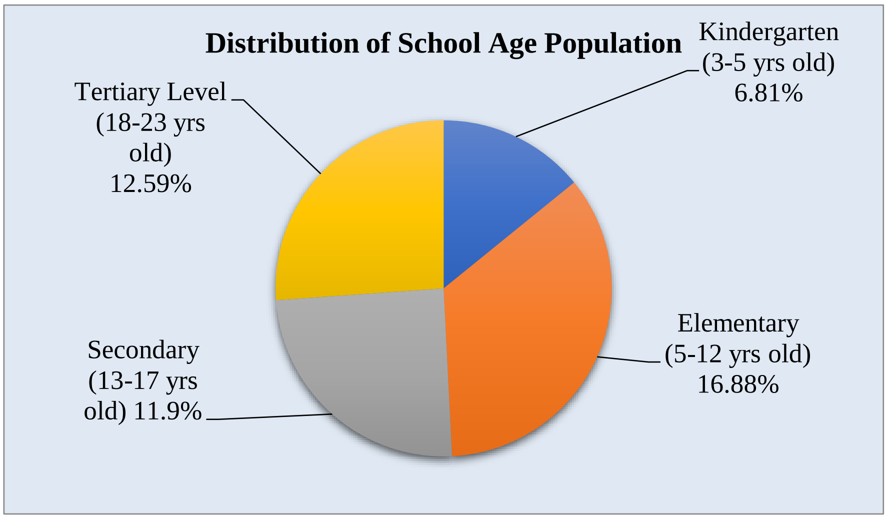
The school going age population now refers to those who belong to ages 3 to 23 years old recorded at 144,335 students or 48.18% of the entire population. Males dominate in number in pre-school and elementary while female dominates in secondary and tertiary level. Table 24.7-10 presents the school-age population composition.

Table 24.7-10 Population Composition by School-Age and Sex, Year 2015

AGE GROUP	2015 BOTH SEXES	Male		Female		Sex Ratio
		No.	%	No.	%	
School Age population	144,335	71,175	23.77	73,160	24.43	97.29
Pre-school (3-5)	20,424	10,373	3.46	10,051	3.35	103.20

Elementary (6-12)	50,599	25,531	8.52	25,068	8.36	101.85
Secondary (13-17)	35,611	17,293	5.78	18,318	6.12	94.40
Tertiary (18-23)	37,701	17,978	6.00	19,723	6.59	91.15

Source: Cotabato City Eco-Profile, 2017, CPDO



Source: Cotabato City Eco-Profile, 2017, CPDO

Figure 24.7-10 Percentage Illustration of School Going Age by Level of Education

Literacy rate is presented in Table 24.7-11 About 90% of the total population is literate, this means able to read and write.

Table 24.7-11 Population Distribution 10 Years and Over Literacy Rate

Total Population 10 years old and over	No. of population Literate			Simple Literacy Rate		
	Total	Male	Female	Total	Male	Female
230,161	206,529	89,786	95,538	90.00	91.00	88.50

Source: RSE trends 2015

- **Health Status**

The Cotabato Regional and Medical Center (CRMC), located along Sinsuat Avenue (National Highway) is the only tertiary government hospital in the Greater Cotabato area. It is considered well-equipped and has a total bed capacity of 300.

The CRMC offers a variety of medical services ranging from the simple medical consultation through its Out-patient Department and Emergency Services to treatment of various illnesses requiring particular medical field of specialization. It has basic and modern medical equipment as well.

Cotabato City health services includes one Main Health Center, the Office on Health Services (OHS) of the city government and 43 Barangay Health Centers (BHC's) spread throughout its 37 barangays.

The OHS is manned by 5 medical doctors/physicians providing medical consultation services. The facility can perform minor surgeries and emergency treatments but refer severe cases to higher health facilities especially when it requires particular field of specialization and/or admission. The center's laboratory has basic equipment but are limited only to the conduct of urinalysis, fecalysis, sputum and smear testing. It has no blood testing equipment and other modern and advance diagnostic equipment except for a manual X-Ray machine. It has a dental clinic and a sub-dental clinic situated beside the Rosary Heights Mother Barangay Hall, along Sinsuat Avenue.

Of the existing BHCs, only 17 centers are currently occupying their own buildings. The rest are either sharing spaces with their respective Barangay Halls or situated in makeshift or borrowed buildings/houses each manned by a Midwife.

The general health situation in Cotabato City reflects inadequacy of birthing homes and basic obstetrics care facilities at the community levels and the need to enhance the implementation of basic and primary health care program and services to address the leading causes of mortality and morbidity of all ages in general but more importantly of children and mothers.

- **Transportation System**

The city's present road network system consists of grid pattern network where there is only one (1) main corridor (Sinsuat Avenue) traversing the city from south to north. Almost all barangays are interconnected with the main backbone except for one (1) barangay that can only be accessed by water transportation. Public utility vehicles ply the routes along the major roads of the City. Non-motorized vehicles and habal-habal serve the needs of the commuters of the interior barangays. Terminals of these informal mode of transportation are situated along intersections of major city roads.

- **Protected Services**

A key priority for the police service is to ensure that it deals effectively with terrorism, serious crime and other major challenges to public safety. Protective services include counter-terrorism and extremism, serious organized and cross-border crime, civil contingencies and emergency planning, critical incident management, major crime, public order, strategic roads policing and protecting vulnerable people.

Under the Protective Services Sector, the Philippine National Police office of Cotabato City has 201 police officers. Fourteen (14) are currently detailed to different personalities, seven (7) are scheduled to retire in 2009 and are now processing their retirement papers while 13 are office based personnel assigned at various sub-stations. Only 121 field police officers, spread thinly among 7 sub-stations at strategic locations, were left to maintain and implement the needed protective service in the area. This figure is currently not absolute considering that, from time to time, some of these personnel are sent outside the city for further training and skills enhancement activities.

In terms of logistics, the police have 6 four-wheeled serviceable vehicles and eleven motorcycles distributed in the various police stations. The City Police is equipped with 2 units of closed-circuit television (CCTV) camera but are yet sufficient. Police officers cannot immediately respond due to unavailability of handheld radios to fast-track communication in the police force, especially those assigned in the field.

These manpower and logistical inadequacies resulted to lesser police visibility. The Barangay Tanod is the freedom and peace-loving citizens organized at the Barangay levels mainly aimed to respond to atrocities and violence at their respective areas. It also aims for civic purposes and community defense in line with the security program of the government. It assists the police and military personnel in some basic crime solution efforts such as gathering crime related information and, further, compliments the PNP in securing the barangays by conducting watch activities. In case of emergencies and disasters, the Tanod provides quick response assistance.

Despite the presence of Barangay Tanod as an auxiliary support to public safety, the index crime rate from 2005 to 2009 showed an alarming increase in terms of grave offenses committed against persons. The figures for non-index crimes or light offenses like slight physical injuries also manifest an undeniable increase. However, it is confusing to observe that the data for crime solution efficiency presents a laudable figure.

In 2008, the felonies rose to a very alarming number of 165 cases for index crimes and 195 cases for non-index crimes for a total of 360 crimes where only 312 of which was accordingly solved while 48 remains unsolved. For the period covering January to February 2009, misdemeanor records listed 57 cases, 49 of which are considered solved.

As one of the five pillars of the Criminal Justice System, the BJMP was created to address growing concern of jail management and penology problem. Primarily, its clients are detainees accused before a court who are temporarily confined in such jails while undergoing investigation, waiting final judgment and those who are serving sentence promulgated by the court 3 years and below.

As provided for under R.A. No. 6975, the Jail Bureau is mandated to take operational and administrative control over all city, district and municipal jails. The Bureau has four major areas of rehabilitation program, namely: Livelihood Projects, Educational and Vocational Training, Recreation and Sports, and Religious/ Spiritual Activities. These are continuously implemented to eliminate the offenders' pattern of criminal behavior and to reform them to become law-abiding and productive citizens.

Manned by only 20 personnel, Cotabato City has only one (1) City Jail located at Rajah Tabunaway Boulevard, Poblacion 5. It has a very limited area against the total number of inmates. Seventy-five (75) inmates fill up in one (1) quarter. Presently, the facility accommodates 143 inmates.

The jail personnel aired concerned that, aside from insufficiency of firearms, the absence of BJMP vehicle hamper their function as jailers. They use or hire passenger vehicles as their mode of transportation for jail related transactions such as ferrying inmates to and from the courts, City Health Office and other destinations. There is also a need to look into the plight of minor inmates who are not supposed to be mixed with hardened adult criminals.

The Cotabato City Bureau of Fire Protection is composed of three (3) stations inclusive of its headquarter which is located at Rajah Tabunaway Boulevard in Poblacion 5. It is manned by 43 personnel. Substation 1 is situated at Sinsuat Avenue, Rosary Heights Mother with five (5) personnel while Fire Substation 2 with five personnel also is located at Lugay Lugay area in Barangay Bagua 1.

Despite the existence of the city firefighters both from the Bureau of Fire Protection and from the Filipino Chinese Fire Brigade, fire incidence is still alarming. This can readily be attributed to the absence of fire hydrants in strategic locations or unserviceability of the existing ones. The community also needs more fire prevention orientation as well as organization or reactivation of fire/disaster prevention group at the barangay levels.

- **Sports & Recreation Sector**

Whether you are a varsity athlete, a play-for-fun jock, a casual game player, or someone who just wants to get into shape, Cotabato City has not so many opportunities to stay fit and competitive. City residents need not be an athletic star to get in the game in the city. One can stay in shape with 2 major school sports arenas, the Cotabato City State Polytechnic School and the Cotabato

City Central Pilot Elementary School outdoor track/oval. The city has 5 basketball and volleyball gymnasium and 4 indoor tennis/badminton courts

The city offers plenty of ways to stay fit in non-competitive settings. Jog or walk in the ORC Compound, in the City Plaza and the People's Palace grounds. One can also take commercial aerobics and cardiovascular training and conditioning at the City Mega Square Commercial Center situated beside the New City Hall at Malagapas, Rosary Heights 10 and at the City Government's state-of-the-art body fitness equipment will give your strength and weight training routines a boost.

The YMCA Recreation Center is a popular gathering place for people who intend to spend their time and unwind. There's a lot of activity in this one building: bowling, darts, billiards and others.

For cyber space afficionados, internet cafes are available everywhere and one can hang out in the computer lounges of hotel lobbies and coffee shops and enjoy wireless connectivity or play games.

- **Utilities Services Facilities**

Power Supply

Electrical needs of the City Cotabato are being provided by the competent Cotabato Light and Power Company. It has a standby diesel facility that provides power during interruptions and power outages. About 19,642 households have accessed to electricity while the rest have other power sources such as kerosene and liquefied petroleum gas (LPG). Only barangays of Poblacion 5 and Rosary Heights 11 have more than a hundred percent access to electrical services. More than 50% of the households in the whole 13 barangays of Rosary Heights ae amply provided with electricity.

Water Services/Usage

Potable water supply is being provided by the Metro Cotabato Water District (MCWD). There are a total of 22,898 households having accessed to level 3 water supply system. Of the total 37 barangays, about 4 have level 2 water supply provisions. These barangays are Tamontaka 2 and 3, Poblacion 9 and Kalanganan Mother. Three barangays that do not have accessed to the services of MCWD get their water needs from other sources.

There is one spring located in Bagua 3. However, its water resource is not guaranteed potable water source. Thus, level 2 water system in the city is being connected with the services provided by the local water district. Level 2 water system projects were implemented jointly with the assistance from Growth with Equity in Mindanao (GEM) Program Phase 2 and the local water district. To date, 4 rural and remote barangays of the city have benefited with this assistance. As of 2008, there are a total 37 active level 2 connections. A significant decrease in the number of level 2 connections was seen in Barangay Poblacion 9 which leaves only 3 level 2 active connections. This is attributed to the household's economic status. Each communal faucet is designed to serve 10 households. To date, there are 370 households benefitting from level 2 water facility.

<u>Communication Sector</u>

Among the utility sectors, Communication is the most dynamic for it changes dramatically over time. Previous years, there are 3 landline companies telephone services to the residents of the city. Currently, there are only 2 landline companies left provide telephone services to the city of Cotabato, the Philippine Long Distance Telephone Company (PLDT) and Telof and only urban barangays are provided with landline facilities. Telephone density in 2007 was pegged at 62.5 per 1000 people. More landline telephone users have availed of the mobile telephone services primarily due to convenience, accessibility and affordability the latter offers. Presently, PLDT published landline subscribers totaled to 2,662 with 1,365 residential and 1,297 non-residentials.

To date, there are 31 registered and licensed internet café establishments in the city. The city has 3 AM and 4 FM Radio Stations, 2 cable TV companies and 3 Internet Service Providers (ISP) which either provides dial-up and wireless internet connections.

The city being the primary urban center in Central Mindanao has access to daily national newspapers and the local print media outfit that produces weekly local newspaper. The local newspapers are circulated not only in the city but also in provinces of Cotabato and South Cotabato, Maguindanao and Sultan Kudarat.

In the city of Cotabato, 3 cellular phone companies have a total of 19 cellular transmission towers located in various strategic areas. Globe Telecom has the greatest number of towers followed by SMART communications and Digitel Mobile Philippines. Most of these towers are installed in areas with higher elevation and strategic enough to serve the company's desired area of coverage. To date, almost all barangays have cell phone signal.

Solid Waste Management

Cotabato City's population has grown over the years. Being the leading institutional, financial and service center in the region, people continue to migrate in the city for employment and other social welfare benefits and services.

As the population of Cotabato City is increasing, naturally the amount of solid waste is also increasing. With such scenario, Cotabato City and even its nearby LGUs are challenged to properly manage their waste collection and disposal.

Studies conducted earlier reveal that a substantial portion of waste is generated from household level followed by the waste coming from the public markets. Waste from commercial, institutional, industrial, agricultural, and city government services trailed next.

To meet the growing problems on solid waste, some barangays, by virtue of Republic Act 9003 or the Ecological Solid Waste Management Act of 2000, have established a solid waste collection system. Barangays Poblacion I, II and V as well as Barangays Rosary Heights I, IX and XIII have set up a full collection system while Barangays Poblacion IV, VII and Barangay Rosary Heights II have a partial collection system.

The Waste Analysis and Characterization Study (WACS) conducted at both public markets disclosed that solid waste generated within the markets is composed largely of biodegradables. Ideally, such solid waste should be diverted from the waste stream to delay the full up and extend the service life of the city's dumpsite. Other studies are being undertaken as to putting up a composting facility in the area of the dumpsite or in a privately owned lands which would be operated by an accredited cooperative or any private entity to receive the biodegradables from the public markets. The establishment of a Central Materials Recovery Facility (MRF) is also seriously considered to cater to the recyclables coming from all sources. Below are tables showing the breakdown of waste in both public markets of the city. A simple WACS was also conducted in selected areas of the city. Table 24.7-12 shows the types of waste being generated in the city and their respective sources.

Table 24.7-12 Solid Waste Characterization by Category

Type of Solid Waste	Percentage Distribution by Source							Average Percentage
	Households	Markets	Food Establishments	Commercial	Schools	Offices	Hospitals	
Compostable	64.44	88.33	52.87	33.33	82.3	26.46	42.62	55.76
Recyclable	22.84	6.86	38.64	56.91	12.45	67.70	30.06	33.64
Non-recyclable	12.72	4.81	8.49	9.76	5.25	5.84	27.32	10.60
Special Wastes	-	-	-	-	-	-	-	100.00

Source: Cotabato City 10 Year Ecological Solid Waste Management Plan/LGU-General Services Office

Local Economy such as Employment and Livelihood

The erstwhile administrative role of Cotabato City as the seat of Central Mindanao (Region XII) paved the way for the establishment of regional offices of National Line Agencies (NLAs) thereby providing employment to its constituents. Together with the Office of the Regional Governor and its component Regional Line Agencies (RLAs) in the Autonomous Region in Muslim Mindanao (ARMM), it comprises a big chunk of employed persons within the labor force. These employees in the government sector have contributed largely to the growth of the city's economy in terms of accessing social and economic services through spending on household needs, consumer goods, use of entertainment facilities, engagement in entrepreneurial concerns and payment of local taxes.

From the private sector, the Commerce and Trade sub-sector represents the major employment provider covering such endeavors as wholesale and retail activities, banking and finance, service facilities, and others. The agriculture sub-sector, in general, has no visible employment participation since most of the concerned populace are self-employed. Fisher folks based in the 3 Kalanganan barangays are engaged in fishing off the coast of Illana Bay while fishpond owners operate their own brackish water fishponds. Even the members of fishpond cooperatives tend to their own fishponds. Workers are hired on piece rate basis as the need arises during harvest, casting of fingerlings at the start of production cycle and maintenance activities. It is more simplified in the case of freshwater fishpond owners as they are all engaged in backyard-raising and do not demand labor support.

The same is true in the case of farmers who also own the land they are tilling. In effect, they are also self-employed. The average family in Cotabato City earns more than what it spends for its basic family needs and services. Going by the generally accepted norm, the average number of family members of 5, has 27,761.00 PhP to use for meeting their personal requirements.

In contrast, the per capita poverty threshold represents the amount needed by an individual to meet his minimum basic needs. The average family in Cotabato City is above the poverty threshold as shown in the poverty incidence of families. This is one reason why the city is classified as a highly urbanizing city in South-Central Mindanao.

Table 24.7-13 Land Prices Survey for Cotabato City (Year 2008)

Particulars	Reference Period	Amount/Percentage
A. Ave. Annual Family Income	2000	P 138,805.00
B. Average Annual Family Expenditures	2000	P 112,816.00
C. Inflation Rate (2000=100)	2008	14.4%
Particulars	**Reference Period**	**Amount/Percentage**
D. Peso Purchasing Power (2000=100)	2008	P 0.63
E. Annual Per Capita Poverty Threshold	2006	P 17,335.00
F. Poverty Incidence of Families	2006	38.0

Source: National Statistics Office (NSO), National Statistics Coordination Board (NSCB), 2008

Particulars	Reference Period	Amount/Percentage
G. Peso Purchasing Power (2000=100)	2008	P 0.63
H. Annual Per Capita Poverty Threshold	2006	P 17,335.00
I. Poverty Incidence of Families	2006	38.0

Source: National Statistics Office (NSO), National Statistics Coordination Board (NSCB), 2008

b) Sultan Kudarat

Population and Demography

The municipality has a land area of 712.91 square kilometers or 275.26 square miles which constitutes 7.15% of Maguindanao's total area. Its population as determined by the 2020 Census was 105,121. This represented 7.83% of the total population of Maguindanao province, or 2.39% of the overall population of the Bangsamoro Autonomous Region in Muslim Mindanao. Based on these figures, the population density is computed at 147 inhabitants per square kilometer or 382 inhabitants per square mile.

Existing Social Infrastructures and Services

- **Education**

The Municipality of Sultan Kudarat has six (6) primary schools, thirteen (13) elementary schools (1 private and 12 public) and six (6) high schools (1 private and 5 public) and one (1) private tertiary school located in Barangay Calsada. The total enrollees of the year 2015-2016 was 11,648 of all levels from preparatory down to the college level.

Table 24.7-14 Student-Teacher and Student-Classroom Ratio by Level SY 2016

Student-Teacher and Student-Classroom Ratio by Level SY 2016					
Type/Level	**Total Number Enrolment**	**Number of Teachers**	**Number of Classroom**	**Student-Teacher Ratio**	**Student-Classroom Ratio**
Private					
Preparatory					
Elementary					
Secondary	988	25	25	1:40	1:40
Junior High School					
Grade 7-10					
Senior High School					
Tertiary	77				
Sub-Total	**1,065**	**25**	**25**		
Public					
Preparatory					
Elementary	10,520	234	245	1:45	1:43
Secondary	1,128	28	25	1:40	1:45
Junior High School					
Grade 7-10					
Senior High School					
Tertiary					
Sub-Total	**11,648**	**262**	**270**		

Source: Municipality of Sultan Kudarat CLUP 2017-25 Planning Period, CPDO

- **Health Status**

The Municipality has 30 barangay health units, one Rural Health Unit (RHU) and one sanitarium hospital manned by one doctor, 7 nurses including the deployment project nurse, one Mid-tech, one sanitary inspector and 22 midwives servicing the 39 barangays of the municipality.

As per record of Municipal Health Office, diarrheal diseases ranked high which constitute 36.50% of the total notifiable diseases reported. Influenza cases comes second and third is pneumonia. TB respiratory diseases have been reported at the age group from 15 years and over. The report indicates that the age group 0-14 is hardly hit by diarrheas and pneumonia diseases which can be associated with drinking water and the unsanitary practices observed in the community.

- **Transportation System**

Sultan Kudarat, traversed by a national road connecting major cities in Mindanao, is relatively accessible through a well-paved roads connecting to the city of Davao via Cotabato-Davao Road, Cagayan de Oro via Narciso Ramos Highway, General Santos City via Cotabato- Marbel-Ala Road. It is 225km to Davao City, 237km to Cagayan de Oro City and 186 km. to General Santos City. The Municipality is also accessible to Public Transportation such as Buses (Mindanao Star) and other public utility vehicles serving the area.

The municipality has a total of 120.76 km of road networks consist of National, Provincial, Municipal and Barangay Roads with road surface type of concrete, asphalt, gravel and earth. The condition of the roads is relatively fair but undergoing upgrading its road network for public convenience.

At present, there is one (1) overland public transport terminal in the Municipality located in Barangay Crossing Simuay which occupies about one (1) hectare of the Barangay area. The terminal is equipped with facilities to include the following: parking areas for both outgoing and waiting vans, waiting area for passengers, comfort room and public assistance counter. Another terminal is the Sultan Kudarat Transport Company (SUKUTSCO) a privately operated terminal for vans located at Barangay Salimbao occupying an area of 0.35 hectares more to less to cater passengers bound to Pagadian City.

- **Protected Services**

There are Police Stations located in Dalumangcob, Bulalo, Crossing and presence of outpost to all barangays in Sultan Kudarat. Personnel to population ratio for uniformed personnel is 1:1,402. There is one (1) Jail (detention cell) also located in Dalumangcob.

Fire station is located in Dalumangcob with one (1) fire truck.

- **Sports & Recreation Sector**

In terms of sports and recreation, facilities are available in some areas in Sultan Kudarat. Table 24.7-15 shows the existing sports and recreational facilities by barangay.

Table 24.7-15 Existing Sports and Recreational Facilities by Barangay

Barangay	Area (Hectares)	Sports Facilities	Recreational Facilities	Ownership	Physical Condition Good, Poor, Critical
Dalumangcob		Basketball Covered Court	-	Public	Good
Dalumangcob		Multi-Purpose Gymnasium	Municipal Plaza	Public	Good
Salimbao		Open basketball Court	-	Public	Good
Salimbao		Public Market			
Limbo		Basketball Court	-	Public	Poor

Source: MPDO, Sports and Recreational Facilities Map

- **Utilities Services Facilities**

Power Supply

There are three (3) electrical companies serving the municipal town, the Cotabato Light and Power Company (COLIGHT) Maguindanao Electric Company (MAGELCO) and the Cotabato Electric Cooperative (COTELCO). The COLIGHT supplies the power requirement of urban areas of the municipality which consists of the twelve (12) barangays and the remaining barangays except the interior barangays of the Municipality energized by MAGELCO and COTELCO. COTELCO energized some household of Barangays of Panatan and Alamada. COLIGHT, MAGELCO, and COTELCO receives power supplies from the NAPOCOR hydroelectric plant at Iligan City. The only advantage of COLIGHT over MAGELCO and COTELCO is that COLIGHT has stand-by direct electric generator to operate in case the NAPOCOR power fails.

Out of 39 barangay in the municipality there are 23 barangays that are not yet served by the 3 electrical companies due to its remote location. At present, there are 218 households that are served with electricity. There is backlog of 13,312 Households for both Urban and Rural Barangays awaits for electrification. On the other hand, the unserved household are utilizing solar power technology and kerosene.

Water Services/Usage

The 1991 inventory of water supply facilities in the Municipality of Sultan Kudarat reveals that its constituents are basically dependent on the underground water for their daily water consumption. The Cotabato City Water District (CCWD) have made use of the Municipality's underground water resources by constructing their pumping station at the Barangay Rebuken. The CCWD is pumping a volume of 2,700 cubic meter daily and serving 10 barangays of this Municipality with a total number service connection of 2,511 as of 2012.

Communication Sector

The municipality has its own operational communication system popularly known as PLECS or Provincial Law Enforcement Communication System that interlinks municipalities, provinces, regions or with national agencies. The Philippine Long Distance Telephone Company (PLDT) is already serving the municipality particularly at its five southern barangays. The municipality still enjoys the services of the Municipal Telecommunications Office stationed at the Municipal Hall. The Philippines Postal Office have put up three (3) postal offices at the Municipal Hall, Provincial Capitol, and at Barangay Salimbao purposely to effectively provide better services in these areas. The introduction of two (2) way radio communication have greatly enhance the communication linkages particularly at the far-flung barangays of the Municipality. Television and radio receivers are also common ways of sending message being enjoyed by its populace.

Solid Waste Management

The Municipality is already preparing its Solid Waste Management Plan with the technical capacitating assistance from the USAID- ECOGOV. The plan, if finished and made operational, will serve as the municipality's tool in its effort of sustaining its eco system.

The Municipal Composting Plan was already finished and ready for implementation. It was formulated through the technical assistance provided by the Eco-Gov. It entails a cost of more than Four Million (4,000,000) pesos.

It will be adopting the high-tech MRF facility of the Solid Waste Management Project of the City of Koronadal. It was decided as a result of the study tour sponsored by the Eco-Gov to the selected areas and LGUs in the South Cotabato areas which was participated by the members of the SWMB of the municipality.

The municipality has an estimated solid waste generation of 47,033 kilograms/day. With this it can generate a total bio-degradable solid waste of about 27,853 kilogram/day and 10,166,324 kilograms/year, while non-biodegradable will be 9,407 kilograms/day or 3,433,409 kilograms/day. The residuals and special wastes have a combined weight of 6,886 kilograms/day or 2,169,914 kilograms/year.

The Municipal Solid Waste Management Board (MSWMB) has already identified the area of the proposed Municipal Material Recovery Facility (MRF) and the Sanitary Landfill site.

Preliminary site suitability investigation has been undertaken by the Bureau of Science and Mines of the Department of Environment and Natural Resources. The lot is located at Brgy. Ladia going to its boundary with Brgy. Damaniog.

The proposed site has an area of about nine hectares and with the estimated municipal residual waste generation of about 2,169,919 kilograms/year or 21,700 cum/year. It is estimated to last for about 50 years.

Local Economy such as Employment and Livelihood

The 2010 population projection reveals that the labor force population of the municipality is 47,395 indicating that the major portions of its population are in the labor force. The main bulk of the work force is in the agricultural sector. Of the said figure, the employed labor force have totaled to 19,906 or 42 % of the total labor force of 47,395. The unemployed labor force constitutes about 58 % or 27,489 while the remaining percentage remains as dependents. In terms of participation rate of labor force, the male group has 23,542 and the female group accounted for 23,853. It can be noted that the female workforce is becoming active partner in the municipal economy.

Labor force is simply defined as those persons belonging to ages ranging from 15 to 64 years old. These include employed, self-employed, and non-employed population who falls under the said age bracket. About 47,395 persons or 57% of the total population of 2010 constituted the labor force.

c) Kabuntalan

Population and Demography

Its population as determined by the 2020 Census was 25,439. This represented 1.90% of the total population of Maguindanao province, or 0.58% of the overall population of the Bangsamoro Autonomous Region in Muslim Mindanao. Based on these figures, the population density is computed at 69 inhabitants per square kilometer or 178 inhabitants per square mile.

Existing Social Infrastructures and Services

- **Education**

Facilities in basic education (elementary and high school) need to be improved. Ideal classroom and availability of additional facilities for practical work and hands-on activities are desired. Provision of facilities in the public schools cannot cope up with yearly increase of enrolment.

There are fourteen (14) Elementary and one (1) Secondary school in the municipality all public schools.

DepEd-ARMM is mandated to establish, maintain and support a complete and integrated system of quality education that is meaningful, relevant and responsive to the needs, ideas and aspiration of the people in Muslim Mindanao. DepEd ARMM has the highest number of employees in the ARMM government.

- **Health Status**

The present situation of Kabuntalan regarding Health and Sanitation; there is a need of permanent assigned doctor in the municipality. The Health personnel is one (1) doctor being compensated by the ARMM, 1 Municipal Health Officer (RN ParidaMamalak), eight (8) midwives, four (4) midwives detail in Rural Health Station at Upper Taviran, paid by the LGU and 17 Barangay Health Workers.

The BHWs are currently subsidized by the municipal government. Medicines and other medical supplies are also limited. There is no municipal health center at the moment. Health services are temporarily conducted within the municipal government premises.

Most of the community members cannot access the services particularly those living in far-flung barangays. There is a need to establish botikasa barangays to augment government medicines subsidizedby the DOH and LGU. Serious illnesses are brought to CotabatoCity for medical attention. Most of the residents have poor knowledge about preventive health care and nutrition and would need an aggressive IEC campaign to address this. The Local Health Board is constituted. Coordination is established between the MHO and the Department of Social Welfare and Development in terms of nutrition. Nutrition posts are established in clustered barangays. There are seven (7) Barangays has the Health Center are the following Lower Taviran, Dadtumeg, Poblacion, Ganta, Gambar, Katidtuan, Liong, Matilak, Langeban, Butelen.

- **Transportation System**

Considered as one of the major factor/tool of growth and development to a municipality is its accessibility to goods and services, hence transportation sector has always been the focus of most of the priority programs/projects of a town.

The Municipality has a total road network as of 2015 of 18.60 km, of which 9.60 kilometers are Provincial Road, 9.0 kilometers are Barangay Road. out of 18.60 kilometers, 1.5 kilometers of it are Earth Road, 11.1 kilometers are Gravel Road and only 4.3 kilometers are concrete.

Fortunately, for the town of Kabuntalan, land transportation is not their only means of mobilizing their goods/production. Since a considerable number of "bancas" are available to them via Rio Grande de Mindanao and Tamontaka rivers. Recently some commuters are opting for the land transport which are also available in their municipality via Taviran - Ganta Provincial Road

- **Protected Services**

Under the present administration of Mayor Diocolano and in collaboration with AFP/PNP created the community patrol, detachments and check points in violent-prone areas. The LGU also initiates community dialogue in support to the peace accord. There is adequate number of police personnel in the area complemented by citizen armed forces geographical units (KITAB) assigned in all barangay. The peace and order council is operational. There is a reorganized people's law enforcement board, functioning lupong tagapamayapa and barangay tanods. The community expressed their need to establish a Shariah Office to support them in their legal requirements.

- **Sports & Recreation Sector**

Only two (2) barangays in Kabuntalan have sport facility located in barangays of Bagumbayan and Población. Included in the list of deprived sectors is the sports sector which up to now evidently has not caught the attention of the local leaders and officials in the municipality. The absence of sports facilities and development programs for the youth is a clear indication that indeed this particular sector has been left - out for quite some time in the development agenda of concerned officials of some local government units in Autonomous Region in Muslim Mindanao. Fortunately, though some people do not believe that way for the simple reason that in general the younger population dominates the entire populace of the town, hence it is imperative that the adequate support financial or otherwise must be afforded to this sector to produce productive and wholesome youth in the municipality.

- **Utilities Services Facilities**

<u>Power Supply</u>

The municipality of Kabuntalan is now being served by Maguindanao Electric Cooperative (MAGELCO). The 15 Barangays of Kabuntalan being served. Unluckily, Barangay Katidtuan and Butiren do not have electricity. MAGELCO provided the amounts of cross subsidies for each customer type.

<u>Water Services/Usage</u>

The municipality have four (4) Level II water facilities and only two (3) are functional located in barangays of Lower Taviran and Dadtumeg. The rest of the barangays have Level I water facilities.

<u>Communication Sector</u>

The municipality is served providers in terms of its need for communication requirements. The SMART and GLOBE Networks have established their towers in the municipality. This enabled the residents to access faster means of communication services. This network services also enabled the populace to utilized internet services, hence, benefitting from the use of social media connections.

Solid Waste Management

The municipality of Kabuntalan has no proper waste management system, coupled with the illegal practices on the town's natural resources altogether contributed to the rapid degradation of the same for the span of few years. For lack of waste disposal system and sanitary facilities, health problems due to the growing population are foreseen. And since the municipality is in low-land area the yearly occurrence of "flood" to critical areas which often devastated their agricultural produce seems to be the primordial concern and problem of the inhabitants in the area.

Flooding is the prominent problem in the area caused by heavy rains. As a marshland area, the local government unit concern focused on illegal fishing, mangrove development and conservation of the area. There is no establishing fish sanctuary at the moment. However, with the initial meeting of the Liguasan Marsh Development Alliance, issues pertaining to environmental conservation, biodiversity and marshland development were tackled.

The LGU have no solid waste management plan as of the moment. The LGU should be prompt and pro-active in identifying areas for solid waste and responding to environmental problems brought by improper waste management.

Local Economy such as Employment and Livelihood

The main source of income in the municipality are (1) agriculture; (2) fishery

The municipality has a huge agricultural land, these areas are primarily devoted to crops such as rice (irrigated and non-irrigated) corn and vegetables which can be found in abundance in their farm lands.

Despite the richness and fertility of its agricultural lands there seems to be a problem in terms of its agricultural production. This could be mainly attributed to various factors like the traditional farming methods, lack of post-harvest facilities and utilities, the frequency of flood occurrence in their farm lands, lack of farm input/technology, poor infrastructure support facilities and other mitigating factors which all contributes to the low agricultural production of the town.

It was only until 1990 when NSO released data on Labor Force by Sex and Employment Status on their Census on Population and Housing Survey. To come up with the same data, a computation on Participation Rate was done for 2007 on Municipal and Provincial Level. In 2007, Labor Force Population is 9,908 with 4,940 males and 4,968 females. With a participation rate of 2.9, Kabuntalan has 9,617 (97.1%) total employed persons with employed males of 4789 (96.9 %) and employed females of 4,828 (97.2%).

Total unemployed persons in 2007 are 291 (2.9%) persons with unemployed males of only 151 (3.1%) and unemployed females of 140 (2.8%).

It was noticeable that most of the communities are employed, and only less than 3% of the population are unemployed. Based on the population data, there are more females than males when it comes to labor force by sex in the Municipality of Kabuntalan.

d) Northern Kabuntalan

Population and Demography

Its population as determined by the 2020 Census was 26,277. This represented 1.96% of the total population of Maguindanao province, or 0.60% of the overall population of the Bangsamoro Autonomous Region in Muslim Mindanao. Based on these figures, the population density is computed at 246 inhabitants per square kilometer or 637 inhabitants per square mile.

Existing Social Infrastructures and Services

- **Education**

With respect to the school by level, there are 12 public schools with a total land area being occupied of 8.832 square hectares. Table 24.7-16 indicates the availability of school facilities and its condition. It also shows the hazard susceptibility by barangay or by school.

Table 24.7-16 School by Level, Type, Facilities and Condition

School	Barangay	Area Occupied (ha)	Ownership	Facilities And Condition							Used as Evacuation Center (Y/N)	Hazard Susceptibility (H/M/L)							
				Lab.	Shop	Library	Clinic	Comfort Room	Play ground	Others (Specify)		Fl	Tc	Eq	Vo	Ln	Ts	Su	Others
Gayonga CES	Gayonga	1.30	Public	N	N	G	G	G	G		N		L						
Tumaguinting ES	Tumaguinting	2.00	Public	N	N	N	N	G	G		N	L	L						
Balong ES	Balong	1.00	Public	N	N	N	N	G	G		N	M	L						
Manampen ES	Kapimpilan	0.50	Public	N	N	N	N	G	G		N	M	L						
Libungan ES	Libungan	0.50	Public	N	N	N	N	G	G		N	M	L						
P. Antipolo Sr. ES	Damatog	0.50	Public	N	N	N	N	G	G		N	L	L						
Montay PS	Montay	0.50	Public	N	N	N	N	G	G		N	L	L						
Pangambitan PS	Sabaken	0.75	Public	N	N	N	N	G	G		N	L	L						
Sabaken PS	Sabaken	1.00	Public	N	N	N	N	G	N		N	H	L						
Guiawa PS	Guiawa	0.50	Public	N	N	N	N	G	G		N	M	L						
Votoaggalan PS	Indatuan	0.25	Public	N	N	N	N	N	N		N	L	L						
Datu Almanza NHS	Balong	0.1	Public	P	N	N	N	P	P		N	H							
Gayonga NHS	Pauino Labio		Public																
Kabuluan PS	Paulino Labio	0.032	Public	N	N	N	N	N	N		N		L						
TOTAL		8.932																	

Source: DepEd District Office, Primaary Survey
Notes:
Ownership – Public/Private
Indicate condition (if facility is present) as follows:
G – Good (Well maintained)
P – Poor (Needs improvement)
C – Critical (Requiring priority action)
N – None/No such facility
Other facilities: Computer room/laboratory, multipurpose halls/auditorium, etc.
Used as evacuation center – Yes (y), No (N)
Type of Hazards – Flood (Fl), Tropical Cyclone (Tc), Earthquake (Eq), Volcano (Vo), Landslide (Ln), Tsunami (Ts), Storm Surge (Su), Others (e.g. coastal erosion, sea level rise, land subsidence, liquefaction, strong wind, change in temperature, change in rainfall, etc.)

- **Health Status**

The medical health facilities enumerated below shows that out of the 11 barangays, 5 barangays have operational Barangay Health Station. Likewise, Barangay Gayonga has operational Rural Health Unit (RHU).

- **Transportation System**

The municipality's road network as of 2011 has a total length of 5.2 kilometers of which 3.00 kilometers are now concreted; 2.0 kilometers are gravel; while 0.2 kilometers are still unsurfaced.

The municipality of Northern Kabuntalan has 2 bridges of which are Reinforced Concrete Deck Guilder (RCDG)

- **Protected Services**

Presented below the protective services facility in the municipality.

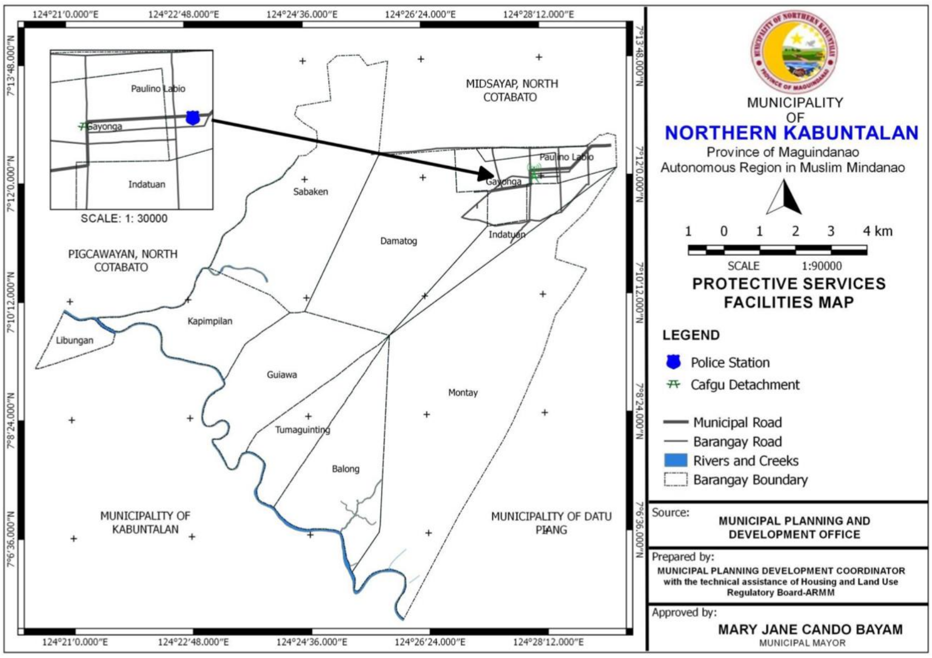


Figure 24.7-11　Protective Services facility Map

- **Sports & Recreation Sector**

Out of the 11 barangays, only 4 barangays have existing basketball court with a total area of 2,400 square meters.

- **Utilities Services Facilities**

<u>Power Supply</u>

The municipality of Kabuntalan is now being served by Maguindanao Electric Cooperative (MAGELCO). The 11 Barangays of Kabuntalan being served. MAGELCO provided the amounts of cross subsidies for each customer type.

<u>Water Services/Usage</u>

Of the 2,886 households in year 2010, 985 or 34.13% is dependent on shallow well; 159 or 5.51% from deep well; 1,320 or 45.74% from dug well; and the remaining 14.62% is dependent on other type of water supply.

In terms of Level II, there is no water works system in the municipality. Residents are dependent on their own or shared hand pumps (shallow/deep well) or dug well. This is due to the lack of operation and maintenance cost. Some agencies constructing level II water system did not consider allocating funds for the social preparation to strengthen the community on ownership, operation and maintenance of the facility.

On the other hand, residents who can afford to install electrical pump use own/shared faucet for their water supply needs but this is only about 4 percent of the municipality's total household population.

Communication Sector

The municipality has communication facility in Gayonga which is privately owned. Cell Sites Network is present in the area, such as SMART and SUN CELLULAR which are wireless network. Broadcast and Television network reaching the municipality is from the neighboring cities and provinces and even broadcast media based in Metro Manila. Residents can avail Cable TV through the wireless signal and others.

Local Economy such as Employment and Livelihood

The Economic Structure of the municipality is more on agricultural productions which is the major income of the residents. The major agricultural crops existing in the municipality are rice, corn, banana and other vegetables. The annual rice crop has a total volume of 9,616.7 both irrigated and rain feed with corresponding total value of 144,250.5. The corn crop, on the other hand, has a total volume of 2,912.5 with corresponding value of 87,825 annually; banana has a total volume of 405 with a value of 2,025; and other vegetables have a volume of 410.

With respect to the comparison of agricultural crop areas to their productions based on the two consecutive years, the rice variety in the irrigated areas has more productions with the ratio of (area to production) of 3,509 kg. volume is to 731 hectares. While that of the non-irrigated portion has a ratio of 3,900/1,500. The corn productions, on the other hand, have a ratio of 3,150/700 hectare.

Consequently, as the area will increase and the corresponding volume of production shall also increase. In other words, the area is directly proportional to the volume of production.

As of 2010, the total labor force (15 years old and over) in the municipality was 14,510. The employed labor force was registered at 4,314 persons or about 29.70 percent and the unemployed labor force was registered at 10,196 persons or about 70.3 percent of the population 15 years old and over.

e) Pigcawayan

Population and Demography

Its population as determined by the 2020 Census was 72,371. This represented 4.86% of the total population of Cotabato province, or 1.48% of the overall population of the SOCCSKSARGEN region. Based on these figures, the population density is computed at 213 inhabitants per square kilometer or 551 inhabitants per square mile.

Existing Social Infrastructures and Services

- **Education**

Table 24.7-17 Schools by Level, Type, Facilities and Condition

School		Location (Brgy.)	Area Occupied (Ha.)	Type		Facilities and Condition						
				Public	Private	Lab.	Shop	Library	Clinic	Comfort Room	Play-ground	Others (Specify)
Elementary (North District)												
`1	Lampaki Elem. School	Kimarayag, Pig.,Cot.	1 ha.	/		N	N	N	N	P	P	P (Sch. Bldg.)
`2	Tigbawan Primary School	Tigbawan, Pig.,Cot.	.5 ha.	/		N	N	N	N	G	N	-
`3	North Manuangan Elem. School	N. Manuangan, Pig.,Cot.	1.3 has.	/		N	N	N	N	G	N	-
`4	Upper Balogo Elem. School	Anick, Pig.,Cot.	1 ha.	/		N	N	N	N	P	N	-
`5	Tabarangao Primary School	Midpapan II, pig.,Cot.	.25 ha.	/		N	N	N	N	P	P	-
`6	Renibon Elem. School	Renibon, Pig.,Cot.	7.3 has.	/		N	N	N	N		P	-
`7	Presbitero Central ES	Presbitero, Pig.,Cot.	2 has.	/		N	N	P	P	G	P	-
`8	Payong-Payong ES	Payong-Payong, Pig.,Cot.	1 ha.	/		N	N	P	P	P	N	-
`9	Patot ES	Patot, Pig.,Cot.	4 has.	/		N	N	P	P	P		-
`10	New Panay ES	New Panay,Pig.,Cot.	2 has.	/		N	N	P	P	P	P	-
`11	New Culasi ES	New Culasi,Pig.,Cot.	4 has.	/		N	N	P	P	P	N	-
`12	Nagret ES	New Igbaras,Pig.,Cot.	1 ha.	/		N	N	P	P	P	N	-
`13	Midpapan I ES	Midpapan I, Pig.,Cot.	2 has.	/		N	N	P	N	P	N	-
`14	Limatong Learning Ctr. (e-impact school)	Limatong,Kimarayag, Pig.,Cot.	.5 ha.	/		N	N	G	P	G	G	-
`15	Kimarayag ES	Kimarayag, Pig.,Cot.	1.7 has.	/		P	P	P	P	N	N	-
`16	Buluan ES	Buluan, Pig.,Cot.	.75 ha.	/		N	N	P	N	G	N	-
`17	Gallego ES	Malu-ao, Pig.,Cot.	1.4 has.	/		N	N	N	N	P	P	-
Elementary (South District)												
1	A. Mana-ay Primary School	Bulucaon, Pig.,Cot.	.25 ha.	/		N	N	N	N	N	P	-
2	Cabpangi ES	Cabpangi, Pig.,Cot.	2 has.	/		N	N	N	N	P	G	-
3	Capayuran ES	Capayuran, Pig.,Cot.	1.025 has.	/		N	N	N	N	G	G	-
4	Central Panatan Primary School	C. Panatan, Pig.,Cot.	.25 ha.	/		N	N	N	N	P	G	-
5	Manuangan ES	Manuangan, Pig.,Cot.	1.22 has.	/		N	N	N	N	G	G	-
6	Pigcawayan Central ES	Poblacion 1, Pig.,Cot.	4.37 has.	/		N	C	N	P	G	G	-
7	Prado ES	Bulucaon, Pig.,Cot.	1 ha.	/		N	N	N	N	G	G	-
8	Tubon ES	Tubon, Pig.,Cot.	.25 ha.	/		N	N	N	N	P	G	-
9	Upper Baguer ES	Upper Baguer, Pig.,Cot.	.12 ha.	/		N	N	N	N	G	G	-
Elementary (West District)												
1	Balacayon Primary School	Balacayon, Pig.,Cot.	.25 ha.	/		N	N	N	N	N	P	-
2	Banucagon ES	Banucagon, Pig.,Cot.	.5 ha.	/		N	N	N	N	P	G	-
3	Buricain ES	Buricain, Pig.,Cot.	2 has.	/		N	N	N	N	N	G	-

Source: DepEd/High Schools

- **Health Status**

Table 24.7-18 Medical Health Personnel

FACILITY				PERSONNEL					
Barangay	Type of Health Services / Facilities*	Capacity**	Physical Condition	Doctors	Nurses	Midwives	Sanitary Inspectors	Others	Total
	Public								
Poblacion 3	1 RHU (1)		Good	1	4	9	2	3	19
	2								
Poblacion 2	Private								
	1Clinic (3)		Good	3	1	1	2		7
	2Laboratory		Good					2	2

Source: MHO Pigcawayan

- **Transportation System**

Table 24.7-19 Inventory of Roads by System Classification and Type of Pavement

Roads By System Classification	Road Surface Type										
	Right of Way (ROW)	Total Length (KM)	Concrete			Asphalt			Gravel		
			Km	%	C	Km	%	C	Km	%	C
National	30 M	10.3	10.3	2.88	Good	-	-	-	-	-	-
Provincial	15 M	45.832	2.048	4.47	Good	1.4	3.05	Good	42.384	92.48	Good
Municipal	12 M	12.838	2.452	19.1	Good	0.67	5.22	Good	9.716	75.68	Good
Barangay Road	10 M	289.684	1.35	0.47	Good	-	-	-	288.334	99.53	Good
Alley	-	None									
Footpath	-										
Source: Municipal Engineering/MPDC Office, Pigcawayan, Cotabato											

- **Protected Services**

Table 24.7-20 Protective Services by Facilities and Equipment

Types of services	Location	Area* (sq.m)	Number of Personnel	Personnel to Pop'n Ration	Facilities/ Equipment		Condition
					Vehicle	Others	
Police							
Headquarters	Poblacion 3	741.50	35	1:1,628	2	-	Good
Outpost	Balogo	48	2	1:1,130	-	-	Good
Fire Protection							
Headquarters	Poblacion 3	165	9	1:6,711	1	-	Good
Jail Management							
City/Mun. Jail	Poblacion 3	198	7	1:03	1	-	Good
Military Outpost	Simsiman Cabpangi New Panay New Igbaras Central Panatan	150-200 sq.mts. per outpost	- - - - -	- - - - -	1 - - - 1	- - - - -	Good Good Good Good Good

Source: PNP, BJMP, BFP and MLGU

- **Sports & Recreation Sector**

Table 24.7-21 Existing Sports and Recreational Facilities

Barangay	Area	Sports Facilities	Recreation Facilities	Ownership	Physical Condition (Good, Poor, Critical)
URBAN					
1. Poblacion 1	26x14	Basketball court	-	Public	Good
	16x35	Softball		Public	Good
2. Poblacion 2	20x30m	Basketball court	Billiard Hall 3 (Private)	Public	Good
3. Poblacion 3	26x14m	Basketball court	Municipal plaza	Public	Good
	30x12m	Tennis court		Public	Good
	26x14	Basketball Court		Private	Good
	30x12	Tennis Court		Private	Good
	16x35	Softball (3)		Public (2) Private (1)	Good
	9x15	Volleyball		Public (1) Private (1)	Good
RURAL					
4. Anick	26x14m	3 Basketball courts		Public	Good
5. Balacayon	-	-	-	-	-
6. Balogo	15x28m	2 Basketball courts	Billiard Hall	Public	Good
7. Banucagon	20x33m	Basketball court	Billiard Hall	Public	Good
8. Buluan	26x14m	Basketball court	-	Public	Good
9. Bulucaon	20x30m	3 Basketball courts	Billiard Hall (3)	Public	Good
10. Buricain	-	Basketball court	-	Private	Good
	10x15	Volleyball		Private	
11. Cabpangi	-	-	-	-	-
12. Capayuran	20x30m	Basketball court	Pigcawayan Gallera, Nating`s Hill Resort	Public	Good
13. Central Panatan	26x14m	Basketball court	-	Public	Poor
14. Datu Binasing	-	-	-	-	-
15. Datu Mantil	-	-	-	-	-
16. Kadingilan	-	-	-	-	-
17. Kimarayag	14x28m	8 Basketball court	Laguting Resort	5 Public 3 Private	Good
18. Libungan Toreta	20x20m --	Basketball court (2) Volleyball court	-	Public	Good
19. Lower Baguer	-	-	-	-	-

Source: MPDC and BLGU, Pigcawayan, Cotabato

- **Utilities Services Facilities**

<u>Power Supply</u>

Table 24.7-22 Households Served and Un-served by electricity

	Number of Households		Percentage (%)	
	Urban	Rural	Urban	Rural
Served	1822	6515	13.22	47.29
Unserved	167	5274	1.21	38.28
Total	1989	11789	14.44	85.56

Source: CBMS Survey 2009/MPDC Office

<u>Water Services/Usage</u>

Table 24.7-23 Level I Water Supply System by Type and Number of Population Served

Barangay		Total House Holds	Shallow Well			Deep Well		
			No.	HH Pop. No.	Served %	No.	HH Pop. No.	Served %
A.	Urban							
1	Poblacion 1	572	115	439	76.75	-	-	-
2	Poblacion 2	675	140	518	76.74	-	-	-
3	Poblacion 3	770	84	405	52.60	-	-	-
B.	Rural					-	-	-
1	Anick	202	21	157	77.72	-	-	-
2	Balacayon	254	6	106	41.73	-	-	-
3	Balogo	564	129	533	94.50	-	-	-
4	Banucagon	263	24	151	57.41	-	-	-
5	Buluan	243	35	193	79.42	-	-	-
6	Bulucaon	709	99	495	69.82	-	-	-
7	Buricain	377	10	277	73.47	-	-	-
8	Cabpangi	296	13	244	82.43	-	-	-
9	Capayuran	621	164	621	100.00	-	-	-
10	Central Panatan	213	20	213	100.00	-	-	-
11	Datu Binasing	244	10	106	43.44	-	-	-
12	Datu Mantil	200	3	42	21.00	-	-	-
13	Kadingilan	255	10	173	67.84	-	-	-
14	Kimarayag	631	55	367	58.16	-	-	-
15	Libungan Toreta	235	-	-	-	-	-	-
16	Lower Baguer	169	5	70	41.42	-	-	-
17	Lower Pangankalan	222	3	174	78.38	-	-	-
18	Malagakit	170	7	57	33.53	-	-	-
19	Maluao	316	36	296	93.67	-	-	-
20	Matilac	429	10	109	25.41	-	-	-
21	Midpapan 1	478	51	478	100.00	-	-	-
22	Midpapan 2	322	45	144	44.72	-	-	-
23	Molok	213	-	-	-	-	-	-
24	New Culasi	156	22	156	100.00	-	-	-
25	New Igbaras	154	9	71	46.10	-	-	-
26	New Panay	235	15	115	48.94	-	-	-
27	North Manuangan	545	65	467	85.69	-	-	-
28	Patot	376	2	10	2.66	-	-	-
29	Payong-Payong	228	45	115	50.44	-	-	-
30	Presbitero	297	20	42	14.14	-	-	-
31	Renibon	258	1	2	0.78	-	-	-
32	Simsiman	310	12	255	82.26	-	-	-
33	South Manuangan	364	48	271	74.45	-	-	-
34	Tigbawan	219	38	219	100.00	-	-	-

Source: BLGU/MPDC, Pigcawayan, Cotabato

Communication Sector

Table 24.7-24 Communication Services Facilities, Year 2010

Type	Barangay	Ownership	
		Public	Private
Postal services	Pob. 3, Pig.,Cot.	1	
Internet Providers	Pob. 1, Pob. 2.		7
Telephone service provider	Pob. 1, Pig., Cot.		1
Cell sites network	Pob. 1, Pob.3, Presbitero, Balogo, S. Manuangan, U. Baguer		7
Public calling stations	Pob. 1, Pig., Cot.		1
T-Radio	Pob. 1, Pig., Cot.		1
Cable Network Provider	Poblacion 1, Pig.,Cot.		1
PLECCS (Radio Room) and PNP	Poblacion 3, Pig.,Cot.	2	
National Newspapers and Local Tabloids Retailers	Poblacion 2 (Public Terminal), Balogo		3
Money Transfer	Poblacion 1, Poblacion 2		5

Source: Private/Public Companies/Primary Survey/MPDC Office, Pigcawayan, Cotabato

Solid Waste Management

Waste management is much a concern in urban areas more than the rural areas. Thus, the waste possibly thrown in the bodies of water and ended there can be attributed to total waste in main urban area. The contribution to levels of pollution in the river system can be attributed to number of LGUs where it traverses. In the case of Rio Grande de Mindanao, multiple localities drain into the river and thus, contribute to its degradation. Thus, the need for collective effort to address the situation.

The Municipality of Pigcawayan generated 18.6 tons of solid waste per day in year 2010 and 3 tons of these were collected and delivered to disposal site located in Central Panatan. These wastes came from both domestic and commercial sources. Most of these came from the Public Market and the urban barangays of the municipality. There was no hospital, industrial and other sources of waste recorded by the MENRO because the municipality has no hospital and the only industrial establishment operating in the locality are rice mills by which their waste out of milled rice were also recycled for other uses.

Table 24.7-25 Solid Waste Generation by Source, Year, 2010

Source	Types of Waste	Volume of Solid Waste Generated (tons/day)	Volume of Solid Wasted Collected (tons/day)	Disposal methods/treatment facilities	Disposal Site
Domestic	Mixed Wastes	18.6	3	Delivered to disposal site everyday	Central Panatan
Commercial					
Industrial	NONE				
Hospital					
Others					

Source: Pigcawayan CDP, 2019, MENRO

The solid waste that is being collected from the domestic and commercial sources were disposed to controlled dumpsite with 6,696 tons for total municipal waste generated every year that included wastes from 200 households. There were also 52 tons of waste being composted, while, 1,339 tons of wastes were being recycled, 1,805 tons being burned and 3,500 waste being dumped in individual open pit. All in, 13,392 tons of solid waste were being disposed every year through different disposal methods.

Table 24.7-26 Methods of Solid Waste Disposal/Treatment, Year 2010

	Methods	Quantity (Total Municipal solid waste generated	No. of household served	Agency Responsible
1	Collected and disposed to:			
	- Open Dump	none		
	- Controlled Dump	6,696 tons	200	MENRO
	- Sanitary Landfill	none		
2	Composting	52 tons		MENRO
3	Recycling	1,339 tons		MENRO
4	Not Collected:			MENRO
	- Burned	1,805 tons		MENRO
	- Dumped in individual open pit (not burned)	3,500 tons		MENRO
	TOTAL	13,392 tons		

Source: Pigcawayan CDP, 2019, MENRO

Table 24.7-27 Projected Area for Landfill, 2011, 2020

Parameters	2011	2012	2013	2014	2015	2020
• Projected population	64,619	65,996	67,402	68,837	70,303	78,117
• Waste generation	11,760,658 kgs/day	12,011,272 kgs/day	12,267,164 kgs/day	12,528,334 kgs/day	12,795,146 kgs/day	14,217,294 kgs/day
• Area required (has.)	3.5	3.6	3.7	3.8	3.9	4.3
• Total area required	5.25	5.4	5.55	5.7	5.85	6.45
• Area of existing landfill	-	-	-	-	-	-
• Deficit/Surplus (has.)						

Source: Pigkawayan CDP 2019, MENRO

On the other hand, the Municipality of Kabuntalan as per reports provided, needs to improve its proper waste management system. For one, it lacks the waste disposal system and sanitary facilities. And since the municipality is in low-land area, the yearly occurrence of flooding all the more resulted to low agricultural produce of the farmers. As indicated in LGU reports, these seem to be the primordial concern and problem of the constituents of the municipality.

Local Economy such as Employment and Livelihood

Poverty and Displacement

Based on 2012 data, poverty incidence of families in Cotabato rural areas is 34.5%. This is higher than the previous figure in 2009 which is 23.7% only.

Table 24.7-28 Poverty Threshold

INDICATOR Cotabato City	Base Year/Source			
	2003 StatWatch, NSCB Jan. 4, 2008	2006 StatWatch, NSCB Jul. 30, 2008/ July 30, 2010	2009 StatWatch, NSCB Sept. 27, 2012	2012 RSEP 2015
Annual Per Capita Poverty Threshold • All Areas • Urban • Rural	13,805.00	17,335.00	16,520.00	20,568.00
Poverty Incidence of Families • All Areas • Urban • Rural	41.2	38.0	23.7	34.5

Source: Cotabato City CLUP/CDP 2017 updating, CPDO

In the Municipality of Pigkawayan, the implementation of 4Ps by MSWD as indicated in reports, significantly help the disadvantaged families. It is expected that poverty incidence would decline in the coming years. The conditional cash transfer scheme had improved the living conditions of the people, giving opportunities for students to attend to schools and families providing food on their tables.

In Kabuntalan, it was reported that there are adequate programs on social welfare and related services. However, the problems are in the implementation and access. Most of these services do not reach the community due to the problem of accessibility.

(13) Ethnic Minority and Indigenous People

The closest known traditional ancestral domains of the Indigenous People in the study area are those in the Municipalities of Upi, South Upi, and Datu Blah Sinsuat which are inhabited by the Teduray tribe. However due to armed conflict among groups (e.g., AFP vs various armed groups) which affect their communities and further pushed by poverty, some IPs left their homeland to re-settle in some of the towns within the study area. The road alignment is not expected to traverse IP lands and/or communities. The estimated number of IPs in the LGUs under the project area which was secured through interview with various agencies/organizations are presented in Table 24.7-29.

Table 24.7-29 Number of Reported IPs in the Greater Cotabato Area

City/Municipality	Number of reported IPs (year of data)	Remarks	Source of Information and Data
Cotabato City	4,967 (2020)	Around 90% of them are Teduray tribe.	National Commission for Indigenous People, Region 12
Datu Odin Sinsuat	14,170 (2018)		Ministry of Indigenous Peoples' Affairs
Sultan Kudarat	No known significant concentration of IPs (2018)		Froilyn T. Mendoza, Executive Director of the Teduray Lambangian Women Organization, Inc. (TLWO)
Parang	About 1,500 people/300 families (2018)	90% of them are Teduray tribe. Migrated in 1970s at the height of the conflict.	Municipal Planning & Development Coordinator of Parang municipality
Pigkawayan	947 individuals (2020)		National Commission for Indigenous People, Region 12
Sultan Mastura	No known significant concentration of IPs (2018)		Froilyn T. Mendoza, Executive Director of the Teduray Lambangian Women Organization, Inc. (TLWO)

(14) Gender and Children's Right

The Philippines is one of the most developed countries in the field of gender equality. Recognition of the rights of women is widely acknowledged and observed. Generally speaking, gender equality is not really a big concern.

In the context of the project road (MRSR), Pigkawayan LGU noted the decreased of abused women and children due to the strengthening of Barangay Council for the Protection for Children (BCPC) and conducting Parenting Effectiveness Service in the barangays regularly.

Table 24.7-30 Historical Number of Population Served by Type of Clientele System

Type of Clientele	Previous Years			2010
	2007	2008	2009	
Day Care Children	1,238	1,178	1,073	1,076
Disadvantaged Families	394	370	474	383
Abused Children and women	0	17	63	16
TOTAL	**1,632**	**1,565**	**1,610**	**1,475**

Source: Pigkawayan CDP Sectoral Studies, 2017, MPDO

In Kabuntalan, there is no GAD/women's desk within the PNP to address women and children's concern. The LGU is informed of programs for the marginalized groups, however these are not tapped because there are no organized groups representing these sectors and if there is, they are not functional. There is a need therefore to organize this group. Moreover, the municipality does not implement any program for women and children.

(15) Land Acquisition and Resettlement

There have been various experiences of land acquisition and resettlement in and around the project areas including projects under safeguard policies of Asian Development Bank (ADB) and JICA's Environmental and Social Considerations. Procedures of land acquisition and resettlement follow the country system of the Philippines.

There may be identified zones dedicated to accommodating housing needs due to population growth and backlog. Yet housing sites for displaced population due to government-initiated projects continue to obtain lands in agricultural areas. A detailed inventory of lands and landowners should be undertaken to precisely locate suitable sites especially for socialize housing.

For this study, the number of affected houses and other structures within the road alignment were counted through google earth image following the prepared kmz file of the proposed MRSR alignment. An estimated of 22 affected structures were identified. The number of affected structures shall be validated during the F/S level, crops and trees shall then be inventoried as well.

Table 24.7-31 shows the summary of possible affected houses/structures per municipality along the MRSR alignment. Figure 24.7-12 show the settlements along the MRSR alignment corresponding to the covering municipalities with coordinates. Impact in land acquisition is foreseen; majority are agricultural lands.

Table 24.7-31 Summary of Possible affected Structures

Municipality	No. of Affected Houses/Sructures
Cotabato City	5
Sultan Kudarat	1
Kabuntalan	0
Northern Kabuntalan	11
Pigcawayan	5
Total	**22**

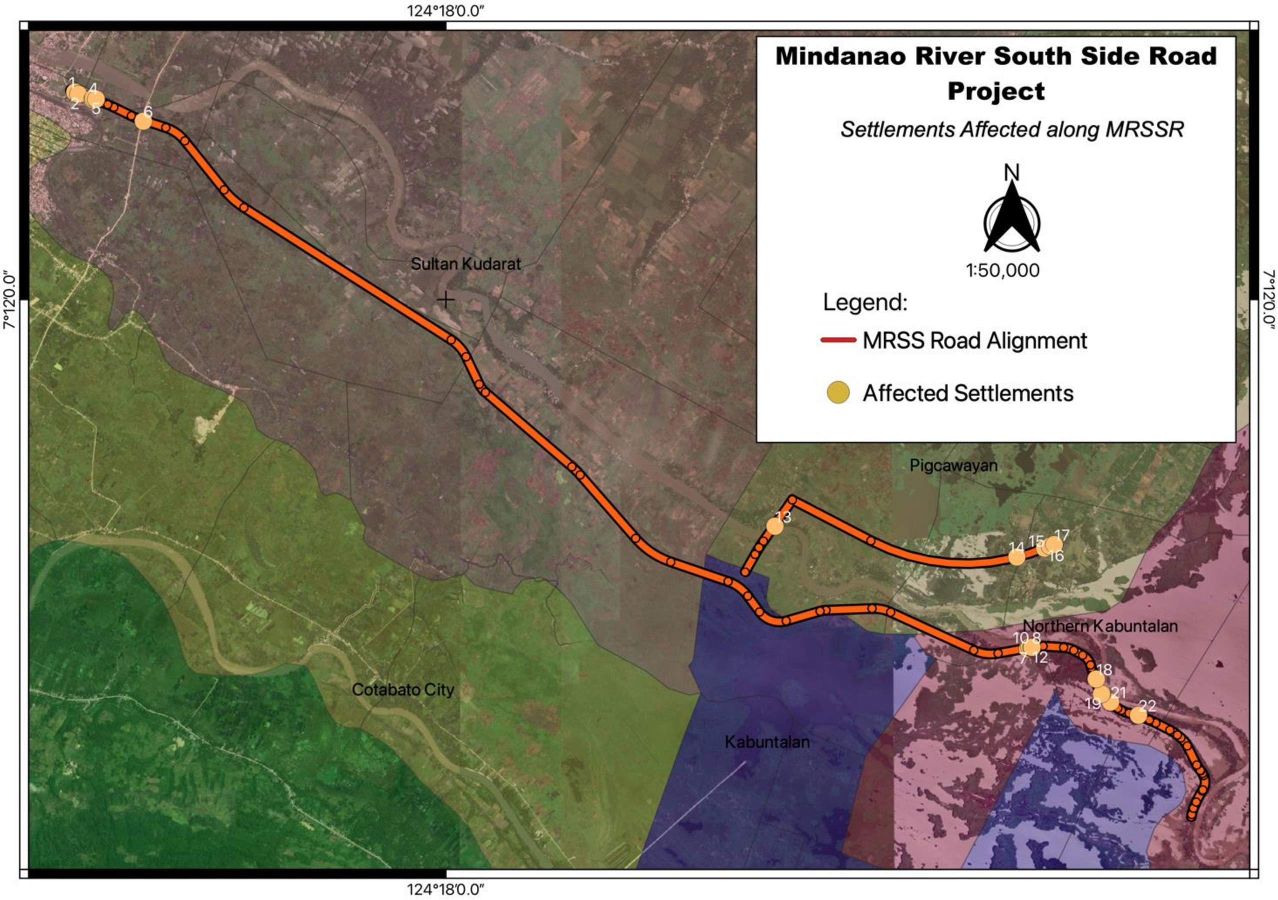
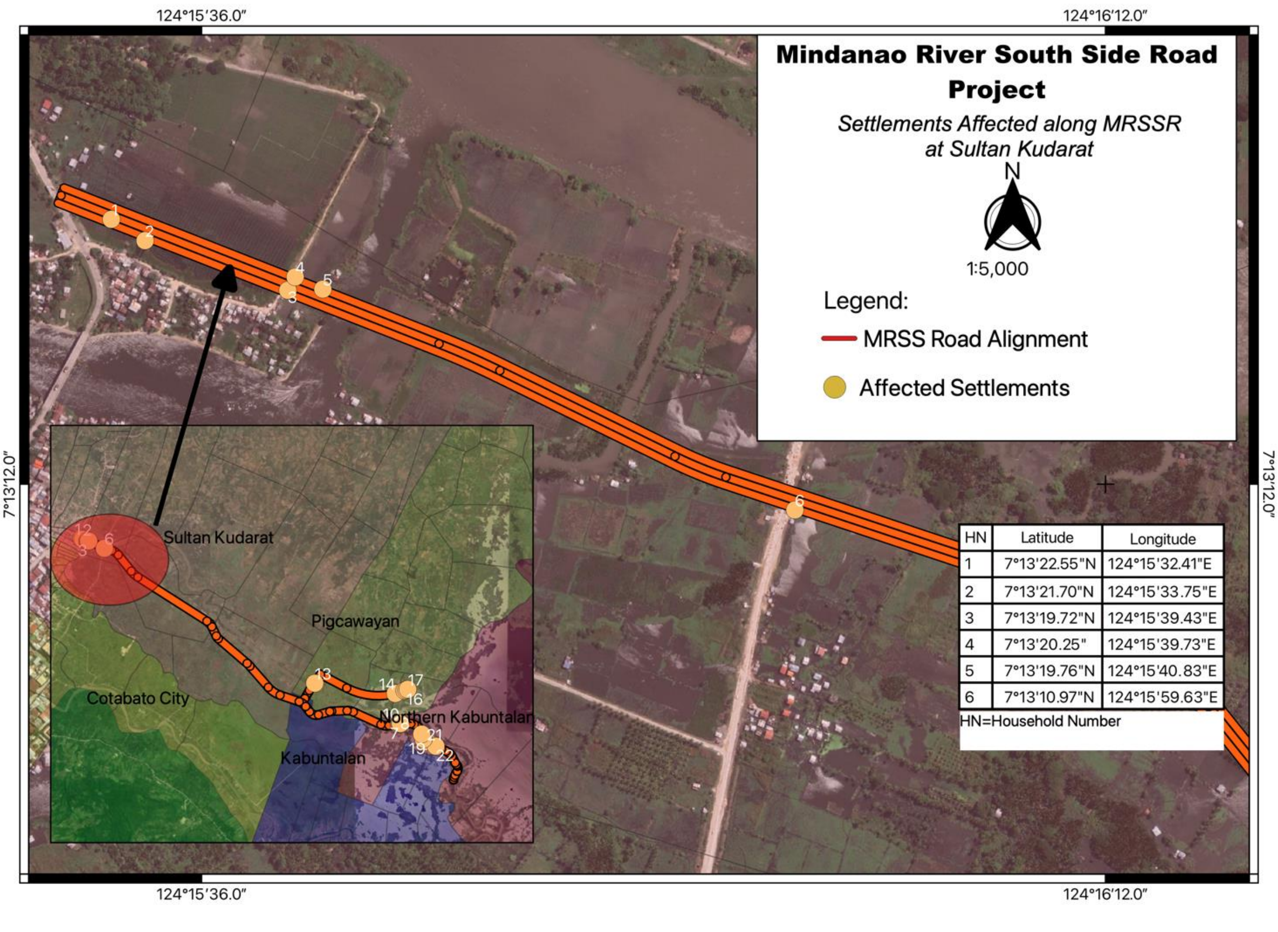


Figure 24.7-12 Houses/Structures along MRSR Alignment



HN	Latitude	Longitude
1	7°13'22.55"N	124°15'32.41"E
2	7°13'21.70"N	124°15'33.75"E
3	7°13'19.72"N	124°15'39.43"E
4	7°13'20.25"	124°15'39.73"E
5	7°13'19.76"N	124°15'40.83"E
6	7°13'10.97"N	124°15'59.63"E

HN=Household Number

Figure 24.7-13 Houses/Structures along MRSR Alignment in the municipality of Sultan Kudarat

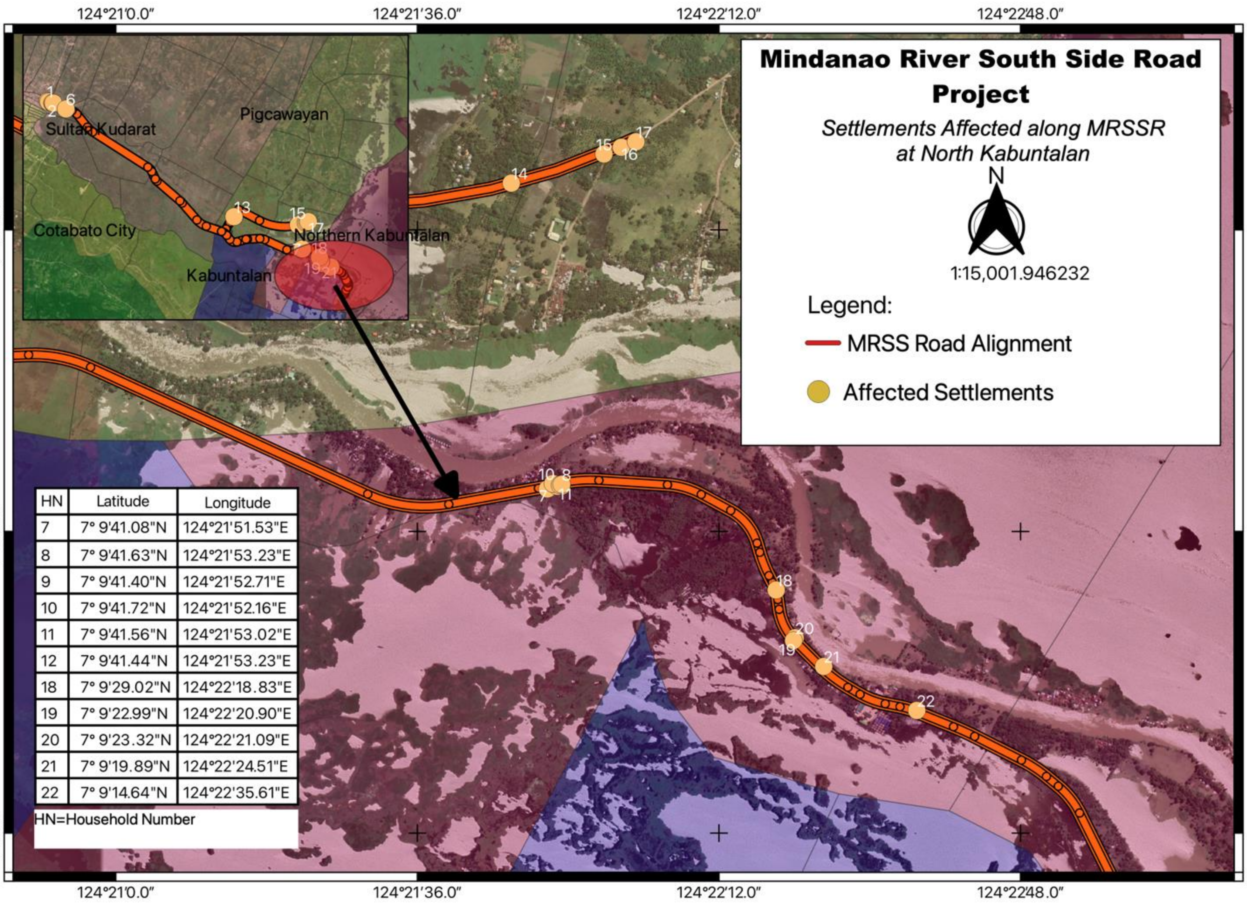


Figure 24.7-14 Houses/Structures along MRSR Alignment in the municipality of Northern Kabuntalan

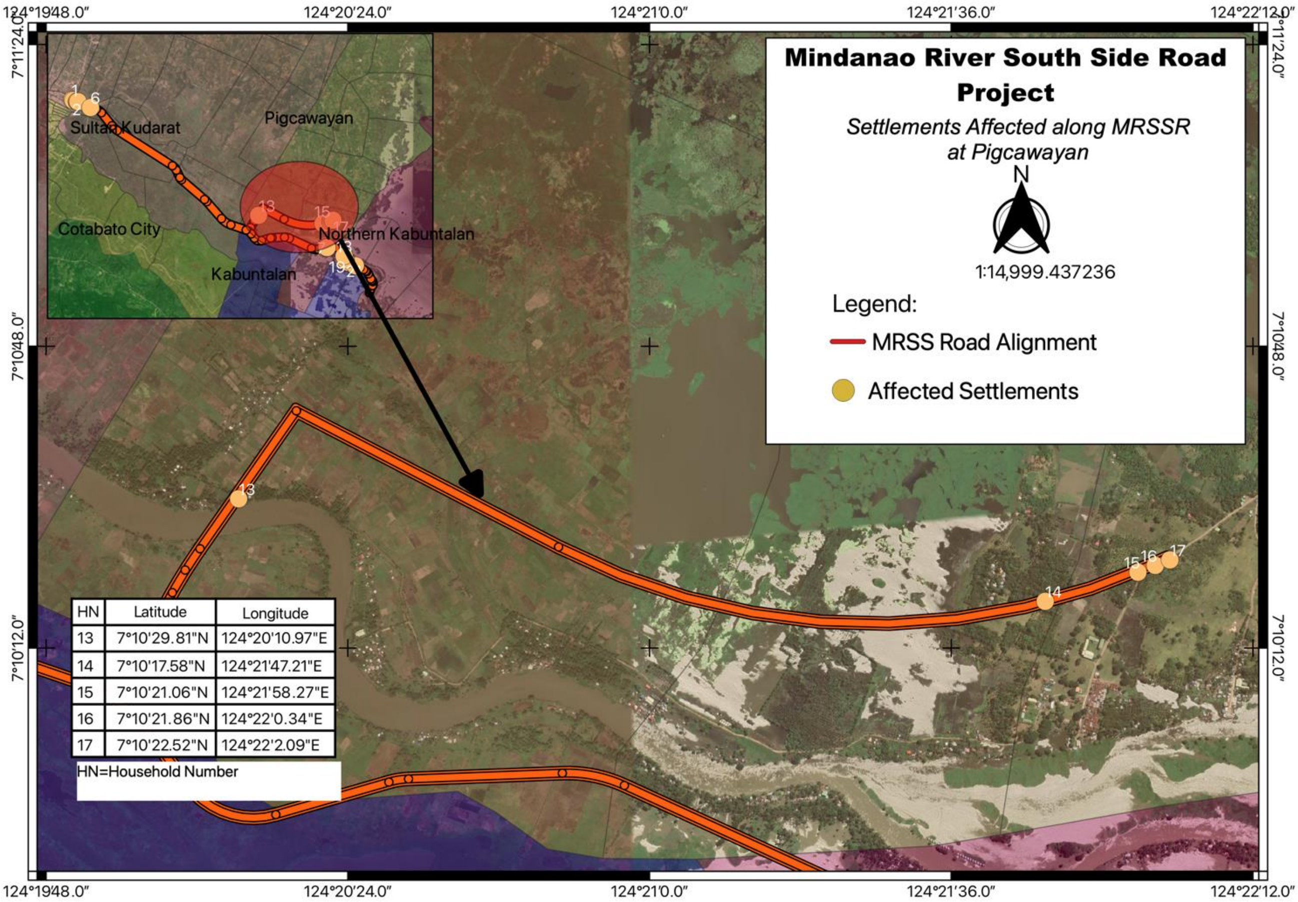


Figure 24.7-15 Houses/Structures along MRSR Alignment in the municipality of Pigcawayan

24.7.5 Stakeholders Meeting

(1) Key Informant Interview (KII)

There were two levels of consultation meetings held with the LGUs to explain the project and seek their support. The first level was consultation with the municipal officers under the influence of the road projects. These LGUs are: Cotabato City, Sultan Kudarat, Kabuntalan, Northern Kabuntalan and Pigcawayan. These was held from June 2021 to September 2021. All of them expressed their support and they would like to continue the close coordination in the next phase of the project.

The second level was consultation meetings with the officials of the 27 barangays under the influence of the road project. This activity was an opportunity to explain the project including its alignment, seek their support, understand their socioeconomic condition among others. Result of this consultation meeting and survey is discussed in Section 24.2.1 of this Chapter. Some of the photos during these meetings are shown in Figure 24.7-16. The perceived benefits by the communities along the influence area of the road project is also presented in the table below. All interviewed barangay officials and ordinary people expressed their support to the project believing that this road will bring development in their barangay. Similarly, since the lack of road connecting their communities to Cotabato City is impacting their daily lives such as difficulty of bringing patients to hospital, difficulty of bringing their agricultural products to market among others, they are hopeful that once the road is built, some of their concerns will be addressed by this project.

On the other hand, no individual consultation was held with the different Ministries of the BARMM to introduce the road project due to difficulty of arranging schedule. However, the road project was introduced to the BARMM officials led by the Chief Minister on April 27, 2021 during the presentation of the Interim Report. During the said meeting, the BARMM government expressed their appreciation that the three projects were selected for the Pre-Feasibility Study. Aside from this stated support, they also requested to consider including in the action plan study the solid waste project since this is one of the serious issues facing the city.

Note: Upper and lower left: LGU Sultan Kudarat; Upper and lower right: LGU Northern Kabuntalan

Note: Upper and lower left: LGU Pigcawayan; Upper and lower right: LGU Mother Kabuntalan

Figure 24.7-16 Consultation Meetings with Municipal and barangay officials to get their feedback on the proposed Mindanao River Southside Road

Table 24.7-32 Benefits of the Road Project perceived by the barangay people

Barangay	Social Services	Economic Benefits	Other Benefits
Sultan Kudarat Municipality			
Bulibod	• Faster access in cases of emergency.	• Better access in importing and exporting goods.	
Nalinan	• Better access to healthcare and education.	• Better access to markets. For urbanization/ development of our barangay	
Kakar	• Faster access to healthcare and in cases of emergency.	• The road may serve as a farmto-market road which will lead to more convenient access to markets and in importing and exporting of goods. The road will enable new establishments and warehouses since the transportation costs won't be doubled. From the previous truck and pump boat costs, the transportation costs for pump boats may be eliminated.	
Kapimpilan	• Better access to education. Better access to emergency and healthcare. •	• Better access in importing and exporting goods.	

Barangay	Social Services	Economic Benefits	Other Benefits
Katidtuan	• Safer and more convenient travel. • It will be helpful in accessing better education and healthcare.	• It will allow accessibility to the community like potential investors, government agencies, NGOs, and other groups. • This will lessen the cost transport costs since travel time will be reduced, which will eventually result to higher profit. • Better access to markets.	
Katamlangan (Matampay)	• Roads are relevant especially in cases of emergency.	• For convenience: a truck may be used as mode of transportation for the products of the barangay. From the travel time of 30-40 minutes using a pump boat, a truck may deliver it within 15-20 minutes.	
Maidapa	• Good quality education will continue in the barangay since teachers and students can go to school much easier.	• It will increase the volume of harvesting. • It will help in the exchange of products from one barangay/ municipality to another.	
Kabuntalan Municipality			
Gambar	• Better access to healthcare and education. • Faster response in case of emergency.	• Better access to markets.	
Ganta	• Better access to healthcare and education.	• For urbanization. • There's a market every Thursday in the barangay. If a road is built, there might be more sellers going to the market. This will also be convenient for the merchants to travel and in bringing their products.	
Katidtuan	• Better access to healthcare and education. • Faster response in case of emergency.	• Better access to markets. For urbanization.	
Matilak	• Better access to education. Better access to emergency and healthcare.	• Better access to markets on importing and exporting goods • For urbanization.	The current means of transportation in the barangay is the pump boat. If a road is built, they may be able to reroute their products and other activities to the road. This will also be more convenient for the people.
Pagalungan	• Better access to education. • Better access to emergency and healthcare.	• Better access to markets on importing and exporting goods. • For urbanization.	
Payan	• Better access to education. • Better access to emergency and healthcare.	• The travel time deliver the goods and the transport cost	

Barangay	Social Services	Economic Benefits	Other Benefits
		of the products will be reduced.	
Pedtad	• More convenient to travel. • Better access to education. • Better access to emergency and healthcare.	• Better access to markets on importing and exporting goods.	
Poblacion	• Better access to education. • Better access to emergency and healthcare.	• Better access to markets on importing and exporting goods.	
Pagalungan	• Better access to education. • Better access to emergency and healthcare.	• Better access to markets on importing and exporting goods.	
Northern Kabuntalan Municipality			
Guiawa	• Better access to hospitals, schools, other barangays, etc.	• This will allow the barangay to have access on trading for the self sustenance of livelihood of the people. This will encourage urbanization of the barangay and the province.	• This will help improve the peace and order in the barangay.
Kapimpilan	• Students can go to school safely and conveniently. • Emergency situations will be addressed faster.	• Better access to markets and in importing and exporting products. • For urbanization.	
Libungan	• Better access to education. • Better access to emergency and healthcare.	• Roads will eventually lead to urbanization, welcoming new businesses. This will allow import and export of goods. Lowers cost of goods since transportation costs will be reduced significantly.	• The road may serve as dike to control flooding.
Tumaguinting	• Better access to hospitals, schools, other barangays, etc.	• This will allow urbanization of the barangay.	
Pigcawayan Municipality			
Balacayon	• Better access to healthcare, education, and rescue in cases of emergency.	• The transportation cost for delivering the products from the farm to the market will be reduced.	
Datu Mantil	• Better access to schools: Schools had been damaged due to earthquake. • Better access to hospitals: Pregnant women cannot give • birth at their birthing clinic since it lacks equipment.	• It will help the farmers in the barangay to conveniently import and export their products.	
Kadingilan	• The road will be convenient especially for the commuters.	• The road may serve as farmto-market road.	
Libungan Torreta	• Convenient and faster for travel.	• The road will enable investors and panels to enter the barangay. As of now, panels are entering only up to barangay Simsiman.	

Barangay	Social Services	Economic Benefits	Other Benefits
Lower Pangangkalan	• The road will provide faster access in cases of emergency. Some residents in need of immediate treatment are brought to the hospital using the pump boat but dies during the travel time. With the provision of the road, these incidents may be prevented.	• The cost of goods in the barangay will decrease since the transportation costs will be reduced significantly. Suppliers can directly sell their products by going to the barangay.	
Matilac	• Better access to healthcare, education, and rescue in cases of emergency.	• The urbanization of the barangay will help in importing and exporting goods.	
Upper Pangangkalan	• Emergency responses will be faster. • Better access to education wherein modules can easily be delivered to students.	• With a road, there can be access to different types of transportation. • It can improve the promotion of agricultural products mainly by imports and exports.	

Source: JICA Study Team, 2021

(2) Stakeholders Meeting (SHM)

This study so far undertook two Stakeholders Meetings. Of the two, the 2nd Stakeholders Meeting has relevance to the West Diversion Road. During the said meeting, the three candidate projects for action plan study were part of the presentation. Hence opinions from the stakeholders were received. It was held on 30 March 2021 at Pagana Kutawato Native Restaurant, Cotabato City. It was attended by a total of 76 participants (male 50 and female 26).

Table 24.7-33 Opinions and Answers

No.	Comment, Questions and Suggestion	Answers
1	**Q&A Part I** **Question:** Mr. Pete Marquez (Governor of PCCI for Cotabato City and Maguindanao) – Urban Utility Group to Mr. USUI: It was said that there is no law governing SEA in the Philippines which could be a hindrance to the implementation of the projects under the study, In the absence of such SEA law, would this not affect the plans and their implementation?	**Answer:** JST Tokyo: At the moment there is no SEA Law in the Philippines, but since this Study is funded by JICA we need to follow the requirements set by the JICA in 2010. Other donors also require the conduct of SEA. Doing the SEA allows us to identify possible environmental impacts much earlier and comply with donor requirements.
2	**Question:** Rommel Pausal – City Assessor: In the absence of a SEA law in the Philippines, what is the best option to comply with the requirements of JICA and other donors, as well as ensure environmental protection for Greater Cotabato City	**Answer:** JST Tokyo: That is a particularly important question. SEA is like an early-stage instrument to consider matters like policies, plans, and programs. There are good Philippine laws on EIA. Without SEA, it is sometimes very difficult to identify negative impacts that could confront you later at the project stage, more difficult to deal with. Thus, better to do SEA first to look at the entire life of the project and use this SEA idea or findings to conduct EIA. This is how we ensure addressing environmental considerations for the project.
3	**Question:** Nash Maulana – (Writer for the Manila Standard and Mindanao Cross) The Cotabato City port at Timako is near a coral reef, in an open sea, and it is also vulnerable to tsunami. How does the study address these concerns?	**Answer:** JST Tokyo: The City Port is a project of the Philippine Ports Authority and they have conducted the Feasibility Study. At the moment, we have yet to conduct a detailed EIA for the Cotabato Port at Timako, but it will be covered by the SEA. With the SEA, we think of environmental considerations such as the ecosystem, among others, Detailed study of possible environmental impacts on specific projects is done through the EIA
4	**Question:** Roy Fiesta - Environment Group: City Agriculture Office Head. On the proposed land use, the agricultural sector is one of the most affected	**Answer:** JST Tokyo: Cotabato City Government should promote land policies to protect agricultural lands. This is kind of

No.	Comment, Questions and Suggestion	Answers
	sectors, did the Study considered ways to avoid/lessen conversion of agricultural lands?	difficult since there is a need to balance the requirement of land to support the development and then the intent to protect agricultural land. **Additional input:** Engr. Rendon: The expansion plans of the city had already been discussed when we are preparing the CLUP. Most developments are to be located inside the resettlement area that will be protected from tsunami and agricultural lands and fisheries are outside that area, thus, fewer numbers of people engaged in agriculture will get affected.
5	**Suggestion/Recommendation:** Pete Marquez – Utility Group: Cotabato City is known to be a city of rivers and creeks; we could include these water resources in the planning for transport and tourism	**Response to Pete Marquez:** Adela Fiesta (CPDO): The utilization of water bodies had already been considered There are specific projects for tourism development, but we are yet still searching for a safer place where it could be placed.
6	**Question:** Edwin Fernandez- Utility Group: On the Institutional framework, it appears that the private sector is not included in the structure, are we not considering (People's Organization) PO's and (NonGovernment Organization) NGO's in the planning and implementation of the components of the studies.	**Answer:** JST Tokyo: For this study, the formal consultation with the NGOs and business sector is through the SHMs. We also understand that the City Government is in constant touch with the private sector.
7	**Q&A Part II:** **Suggestion:** Adela Fiesta to JST Tokyo: Traffic congestion is mainly caused by wrong parking, houses along the roads, wrong placement of loading/unloading in some schools; We need to put an emphasis on policies to address these obstructions.	
8	**Suggestion:** Badrudin Ali: On the approval of the implementation for the opening of traffic routes in Cotabato City. I noticed the traffic congestion in Cotabato City, particularly along Sinsuat Avenue. I suggest that the City Government implement the	**Answer:** JST Tokyo: Good idea. Noted

No.	Comment, Questions and Suggestion	Answers
	approved traffic routes to lessen vehicles passing through Sinsuat Avenue.	
9	**Suggestion:** Edwin Fernandez: Could you consider putting a skyway along Sinsuat Avenue?	**Response:** JST Tokyo: It may be too early for such an idea. Skyway/flyovers can be a 2nd phase response after we exhaust options like widening the roads and improving the flow of traffic
10	**Question:** Nash Maulana: Is there a demarcation study to consider the separation of routes for Cotabato Port and Polloc Port? Or how it can potentially connect? Polloc, Cotabato, Zamboanga, Manila.	**Answer:** JST Tokyo: We have not gone to that extent yet. Initially, Cotabato port is for the Cotabato area while Polloc is a regional port – to serve a larger area
11	**Suggestion:** Pete Marquez to LGU: Parking is restrictive, this affects the business sector and buyers now prefer other areas like Midsayap. Parking areas need to be established, as business parking structures	**Response to Pete Marquez:** JST Tokyo: It is a difficult balancing act to cater to the interest of the business sector and the transport sector – the solution could be promoting a parking business. Perhaps private investors can use lands that are not yet utilized by owners for this purpose
12	**Recommendation from Water District:** Asst. GM Villarma: Roads are important to Water District – what about the West Diversion Road, will it also be able to help the Metro Cotabato Water District (MCWD) improve its distribution system?	**Response:** JST Tokyo: Yes, for your information, the route shall cross along the Tamontaka river and it will connect the City to Datu Odin Sinsuat town, through the Southern Philippines Development Authority (SPDA) village and a bridge over the Rio Grande will link the City to Sultan Mastura town
13	**Q&A Part III** **Question:** Engr. Crisanto Saavedra: There is a need to update the data on the plan. Data on solid waste, the daily collection seems to be incomplete – we have these data now. We now have the Materials Recovery Facilities (MRFS) in all barangays – though some need to be completed. We also have a strategy to turn solid waste into fertilizers, this is under negotiation with a proponent. In addition, the presentation slides show a proposal for a sanitary landfill, what is the proposal of the JST, to place it outside or inside Cotabato City considering it is below sea level?	**Answer:** JST Tokyo: Please provide updates. Not yet sure where it is the best area to place the sanitary landfill, information on Disaster Risk could help. We believe the SLF will be in the surrounding towns, but we still need to do some investigation to validate this option/idea.

No.	Comment, Questions and Suggestion	Answers
14	**Question:** Engr. Crisanto Saavedra: On the septic tanks – We can mandate the construction of proper septic tanks when firms or households apply for business permits or construction permits	**Answer:** JST Tokyo: the suggestion is well taken
15	**Suggestion:** Badrudin Ali: on the water system, members of the Integrated Transport Group of Cotabato City Urban settlers in Kalanganan 2 applied for the water connection and it was expensive. Perhaps, MCWD can improve its distribution system in the area to lessen the cost of the water connection to Bubong area residents.	**Response:** JST Tokyo: That is a good suggestion that the MCWD may consider
16	**Q&A Part IV** **Question**: Mr. Ismael Tolentino: What will be the part of the BARMM in implementing all of these programs/projects?	**Answer:** JST Cotabato City. The aspects of the final implementation have not yet been finalized. This is a matter that can be addressed later by the Philippine government or those with authority on the subject.
17	**Question:** Nash Maulana: on the proposal to use Solar panels to augment the supply of electricity, there is a need to consider the possibility of having power surges due to lightning that can strike the system, Control system, service the current technology. Technology has evolved – a recent device has a KW meter. Did the JST already consider this possible problem?	**Answer:** JST Tokyo: Solar panels can be damaged by lightning. It really depends on the areas that have thunder and lightning. If the area does not have that much weather disturbance, then the use of solar panels is desirable. We will consider your input.
18	**Question:** Architect Rebecca Hagad: Did this Study for improving Cotabato City's power sector consider renewable energy; solar, wind, or hydro?	**Answer:** JST Tokyo: The Study is focusing on improving the supply and distribution of power. We can also look at renewable energy, like solar energy being considered by MAGELCO. We could study if there is a potential for tapping renewable energy in Greater Cotabato City.

Source: Stakeholder Consultation, 2021, JICA Study Team

24.7.6 Legal and Institutional Framework of Environmental and Social Considerations

Laws and Regulations related to environmental and social issues in the Philippines are summarized in Chapter 7 of this report. Based on both legal frameworks in Philippines (DAO 30 s. 2003 & EMB MC No. 005 July 2014) and the JICA Guidelines for Environmental and Social Considerations, April 2010 (hereinafter, "JICA Environmental Guidelines"), Categorization of MRSR Project is estimated as follows:

(1) Categorization of EIA in line with JICA

Each project is classified by JICA into one of the following Environmental Categories based on the magnitude of its potential impact on the environment or society. In other words, the category indicates the level of Environmental and Social Considerations required.

Table 24.7-34 JICA Environmental Categories

Categories	Description
Category A	The project is likely to have significantly adverse impacts on the environment or society. A project with a wide range of impacts, impacts that are irreversible, complicated, or unprecedented, and impacts that are difficult to assess. A project for a sector that requires special attention (e.g., a sector that involves large-scale infrastructure development), involves activity that requires careful consideration (e.g., large-scale involuntary resettlement), or takes place inside or adjacent to a sensitive area (e.g., protected natural habitat).
Category B	The project may have adverse impacts on the environment or society, but these impacts are less significant than those of Category A projects. These impacts are site-specific; few, if any, of them are irreversible; in most cases, they can be mitigated more readily than Category A projects. Responsibilities of the project proponents include the planning and monitoring of necessary ESC activities. ESC procedures such as Initial Environmental Examination and stakeholder participation may be required, depending on the scale and nature of the adverse impacts.
Category C	The project is likely to have minimal or no adverse impact on the environment or society.
Category FI	JICA provides funds to a Financial Intermediary, which in turn implements sub-projects that may have adverse impacts on the environment or society, but these impacts cannot be identified in detail prior to JICA's approval. If there is a sub-project that can be categorized as Category A, it needs to go through the same procedure as a Category A project including JICA's environmental review and information disclosure prior to its implementation.

Source: The Basics of Environmental and Social Considerations (Introduction to the JICA Guidelines for Environmental and Social Considerations)

(2) Categorization of EIA in line with PEISS

Every proposed project or undertaking which is projected to have significant adverse impact to the quality of the environment is covered by the Philippine EIS system. This includes proposed major expansion, rehabilitation, and/or modification of existing projects as well as resumption of projects that have stopped operations for a prolonged period. (EMB Memorandum Circular No. 005 July 2014 amending Section 2.1 of the Revised Procedural Manual for DAO 2003-30). To determine coverage, proposed projects or undertakings shall be screened according to the following categories in Table 24.7-35, Philippine EIS System Environmental Categories and Table 24.7-36 for Environmentally Critical Area (ECA) Categories.

Table 24.7-35 Philippine EIS System Environmental Categories

Categories	Description
Category A	Projects or undertakings which are classified as environmentally critical projects (ECPs) under Presidential Proclamation No. 2146 (1981), Proclamation No. 803 (1996), and any other projects that may later be declared as such by the President of the Philippines. Proponents of these projects implemented from 1982 onwards are required to secure Environmental Compliance Certificate (ECC).
Category B	Projects or undertakings which are not classified as ECP under Category A, but which are likely deemed to significantly affect the quality of the environment by virtue of being located in Environmentally Critical Area (ECA) as declared under Proclamation 2146 and according to the parameters set forth in the succeeding sections. Proponents of these projects implemented from 1982 onwards are required to secure an ECC.
Category C	Projects or undertakings not falling under Category A or Category B which are intended to directly enhance the quality of the environment or directly address existing environmental problems.
Category D	Projects or undertakings that are deemed unlikely to cause significant adverse impact on the quality of the environment according to the parameters set forth in the Screening Guidelines. These projects are not covered by the Philippines EIS system and are not required to secure an ECC. However, such non-coverage shall not be construed as an exemption from compliance with other environmental laws and government permitting requirements.

Source: EMB Memorandum Circular No. 005 July 2014 Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippines EIS System
JICA Study Team, 2021

Table 24.7-36 List of ECA Categories

No.	ECA Category
1	All areas declared by law as national parks, watershed reserves, wildlife preserves, sanctuaries
2	Areas set aside as aesthetic potential tourist spots
3	Areas which constitute the habitat of any endangered or threatened species of Philippine wildlife (flora and fauna)
4	Areas of unique historic, archaeological, or scientific interests
5	Areas which are traditionally occupied by cultural communities or tribes
6	Areas frequently visited and/or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.)
7	Areas with critical slopes
8	Areas classified as prime agricultural lands
9	Recharged areas of aquifers
10	Water bodies characterized by one or any combination of the following conditions: tapped for domestic purposes; within the controlled and/or protected areas declared by appropriate authorities; which support wildlife and fishery activities
11	Mangrove areas characterized by one or any combination of the following conditions: with primary pristine and dense young growth; adjoining mouth of major river systems; near or adjacent to traditional productive fry or fishing grounds; areas which act as natural buffers against shore erosion, strong winds and storm floods; areas on which people are dependent for their livelihood.
12	Coral reefs characterized by one or any combination of the following conditions: With 50% and above live coralline cover; Spawning and nursery grounds for fish; Act as natural breakwater of coastlines

Source: EMB Memorandum Circular No. 005 July 2014 Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippines EIS System
JICA Study Team, 2021

(3) Project Threshold Coverage and Categorization

According to EMB Memorandum Circular No. 2014-005 otherwise known as Guidelines for Coverage Screening and Standardized Requirements under the Philippine Environmental Impact Statement system (PEISS), the proposed MRSR road alignment project falls under the Category B, as categorized under Project No. 3.4.1 of Annex A (Project Thresholds for Coverage Screening and Categorization) of the same revised guidelines.

Table 24.7-37 Project Threshold for Coverage Screening and Categorization under PEISS

Project/ Description	Covered (Required to secure ECC)			Not covered (may secure CNC)	Project size parameters
	Category A: ECP	Category B: Non-ECP		Category D	
	EIS	EIS	IEE Checklist	PD (Part I only)	
3.4.1 Road, new construction -Road 1 = 17.5km Road 2=v4.5km	National Road: ≥ 20km (length w/ no critical slope) OR ≥10km (length w/ critical slope)	Provincial Roads & other Types of Roads: ≥ 20km (length w/ no critical slope) OR ≥10km (length w/ critical slope)	All types of roads: > 2km but <20km (length w/ no critical slope) OR >2km but <10km (length w/ critical slope)	≤ 2 km	

Notes:
ECC – Environmental Compliance Certificate
CNC - Certificate of Non-Coverage
PD – Project Description
IEE - Initial Environmental Examination
EIS – Environmental Impact Statement
ECP - Environmentally Critical Project
ECA- Environmentally Critical Area

Source: EMB Memorandum Circular No. 005 July 2014 Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippines EIS System
JICA Study Team, 2021

Based on the project threshold for coverage screening and categorization, the proposed road project falls under Category B which is required to secure an ECC. An Environmental Impact Statement (EIS) Report shall be prepared and submitted to DENR-EMB for evaluation. Public consultation and baseline social and environmental studies are required to be conducted within the affected areas as requirements in the preparation of EIS report.

In terms of ECA category, the proposed MRSR is considered as non-ECA project because it will not traverse any protected area and not within the Ligawasan Marsh. MRSR will not encroach any ancestral domain or CADT area, and it is not covered by any Key Biodiversity Area.

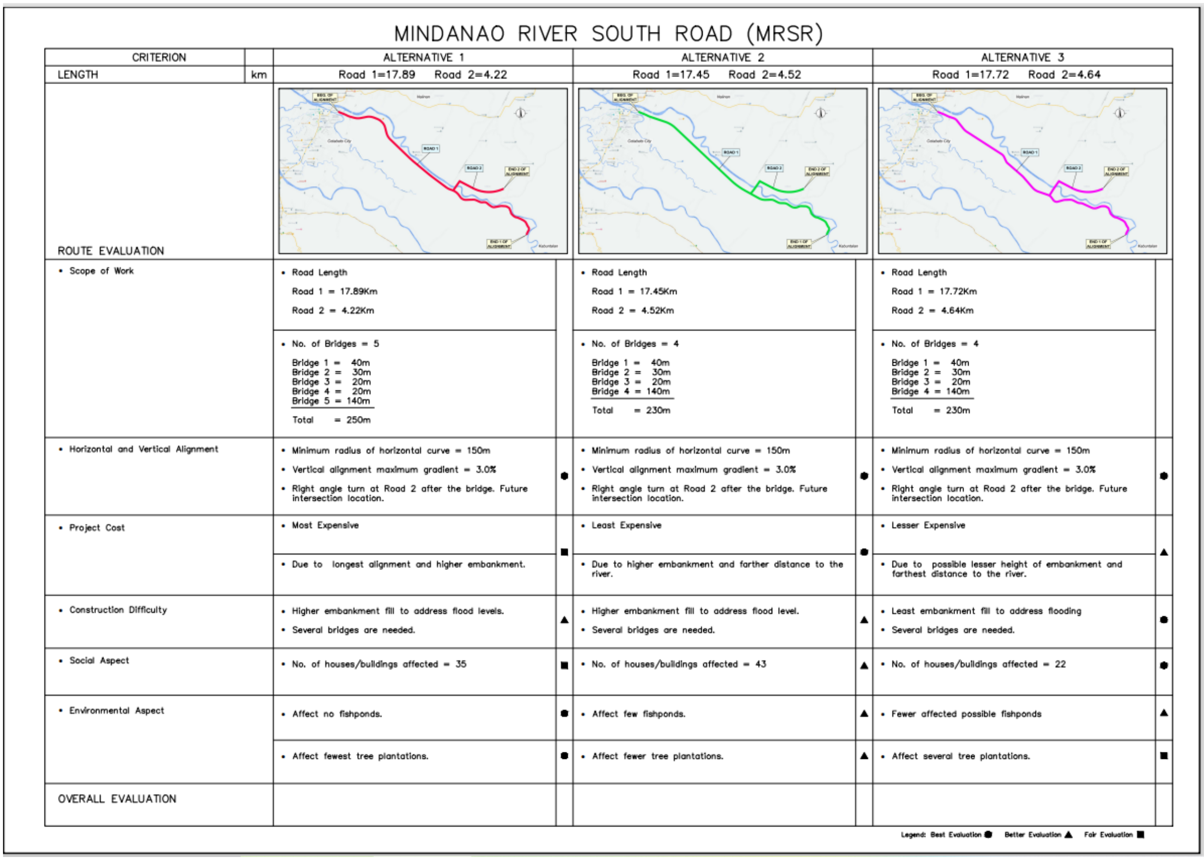
Categorization shall be further studied during the Feasibility Study stage after having firm understanding of the project's impact based on socioeconomic and engineering surveys.

Table 24.7-38 Initial Project Coverage and Categorization based on PEISS and JICA

Project Component	Location	Category		ECA Category
		PEISS	JICA	
West diversion road about 17.5 km length (new road)	1. DOS 2. Cotabato City 3. Sultan Kudarat 4. Sultan Mastura 5. Parang	B	B	None

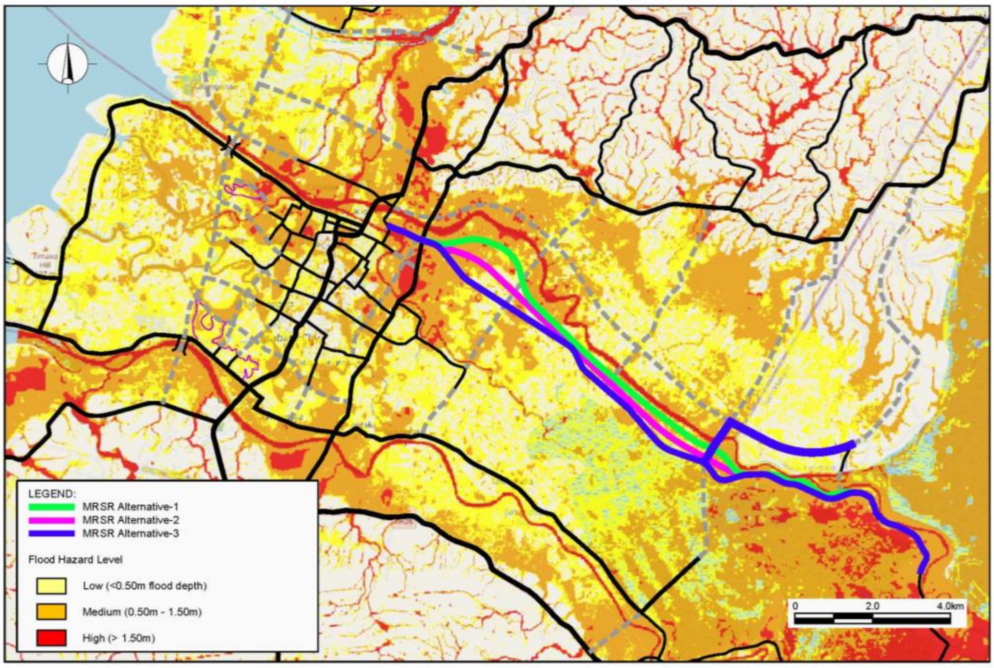
(4) Alternative Comparison

Discussion of comparison for alternative designs of MRSR Project is presented in Figure 24.7-17. In terms of social impact, Alternative 1 has the highest impact in terms of houses and buildings, with 35 structures affected. Alternative 2 affects 43 structures, while Alternative 3 affects 22, the least in terms of impact.



Source: JICA Study Team, 2021

Figure 24.7-17 Alternative Designs



Source: JICA Study Team, 2021

Figure 24.7-18 Road Alignments (Alternatives 1-3)

24.7.7 Scoping and ToR for Environmental and Social Considerations Surveys

(1) Scoping

Scoping means choosing alternatives for analysis, a range of significant and potentially significant impacts, and study methods. ✓ mark is applied for environmental items which will be affected by the project or cannot be decided without additional surveys. Scoping is executed for different phases of pre-construction/construction and operation in each environmental item. Items without ✓in both two phases are not the target of following survey and evaluation if there are enough reasons that the items will not be affected by the project. Following table shows the result of scoping for MRSR.

Table 24.7-39 Result of Scoping for MRSR

No	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
1	Air Quality	✓	✓	[CS] Construction vehicles including fuel-fed machineries/equipment may cause air pollution temporarily during road construction. [OS] There might be some kind of impact on air quality in the area, unlike before when there's no road. The project when fully operated, might cause mobile emissions/pollutions coming from the vehicles. Another consideration is the volume of vehicles that will pass the new road as this will serve as new access to municipalities in the direction of Liguasan Marsh.
2	Water Quality	✓	✓	[CS] Construction activities (such as cutting/filling works with surface erosion), construction vehicles, camp yards may cause water pollution through drainage water and effluents. Thus, pose a concern on water quality. [OS] Drainage from road structure likely to cause water pollution in water bodies (esp the Rio Grande de Mindanao River) parallel to the project road.
3	Waste	✓	✓	[CS] Construction waste including concrete, asphalt, cut trees and soil may be generated through construction activities. Waste generated in

No	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
				camps and sleeping quarters may also add to the volume of waste (total garbage generation). [OS] With the new road parallel to the main river, possibility of having waste dumped in the said water body since it now has the access.
4	Soil Contamination	✓	✓	[CS] There is a possibility of soil contamination by oil leakage from construction vehicles and soil generated by the project. [OS] There might be soil (and water) contamination when the road is fully operated.
5	Noise and Vibration	✓	✓	[CS] Construction vehicles may cause noise and vibration temporarily in sections that are near the existing residential areas. [OS] Ambient noise and vibration along the proposed MRSR may cause negative impact on sections nearby sensitive receptors/sectors, which erstwhile have no similar threats/issues.
6	Ground Subsidence	✓	✓	[CS/OS] Landfilling may cause ground subsidence in the area of soft soil and other specific conditions. Also, during the road operation because of increased vehicle traffic, some of which carrying heavy loads, all the more since it is parallel to the main river system.
7	Offensive Odor	✓	✓	[CS] There is a possibility of offensive odor by construction activities only to residential areas that are near the road alignment. But generally, this may not pose a concern as the road sections are mostly agricultural in uses (rice fields). [OS] There might be some issues of offensive odor/smell when the road is fully operated due to threats of illegal dumping of waste and uncollected garbage since the new road will open access to the riverbanks.
8	Bottom Sediment	✓	✓	[CS] There is a minimal possibility of impact on the bottom sediment (land and water bodies) by leaked oil from construction vehicles and flown soil caused by earthwork. [OS] There might be some issues on bottom sediment when the road is fully operated, as the new road is near and running parallel to the existing major river.
9	Protected Area	✓	✓	[CS/OS] The project may cause impact/threat to identified protected areas/overall natural environment of the project area.
10	Ecosystem	✓	✓	[CS/OS] The project may cause impact such as tree-cutting and clearing activities on ecosystem including indicator species and plants/trees along the project site.
11	Hydrology	✓	✓	[CS/OS] There is a possibility of changes to hydrology because the project is right on parallel a major river and also passing through minor creeks for some road sections.
12	Topography and Geology	✓	✓	[CS] Topography might change by land cutting and filling works. There are possibilities of land slide and soil erosion along the project roads (which mostly are rice fields/agricultural areas) due to land filling works. [OS] Operation of roads may still have impact on geographical and topographical changes both directly and indirectly.
13	Land Acquisition and Resettlement			[PCS] There will be no land acquisition and resettlement for road and other facilities/structures of MRSR project. The road alignment and sections are mostly passing through agricultural areas and mostly public lands. [CS/OS] No resettlement is expected.
14	Poverty		✓	[PCS/CS] There will be no displacement of the vulnerable groups due to the road project. [OS] No adverse impact on poor and vulnerable groups, in fact the road will open opportunities for them.
15	Ethnic Minority and Indigenous People			[PCS/CS/OS] There may no ethnic minority and/or indigenous people affected by the project since the road project requires no displacement of people.
16	Local Economy such as Employment and Livelihood	✓	✓	[CS] Construction activities may cause temporary inconvenience to farmers affected by the projects. There may be minimal effect on the employment and livelihood (including farming) of project affected households during construction.

No	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
				[OS] The new road will open opportunities for the local residents in terms of livelihood and employment opportunities.
17	Land Use and Usage of Local Resources	✓	✓	[CS] Loss of farmlands for new roads are expected. Land and other natural resources such as trees/rice paddies of project affected households may also be affected by construction activities. [OS] MRSR may cause some negative impact on land use such as conversion of agricultural areas and extraction of water resources.
18	Water Usage	✓	✓	[CS] River water may be affected by earthworks. There may be changes in water usage due to construction activities. [OS] Operation of roads may cause impact on water usage both directly and indirectly.
19	Existing Social Infrastructure and Services	✓	✓	[PCS/CS] There may be minimal disturbances on accessing various social infrastructure services (health and educational centers) due to the road construction. [OS] Highway may bring positive impact on exiting road networks around the area. This facilitates economic progress and development of the area.
20	Social Institutions such as Socially Related Capital and Decision-making Organizations	✓	✓	[CS] There may be adjustments and impacts to local decision-making organizational dynamics due to road constructions as some affected induvial/families may have complaints or issues. [OS] The new road will improve mobility in the area and thus, improve access to social infrastructures and facilities.
21	Misdistribution of Benefit and Damage			Misdistribution of benefit and damage caused by the road construction is not expected.
22	Local Conflicts of Interest	✓	✓	[CS] Because of increased land value, conflicts may arise due to various claims on lands near the road project. [OS] Because of increased land value, conflicts may arise due to various claims on lands near the road project.
23	Cultural Heritage	✓		Kutawato Cave is the historical/cultural/natural site near the proposed alignment. But this is significantly distant already. This may not really cause serious threat to the heritage site.
24	Landscape	✓	✓	[CS] There is a minor possibility of disturbance of landscape by the road structures including bridges. [OS] Operation of roads may really cause impact on landscape both directly and indirectly. The new road will open up development of erstwhile a peaceful and serene environment. Land uses will significantly change over time and this may cause changes in overall landscape of the area.
25	Gender	✓	✓	[CS] Women and children may not really be affected by the road project as the road alignment is quite distant from the residential areas. [OS] Improved access by the project may cause positive impact on gender.
26	Children's Right	✓	✓	[CS] There is a possibility of occurrence of child labor. [OS] Due to the improvement of traffic flow and road openings, traveling time to institutional facilities (school and hospital) will become faster and safer for children to access schools/education centers
27	Infectious Diseases such as HIV/AIDS	✓	✓	[CS] Infectious diseases (ex. COVID 19, HIV AIDS) are possible to spread due to inflow of construction workers in the area. [OS] Infectious diseases (ex. COVID 19, HIV AIDS) are possible due to increased human travel and foot traffic.
28	Labor Environment including Safety	✓	✓	[CS] Due to construction activities, labor environment may be affected. Incidence of unfair labor practices may happen in contracting arrangement and actual work. [OS] Operation of roads may still cause impact on labor environment depending on how the concerned authorities put things in order.

No	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
29	Accident	✓	✓	[CS] Traffic accident related to construction vehicles and accident in construction sites are expected. [OS] Traffic accident may increase due to increased traffic volume because it's a new road network that will open up areas for vehicular travel.
30	Transboundary Impact and Climate Change	✓	✓	[CS] and [OS] Emissions of Greenhouse Gasses may increase due to construction machinery / vehicles and newly generated traffic. Movement of people and goods are expected when the road is fully operated and this may pose transboundary concerns on climate change and public health.

Note: Project stage: PCS: Pre-construction stage, CS: Construction stage, OS: Operation stage
Source: JICA Study Team, 2021

(2) ToR for Environmental and Social Considerations Surveys

Based on the scoping results in the previous section, terms of references (ToR) for surveys of necessary environmental items are developed to determine project induced impacts. Possible impact to be caused by project implementation will be evaluated qualitatively based on existing secondary data, interview of concerned parties and examining project design. Table 24.7-40 shows the ToR for environmental and social considerations survey.

Table 24.7-40 ToR for Surveys of Environmental and Social Considerations

	Item	Survey Item	Survey Method
1	Air Quality	(1) Relevant standards on air quality monitoring (Domestic, Japanese, WHO, etc.) (2) Status of air quality vis-a-vis national guideline values	(1) Existing material/baseline (2) Secondary data/information from past projects nearby (3) Qualitative evaluation based on expected traffic volume and construction vehicles
2	Water Quality	(1) Relevant standards on water quality monitoring (DENR, Japanese, WHO, etc.) (2) Status of water quality items	(1) Existing material/baseline (2) Secondary data/information from past projects nearby (3) Qualitative evaluation based on expected construction methods
3	Waste	(1) Waste (solid and waste water) management process	(1) Secondary data/information from past projects (similar project location, scope or context) (2) Qualitative evaluation based on expected construction methods and facilities
4	Soil Contamination	(1) Protection method against oil leakage	(1) Confirmation on implementation plan of construction vehicles (2) Qualitative evaluation based on expected construction methods
5	Noise and Vibration	(1) Relevant standards on noise and vibration monitoring standards (DENR, Japanese, IFC's, etc.) (2) Status of noise and vibration	(1) Existing material/baseline (2) Secondary data/information from past projects nearby (3) Qualitative evaluation based on expected traffic volume and construction vehicles

	Item	Survey Item	Survey Method
6	Ground Subsidence	(1) Soil conditions	(1) Past study around the area (2) Qualitative evaluation based on expected construction methods
7	Offensive Odor	(1) Possible events and practices causing odor	(1) Collection of necessary information on construction method (2) Qualitative evaluation based on expected construction methods
8	Bottom Sediment	(1) Construction method causing sedimentation	(1) Collection of necessary information on construction method (2) Qualitative evaluation based on expected construction methods
9	Protected Areas	(1) Situation of registration (2) Outline of the protected areas	(1) Relevant laws and regulations (2) Past study around the area (3) Qualitative evaluation based on expected construction methods
10	Ecosystem	(1) Baseline situation of general ecosystem (2) IUCN listed species	(1) Past field surveys on occurrences of fauna and flora (2) IUCN Website etc. (3) Qualitative evaluation based on expected construction methods
11	Hydrology	(1) Situation of surface water, such as rivers and lakes (2) Impact during construction	(1) Past field surveys (2) Confirmation of construction methods (3) Qualitative evaluation based on expected construction methods
12	Topography and Geology	(1) Construction method causing changes of topography and geology	(1) Collection of necessary information on construction method (2) Qualitative evaluation based on expected construction methods
13	Land Acquisition and Resettlement	(1) Size of impact (only on structures) (2) Compensation policy on structures	(1) Aerial photos, design, etc. (2) Existing surveys (3) Qualitative evaluation based on expected project effects
14	Poverty	(1) Distribution of poverty groups; degree and extent	(1) Existing surveys and Statistics (2) Qualitative evaluation based on expected project effects
15	Ethnic Minority and Indigenous People	(1) Distribution of ethnic minority and indigenous people (not applicable in this project)	(1) Existing surveys and Statistics (2) Qualitative evaluation based on expected project effects
16	Local Economy such as Employment and Livelihood	(1) Local economic status	(1) Existing surveys and Statistics (2) Qualitative evaluation based on expected project effects
17	Land Use and Usage of Local Resources	(1) Land use status	(1) Existing surveys and existing maps (2) Qualitative evaluation based on expected project effects
18	Water Usage	(1) Water usage status in rivers and other resources (2) Impact during construction	(1) Existing surveys and literature materials (2) Confirmation of construction methods (3) Qualitative evaluation based on expected impact on water use
19	Existing Social Infrastructure and Services	(1) Distribution of residential areas, schools, hospitals, and etc.	(1) Existing surveys and literature materials (2) Qualitative evaluation based on expected project effects
20	Social Institutions such as Socially Related Capital and	(1) Social institutions and possible impact	(1) Existing surveys and literature materials (2) Qualitative evaluation based on

	Item	Survey Item	Survey Method
	Decision-making Organizations		expected project effects
21	Local Conflicts of Interest	(1) Expected conflicts	(1) Project design and distribution of interest (2) Qualitative evaluation based on expected project effects
22	Landscape	(1) Scenic areas	(1) Existing surveys and literature materials (2) Qualitative evaluation based on expected structures and topographical changes
23	Gender	(1) Impact on gender	(1) Existing surveys and literature materials (2) Qualitative evaluation based on expected project effects
24	Children's Right	(1) General situation/possibility of child labor	(1) Existing surveys and literature materials (2) Qualitative evaluation based on expected project effects
25	Infectious Diseases such as HIV/AIDS	(1) General situation/possibility of spread of infectious diseases	(1) Existing surveys and literature materials (2) Qualitative evaluation based on expected project effects
26	Labor Environment including Safety	(1) General situation/possibility of labor safety substandard environment	(1) Existing surveys and literature materials (2) Qualitative evaluation based on expected project effects
27	Accident	(1) Expected increase of accidents	(1) Existing surveys and literature materials (2) Qualitative evaluation based on expected project effects
28	Transboundary Impact and Climate Change	(1) Elements related to cross boundary impacts, cumulative impacts, and climate change	(1) Collect information based on highway construction and management (2) Qualitative evaluation based on expected project effects

Source: JICA Study Team, 2021

24.7.8 Impact Assessment

(1) Preliminary Impact Assessment

The result of potential negative environmental and social impact assessment at action plan study is shown in the following table. In consideration of survey results, the impacts were evaluated qualitatively in each of the three stages separately, namely: pre-construction stage [PCS], construction stage [CS], and operation stage [OS]. The impacts of pollution, natural environment, and social environment were classified as A to D in accordance with the following criteria, assuming no specific measures toward the impacts are taken:

A: Significant Negative Impact A+: Significant Positive Impact

B: Some Negative Impact B+: Some Positive Impact

C: Impacts are not clear, need more investigation

D: No impacts or impacts are negligible, no further study required

Table 24.7-41 Result of ESIA at action plan study

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS/ CS	OS	PCS/ CS	OS	
1	Air Quality	✓	✓	B	B	[CS] In consideration of current residential land use, temporary negative impacts are expected on air quality due to exhaust gas and dust generated from construction activities. The exhaust gas such as NOx, SOx, CO TSP, PM10, PM2.5 will be generated from construction machines, equipment and traffic congestion around the construction yard due to the temporary traffic restriction. And dust will be generated by earth work including foundation excavation for piers, transporting of earth-and-sand, etc. [OS] Ambient air quality along the new road will be impacted by current traffic exhaust gas. Since it is expected that traffic flow will be smoother by shifting vehicles from existing road to new road, air quality along the this will be improved. On the other hand, there is a possibility of increase in the number of vehicles. In that case, air quality along the road may have significant change vis-à-vis current condition.
2	Water Quality	✓	✓	B	B	[CS] The project area is located in mostly agricultural areas. Turbid water may be generated from excavation areas due to surface run-off. Improper stockpiling of construction materials in low -lying areas could affect the water quality of nearby bodies of water. Furthermore, there is a possibility of inadequate treatment and/or mishandling of wastewater, suspended matter, waste oil, and other chemicals, in the all-earthwork area including the main road area and borrow pit, etc. Additionally, domestic wastewater may be discharged from the labor camp. [OS] There may be some impacts expected on water quality given the adjacent location of the existing major river.
3	Waste	✓	✓	B	B	[CS] Construction waste including waste soil, asphalt mass and cut trees are expected at the construction site. In addition, domestic waste (garbage) may also be generated from the labor camp during construction. Likewise in actual operation of the new road network, waste can be a concern as garbage can be thrown in the rivers and along the roads.
4	Soil Contaminatio n	✓	✓	B	B	[CS] There is a possibility of soil contamination by wastewater from tunneling work/piling construction/excavation process, if wastewater is discharged without adequate treatment and/or mishandling. Dumping soil and muck also can cause soil contamination if they have specific chemicals. Furthermore, there is a possibility of soil contamination due to unexpected leakage/ mishandling of oil and other chemicals, in the all-earthwork area including the main road area and borrow pit, etc. Dumping soil and muck also can cause soil contamination if they have specific chemicals.
5	Noise and Vibration	✓	✓	B	A	[CS] In consideration of current land use, temporary negative impacts are expected on ambient noise due to higher noise generated from construction machines and equipment. [OS] Ambient noise and vibration along existing road is already impacted by current passing vehicles. Though it is expected that traffic flow may become smooth by shifting from existing road to the new road, noise and vibration level might increase because of the increase in traffic and travelling speed of vehicles. As this is a new road alignment, negative impact on this parameter is expected.
6	Ground Subsidence	✓	✓	B	C	[CS/OS] The extent of impact is still unknown, because there is no detailed amount of ground water and geographical test data, and the proposed ROW and tunnel excavation methodology are not yet decided at this moment. In case of large amount of discharge water and/or worse ground foundation occur than expected, there is a possibility of ground subsidence in the existing agricultural area due to road construction. To clarify the baseline condition of geographic mechanism including ground water level, geological test shall be conducted along the proposed alignment during the feasibility study.

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS/ CS	OS	PCS/ CS	OS	
7	Offensive Odor	✓	✓	C	B	[CS] There might be indirect project-related activities that can generate some odor due to the general road construction in few instances where there are nearby houses. On the other hand, impact of construction basecamp operations may have temporary impact. [OS] Odor may come from garbage indiscriminately thrown when the road is already being used, especially that there is now new access to the water bodies, in this case a major river (Rio Grande de Mindanao).
8	Bottom Sediment	✓	✓	C	C	[CS] There is a possibility of impact on the river bottom sediment by flown soil caused by earthwork in the river, depending on the construction methodology. In case of river crossing, when bottom sediment may had already been polluted, and dumping soils in the riverbed will also have the possibility of soil contamination when they are dumped in other places.
9	Protected Area	✓	✓	C	C	Basically, not yet clear if impacts are expected at both construction and operation stage, since the proposed protected area (Timako Hill) is not within the immediate vicinity of project area. The immediate vicinity is a river system which is considered a critical natural resource.
10	Ecosystem	✓	✓	B	C	[CS] Construction activities and existence of road structures may have some impact (such as damage of trees and vegetation, loss of nest/feeding area/breeding area, and migration inhibition, division of the habitation area, road killing, noise/vibration due to the new traffic flow, etc.) on surrounding ecosystem along the project alignment. There is a possibility of decreasing the biodiversity and habitat around the mangrove areas where variety of land species are using this as nesting, feeding and breeding place due to the implementation activities of the project depending on the final design and construction process. To evaluate the impact, seasonal flora and fauna survey and tree inventory survey shall be conducted during the feasibility study survey. In addition, coral reefs along the seashore might be affected by polluted water (turbid water) and sedimentation from rivers. [OS] Operation of roads may have severe impact on existing ecosystem within the road right of way and vicinity. It is yet to be further assessed.
11	Hydrology	✓	✓	B	B	[CS/OS] To clarify the baseline condition of geographic mechanism including groundwater level and flow, geological tests shall be conducted along the proposed alignment during the feasibility study. The amount of water uses and source during construction and operation shall be clarified during the feasibility study. And also, there is a possibility of disturbance of water flow by construction of bridge pier in the river and preventing /changing water flow by concrete structures.
12	Topography and Geology	✓	✓	B	B	[CS] The project area is located in the area of high susceptibility to flooding area as defined in the ECA. Topography might change by land development. There is a possibility of topsoil erosion in the construction site during rainy season (May-October).
13	Land Acquisition and Resettlement			D	D	[PCS] It is expected that only few existing structures including houses are affected due to the implementation of the Project, based on satellite image (Google Earth) interpretation. Since no land acquisition and displacement for this project, socio-economic survey, inventory survey and market value survey may just focus on identification of landowners and compensation for the loss of trees and similar properties.
14	Poverty	✓	✓	B	B+	[PCS/CS] The project may bring positive impact on local economy through construction activities and rural development. Some poor groups may be negatively affected by the project if their properties are affected and/or their

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS/ CS	OS	PCS/ CS	OS	
						livelihood is lost due to the project. On the other hand, the new road may provide opportunities for land owners as this may result to the increase of land values and possible use of land for development.
15	Ethnic Minority and Indigenous People			B-	C	There is no ethnic minority and/or indigenous people directly in the project site that might be affected by the proposed new road. However, it is better to confirm this during the feasibility study phase.
16	Local Economy such as Employment and Livelihood	✓	✓	B	B+	[CS] Employment opportunity can be created due to the project construction. On the other hand, overall construction activities and traffic movement would affect local economic activities that are focused on the context of project location, in this case farming and fishery sectors. [OS] Employment and livelihood opportunities may improve during the operation stage, as local population expects improved mobility and transport for work and trading activities.
17	Land Use and Usage of Local Resources	✓	✓	B	C	[CS] The project area is located in the prime agricultural land as defined in the ECA. Loss of farmland for new roads are expected and land use may be changed along the road's vicinity. Land and local resources such as trees and households are also affected by the construction of the new road. [OS] Effective use of lands and local resources due to high accessibility are expected. At the same time, project-induced development may or may not affect the utilization of local resources. It is something to be assessed further.
18	Water Usage	✓	✓	B-	B-	[CS/OS] To clarify the baseline condition of underground water use around the project area, inventory survey for wells shall be conducted during the feasibility study stage. Although water source during construction is not yet decided at this moment, water use permission in line with regulation shall besought from relevant agencies prior to the construction to avoid conflict with water users. The amount of water uses and source during construction shall be made clear during the feasibility study.
19	Existing Social Infrastructure and Services	✓	✓	B-	B+	[PCS/CS] There might be very few existing utilities (transmission lines, telecom lines, water lines, etc.) along the project road as the alignment is a new network. These infrastructures shall be protected and/or diverted before construction work. [OS] More convenient access to services due to new road access is expected during operation stage.
20	Social Institutions such as Socially Related Capital and Decision-making Organizations	✓	✓	B-	N/A	[CS] There is a possibility of a temporary physical community division by construction yard during construction.

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS/ CS	OS	PCS/ CS	OS	
21	Local Conflicts of Interest	✓	✓	B	C	[OS] New alignment may cause access issues for existing communities and owners/tenants of the farmlands and their interest may cause local conflicts especially on land ownerships and the likes.
22	Landscape	✓	✓	B-	B-	[CS] There is a possibility of disturbance of landscape by the road structures, such as bridges.
23	Gender	✓	✓	C	B+	[CS]: Temporary inconvenience to residents, commuters, and pedestrians because of construction activities is expected. On the one hand, the Project can provide additional employment opportunities during this phase, which women can take advantage of. However, there might be gaps on working conditions such as wage between men and women when local employment is considered.
24	Children's Right	✓	✓	C	B+	[CS] There is a possibility of occurrence of child labor during road construction phase.
25	Infectious Diseases such as HIV/AIDS	✓	✓	B	C	[CS] Infectious diseases, such as HIV/AIDS/COVID 19 are possible to spread due to inflow of construction workers. Furthermore, alteration of the ground by cutting, soil excavation and land filling may lead to the creation of habitats for mosquitos that possibly transmit dengue fever.
26	Labor Environment including Safety	✓	✓	C	C	[CS] Accident and harm to health of workers may happen in the construction area for bridge section; however, it will be secured in accordance with the domestic laws and regulations during construction.
27	Accident	✓	✓	B	B	[CS] Traffic accidents related to construction vehicles and accidents in construction sites are expected to happen. [OS] Traffic accidents may increase due to increased traffic volume.
28	Transboundary Impact and Climate Change	✓	✓	B	C	[CS] Significant distortion of land forms and degradation of agricultural/farmlands are expected during this project phase. [OS] [OS] Increase of Greenhouse Effect Gas is anticipated as vehicular traffic in new road network causes increased emissions/pollutions.

Note: Project stage: PCS: Pre-construction stage, CS: Construction stage, OS: Operation stage

Impact:

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

D: No impact is expected.

N/A: Impact assessment isn't conducted because the items was not checked ✓ in scoping phase.

Source: JICA Study Team,2021

24.7.9 Mitigation Measures

Items rated as A- and B- in the table of impact assessment are the target of mitigation measures. Mitigation measures should be feasible and practical. Table below shows mitigation measures for the road project classified into construction and operation phases.

Table 24.7-42 Mitigation Measures

No.	Items (Impacts)	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost (PhP)
Construction Stage					
1	Air Quality	- Water sprinkling to reduce particulate matter - Routine / periodic maintenance and washing of construction machineries and vehicles to minimize air pollutants -Announcement of construction work to nearby residents (esp at start and end sections) - In the event of complaint from residents, review the additional mitigation measures including the construction schedule or location of heavy vehicles through the communication with local people	Contractor	DPWH (UPMO); BARMM-MPW	TBD
2	Water Quality	- Installing sedimentation tank to reduce discharged turbid water - Cover exposed earth especially before heavy rains are expected. - Installing septic tanks for origin of polluted water such as camp yard - Appropriate wastewater treatment, such as connecting drainage system to existing sewage systems	Contractor	DPWH (UPMO); BARMM-MPW	TBD
3	Waste	-Prepare detailed waste management program in consideration with LGU's waste management system - Education on waste treatment for workers - Separation of hazardous waste and bring out to appropriate treatment facilities - 3Rs promotion to reduce waste	Contractor	DPWH (UPMO); BARMM-MPW	TBD
4	Soil Contamination	- Necessary laboratory test to identify contaminated soil and mock for special care - Find feasible treatment facilities or filling area in earlier stage of the project such as F/S	Contractor	DPWH (UPMO); BARMM-MPW	TBD
5	Noise and Vibration	- To avoid disturbance of daily life, construction time shall be set within daytime, especially near residential areas (applied in just few identified sections) - Apply low-noise and vibration machineries as much as possible at nearby residential areas -Provide the temporary noise barrier and/or fence around the construction yard near residential areas, if necessary -Announcement of construction work to surrounding residents - In the event of complaint from residents, review the additional mitigation measures including the construction schedule or location of heavy vehicles through the communication with local people	Contractor	DPWH (UPMO); BARMM-MPW	TBD
6	Ground Subsidence	- Avoid extraction of ground water for construction	Contractor	DPWH (UPMO);	TBD

No.	Items (Impacts)	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost (PhP)
		- Applying replacement methods for soft soil areas and prevention measures for liquefaction based on further studies and discussion in F/S. - Monitoring to identify early symptoms of subsidence		BARMM-MPW	
7	Offensive Odor	- Education and instruction of rules in camp yards to keep good hygiene	Contractor	DPWH (UPMO); BARMM-MPW	TBD
8	Bottom Sediment	- Installing sedimentation tank to reduce discharged turbid water	Contractor	DPWH (UPMO); BARMM-MPW	TBD
9	Ecosystem	- Avoid tree cutting to reduce impact on habitat -Relocation/replant of trees - Consider construction season and time if specific rare species' breeding points / nests / important feeding ground are confirmed in the affected areas. -Conduct awareness campaign to all relevant construction workers about the careful consideration for ecosystem -Adoption of lower noise and vibration construction method and machines - Adoption of adequate pass route, based on the field survey, estimated impact and advices from biological expert, if necessary	Contractor	DPWH (UPMO); BARMM-MPW	TBD
10	Hydrology	- Avoid large amount of extraction of ground water	Contractor	DPWH (UPMO); BARMM-MPW	TBD
11	Topography and Geology	- Slope protection is required after cutting slopes especially in the period of rainy season	Contractor	DPWH (UPMO); BARMM-MPW	TBD
12	Land Acquisition and Resettlement	- Alignment discussion should be carefully done during F/S study	Consultant, Contractor, DPWH, LGUs, NHA	DPWH (UPMO); BARMM-MPW	TBD
13	Poverty	- Study the poverty profile of nearby communities	Consultant, Contractor, DPWH, LGUs, NHA	DPWH (UPMO); BARMM-MPW	TBD
14	Ethnic Minority and Indigenous People	- Just for validation, countercheck if there are indeed no IPs in nearby communities	Consultant, Contractor, DPWH, LGUs, NHA	DPWH (UPMO); BARMM-MPW	TBD
15	Local Economy such as Employment and Livelihood	- Appropriate mitigation measures in cases of negative impact on livelihood and employment during construction phase must be prepared consistent with domestic and development partner's policies with assistance for business disturbances.	Consultant, Contractor, DPWH, LGUs, NHA	DPWH (UPMO); BARMM-MPW	TBD
16	Land Use and Usage of Local Resources	- Further assessment must be prepared consistent with domestic and development partner's policies.	LGUs	LGUs	TBD
17	Water Usage	- Avoid large amount of extraction of ground water	Contractor	DPWH (UPMO);	TBD

No.	Items (Impacts)	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost (PhP)
				BARMM-MPW	
18	Existing Social Infrastructure and Services	- Appropriate / agreed compensation for owners of infrastructures to recover, divert, and replace (just in few sections).	DPWH, LGUs	DPWH (UPMO); BARMM-MPW	TBD
19	Social Institutions such as Socially Related Capital and Decision-making Organizations	- Detour for securing reasonable accessibility to social institutions	Contractor	DPWH (UPMO); BARMM-MPW	TBD
20	Landscape	- Minimize cutting of trees and slopes - Installation of slope seeding / planting to recover construction areas	Contractor	DPWH (UPMO); BARMM-MPW	TBD
21	Gender	- Positive employment of women for light works in construction activities such as cleaning (in camps) with fair salary and other conditions - Prepare toilet and dressing spaces for women workers - Education on gender equality for workers	Contractor	DPWH (UPMO); BARMM-MPW	TBD
22	Children's Right	- Restrict child labor (workers under 14 years old) in contract with punishment - Report list of workers with their age information	Contractor	DPWH (UPMO); BARMM-MPW	TBD
23	Infectious Diseases such as HIV/AIDS	- Education on infectious diseases for workers - Vaccination of workers (COVID-19)	Contractor	DPWH (UPMO); BARMM-MPW	TBD
24	Labor Environment including Safety	- Education on occupational safety for workers - Safety patrol - Sign boards	Contractor	DPWH (UPMO); BARMM-MPW	TBD
25	Accident	- Periodic maintenance of machineries and vehicles - Sign boards - Employ enough number of traffic guards	Contractor	DPWH (UPMO); BARMM-MPW	TBD
26	Transboundary Impact and Climate Change	- Periodic maintenance of machineries and vehicles - Recommendation of idling stop activities/engine maintenance	Contractor	DPWH (UPMO); BARMM-MPW	TBD
Operational Stage					
1	Air Quality	- Strengthening of vehicle inspection	DPWH	DPWH (UPMO); BARMM-MPW	TBD
2	Noise and Vibration	- Noise barriers if the level significantly exceeds the standard - Restriction of maximum speed	DPWH	DPWH (UPMO); BARMM-MPW	TBD
3	Ground Subsidence	- Periodic observation of level changes	DPWH	DPWH (UPMO); BARMM-MPW	TBD

No.	Items (Impacts)	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost (PhP)
4	Hydrology	- Avoid large amount of extraction of ground water - Periodic observation of water flow / level	DPWH	DPWH (UPMO); BARMM-MPW	TBD
5	Ethnic Minority and Indigenous People	- Validation if indeed there are no indigenous people in and around the project areas/sections	DPWH, LGUs	DPWH (UPMO); BARMM-MPW	TBD
6	Land Use and Usage of Local Resources	- Study the prevailing legal frameworks and masterplans by LGUs	LGUs	LGUs	TBD
7	Water Usage	- Avoid large amount of extraction of ground water - Periodic observation of water flow / level	DPWH, LGUs	DPWH (UPMO); BARMM-MPW	TBD
8	Local Conflicts of Interest	- Design box culvert or any other crossing structure to secure accessibility	DPWH, LGUs	DPWH (UPMO); BARMM-MPW	TBD
9	Accident	- Sign boards - Traffic violation crackdown by police - Road safety education at schools and other appropriate facilities	DPWH, LGUs, Police	DPWH (UPMO); BARMM-MPW	TBD
10	Transboundary Impact and Climate Change	- Strengthening of vehicle inspection	DPWH	DPWH (UPMO); BARMM-MPW	TBD
				Total Cost	TBD

Source: JICA Study Team, 2021

24.7.10 Monitoring Plan

(1) Proposed EMoP

Table 24.7-43 presents general/typical proposed Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) for mitigating the negative impact. Feasible and specific EMP and EMoP shall be studied during the Feasibility Study.

Table 24.7-43 Monitoring Plan

No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost (PhP)
Construction Stage							
1	Air Quality	PM10, PM2.5, SO2, CO, NO2	Construction sites, major access routes to the construction sites	Once a month	Contractor	BARMM-MPW	TBD
2	Water Quality	BOD5, COD, Oil and Grease, pH, Total Coliform, Total Nitrogen, Total Phosphorous, Total suspended solids, Turbidity, Arsenic, Iron, Sulphate	Rivers, drainages, camp yards, wells, springs	Once every three-month	Contractor	BARMM-MPW	TBD

No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost (PhP)
3	Waste	Types and amount of waste	Temporary waste storage	Once every three-month	Contractor	BARMM-MPW	TBD
4	Soil Contamination	Soil quality test in accordance with the baseline survey and existing land use, Monitoring accident, maintenance record of machineries and vehicles, site observation	Construction sites and camp yards	Once a month	Contractor	BARMM-MPW	TBD
5	Noise and Vibration	Sound level and vibration.	Construction sites, major access routes to the construction sites	Once a month	Contractor	BARMM-MPW	TBD
6	Ground Subsidence	Visible observation on markers and gauges	Surrounding structures of construction sites	Once a week	Contractor	BARMM-MPW	TBD
7	Offensive Odor	Types and amount of waste, other specific cases such as oil leakage	Temporary waste storage	Once every three-month	Contractor	BARMM-MPW	TBD
8	Bottom Sediment	Visible observation of rivers and drainage from construction sites	Construction sites and rivers	Once every three-month	Contractor	BARMM-MPW	TBD
9	Ecosystem	Field confirmation by experts, number of cut mangrove trees	Construction sites and surrounding areas	Once a year	Contractor	BARMM-MPW	TBD
10	Hydrology	Visible observation, interview, measurement of water volume	Rivers, springs, wells, etc.	Once every three-month	Contractor	BARMM-MPW	TBD
11	Topography and Geology	Visible observation, reviewing of cut and fill plan, tree cutting plan with certification	Forest, hilly areas	Once every three-month	Contractor	BARMM-MPW	TBD
12	Land Acquisition and Resettlement	Internal / External monitoring report/grievance records	Project Areas	Following RAP	LGUs, NHA, other relevant bodies	BARMM-MPW	TBD
13	Poverty	Internal / External monitoring report/grievance records	Project Areas	Following RAP	LGUs, NHA, other relevant bodies	BARMM-MPW	TBD
14	Ethnic Minority and Indigenous People	Internal / External monitoring report /grievance records, IPP, if any	Project Areas	Following RAP and IPP	LGUs, NHA, other relevant bodies	BARMM-MPW	TBD
15	Local Economy such as Employment and Livelihood	Internal / External monitoring report /grievance records, income restoration program (IRP)	Project Areas	Following RAP, IRP	LGUs, NHA, other relevant bodies	BARMM-MPW	TBD
16	Land Use and Usage of Local Resources	Construction plan including lease land, grievance records	Project Areas	Once every three-month	Contractor	BARMM-MPW	TBD
17	Water Usage	Water volume, visible observation, interview, grievance records	Water usage areas	Once a month	Contractor	BARMM-MPW	TBD

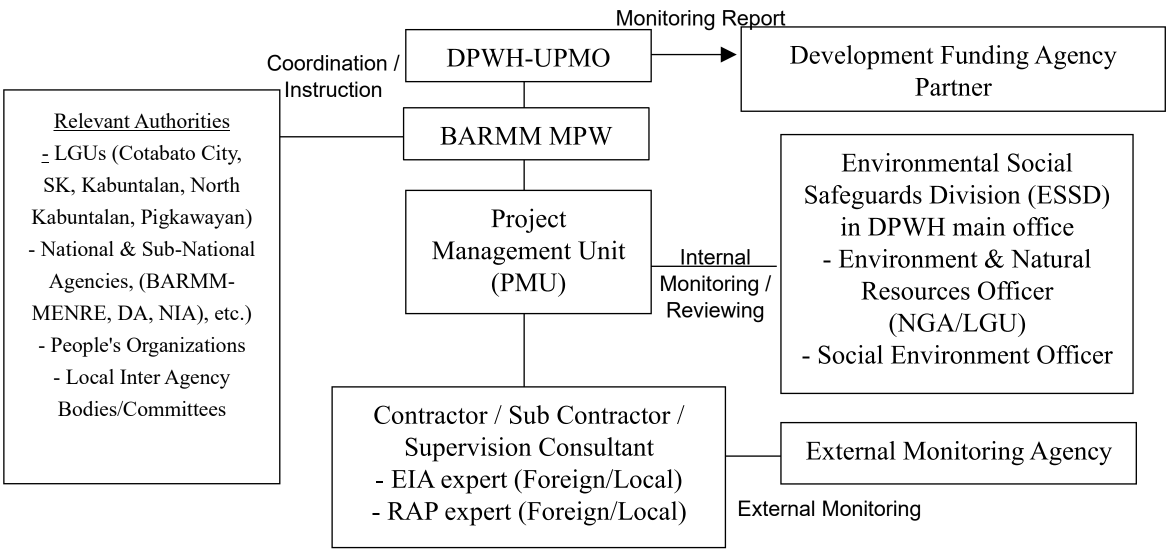
No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost (PhP)
18	Existing Social Infrastructure and Services	Visible observation, interview, grievance records	Project Areas	Once every three-month	Contractor	BARMM-MPW	TBD
19	Social Institutions such as Socially Related Capital and Decision-making Organizations	Visible observation, interview, grievance records	Project Areas	Once every three-month	Contractor	BARMM-MPW	TBD
20	Landscape	Visible observation, interview, grievance records	Project Areas	Once every three-month	Contractor	BARMM-MPW	TBD
21	Gender	Visible observation, interview, grievance records, list of construction workers, record of education, number of facilities for women in construction site and camp yard	Project Areas	Once a month	Contractor	BARMM-MPW	TBD
22	Children's Right	Visible observation, interview, grievance records, list of construction workers, record of education	Construction sites	Once a month	Contractor	BARMM-MPW	TBD
23	Infectious Diseases such as HIV/AIDS	Visible observation, interview, grievance records, record of education	Construction sites	Once a month	Contractor	BARMM-MPW	TBD
24	Labor Environment including Safety	Visible observation, interview, grievance records, record of education, record of safety patrol, sign boards	Construction sites	Once a month	Contractor	BARMM-MPW	TBD
25	Accident	Record of accidents, record of education, sign boards	Construction sites and surrounding areas	Once a month, on demand	Contractor	BARMM-MPW	TBD
26	Transboundary Impact and Climate Change	Record of maintenance of machinery and vehicles, sign boards	Construction sites	Once a year	Contractor	BARMM-MPW	TBD
Operational Stage							
1	Air Quality	PM10, PM2.5, SO_2, CO, NO_2	Residential area, junctions, etc.	Once a year	Regional Office (RO) - DPWH	BARMM-MPW	TBD
2	Noise and Vibration	Sound level and vibration.	Junctions and residential areas	Once a year	RO	BARMM-MPW	TBD
3	Ground Subsidence	Visible observation on markers and gauges	Surrounding structures of construction sites	Once a year	RO	BARMM-MPW	TBD
4	Hydrology	Visible observation, interview, measurement of water volume	Rivers, springs, wells, etc.	Once a year	RO	BARMM-MPW	TBD
5	Ethnic Minority and Indigenous People	Interview, observation, socio-economic survey, if needed	Project Areas	Once a year	RO	BARMM-MPW	TBD
6	Land Use and Usage of Local Resources	Regional development plan, visible observation	Project Areas	Once a year	LGUs	BARMM-MPW	TBD

No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost (PhP)
7	Water Usage	Water volume, visible observation, interview, grievance records	Water usage areas	Once a year	RO	BARMM-MPW	TBD
8	Local Conflicts of Interest	Interview, observation	Project Areas	Once a year	LGUs	BARMM-MPW	TBD
9	Accident	Record of accidents, record of education, sign boards	Project road and surrounding areas	Once a year	RO	BARMM-MPW	TBD
10	Transboundary Impact and Climate Change	Record of maintenance of machinery and vehicles, sign boards	Project road and surrounding areas	Once a year	RO	BARMM-MPW	TBD

Source: JICA Study Team,2021

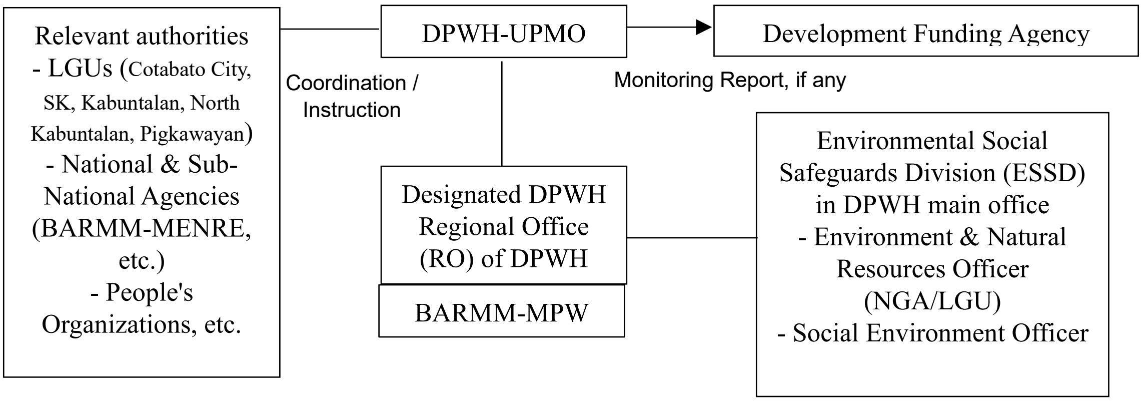
24.7.11 Implementation Structure

Implementation structure for MRSR Project will be established based on local legal frameworks with reporting/discussion channels to investors/development partners. Based on project implementation structure of other projects through JICA's cooperation (such as Cebu-Mactan Bridge Construction Project), the proposed implementation structure of environmental and social consideration is illustrated in Figure 24.7-19 and Figure 24.7-20.



Source: JICA Study Team, 2021

Figure 24.7-19 Implementation Structure of Environmental and Social Considerations During Construction Stage



Source: JICA Study Team

Figure 24.7-20 Implementation Structure of Environmental and Social Considerations During Operation Stage

24.8 Economic Evaluation of the Project

24.8.1 General Methodology

(1) Procedure of Economic Evaluation

Procedure of economic evaluation is explained in Chapter 23.9.

(2) Economic Evaluation Indicators

Economic evaluation indicators are explained in Chapter 23.9.

(3) Implementation Schedule

The project is proposed to be implemented for the following:

Year	Subject
2023.1 - 2024.3	: Detailed Design
2024.1 - 2024.12	: Tender Assistance
2025.1 - 2027.12	: Construction for MRSR (36 Months)

Source: JICA Study Team

24.8.2 Economic Cost of the Project

(1) Methodology of Economic Cost Estimation

Methodology of economic cost estimation is explained in Chapter 23.9.2.

(2) Setting of Project Cost

1) Construction Cost

Financial cost and converted economic cost are shown in Table 24.8-1 and Table 24.8-2.

Table 24.8-1 Financial Cost

Unit: million PhP

Case	Construction cost	ROW Cost	Consulting Service (D/D)	Consulting Service (C/S)	Administration Cost	Total
2 Lane	4,562	158	183	256	143	5,302

Source: JICA Study Team

Table 24.8-2 Converted to Economic Cost

Unit: million PhP

Case	Construction cost	ROW Cost	Consulting Service (D/D)	Consulting Service (C/S)	Administration Cost	Total
2 Lane	3,969	158	185	259	128	4,699

Source: JICA Study Team

2) O&M Cost

O&M costs for routine and periodic are set at 0.01% and 0.005% of construction cost in this action plan study.

24.8.3 Economic Benefit of the Project

(1) Scenario of Economic Benefit

The two main economic benefits that were considered in this project are i) Saving of VOC/ TTC and ii) Economic Benefit to Agriculture.

(2) Estimation of Benefit for Travel Time Cost and Vehicle Operation Cost

Unit cost of TTC and VOC is explained in Chapter 23.

(3) Estimation of Economic Benefit to Agriculture

The methodology of estimation of economic benefit to agriculture is explained in Chapter 23.

(4) Result of Economic Benefit

1) Economic Benefit to Traffic

Economic benefits to traffic in 2028 and 2040 are estimated based on the result of future traffic, unit VOC and TTC as shown in Table 24.8-3. Total benefits are calculated at PhP 169.2 Million in 2028 and PhP 284.5 Million in 2040.

Table 24.8-3 Result of Economic Benefits to Traffic

Unit: Million PhP

	VOC	TTC	Total
2028	105.0	64.2	169.2
2040	195.9	88.6	284.5

Source: Estimated by JICA Study Team

2) Economic Benefit to Agriculture

On the basis of farmers' annual incremental net income from reduced transport costs of agricultural produce and agricultural production inputs, the estimated economic benefit of the road improvement for agriculture amounts to PhP 78,683,292.

Table 24.8-4 Farmers' Annual Incremental Net Income from Reduced Transport Costs of Agricultural Produce and Agricultural Production Inputs

Crops	production/ha/year (kg) a	amount of inputs/ha/year (kg) b	labor cost in transporting products/kg (pesos) c	transport cost/kg (pesos) d	transport cost of products/ ha/year ax(c+d) =e	transport cost of inputs/ha/ year bxd=f	area under cultivation (ha) g	total transport cost/year (pesos) (e+f) xg=h	reduction in transport cost after road construction (%) i	farmers' incremental net income from cost reduction (pesos) hxi=j
Palay	3,052	3,052	0.8	1.1	5,806	3,337	12,934	118,262,300	40%	47,304,920
transport cost reduction of household rice consumption										-3,619,508
Yellow Corn	4,135	4,135	1.0	1.0	8,254	4,127	2,767	34,258,358	40%	13,703,343
White Corn	2,333	2,333	0.9	0.9	4,430	2,215	3,441	22,863,747	40%	9,145,499
Coconut	3,600	3,600	1.5	1.5	10,815	5,407	1,809	29,339,231	40%	11,735,692
Others	5,019	5,019	1.2	1.2	11,598	5,799	59	1,033,365	40%	413,346
Total										78,683,292

** Number of inputs is used by JICA Feasibility Study "RNDP".*
** Labor cost in transporting products is used by JICA Feasibility Study "RNDP".*

The improvement of the road may also make the cultivation of unused land economical, causing an increase in the cultivation area. As an expected impact of the improvement of the road, farmers' incremental net income from the increased cultivation area is estimated based on the social survey results. There may not be enough land for all farming households in the area to expand cultivation as much as household survey respondents are willing to expand. Therefore, farmers' incremental net income was estimated based on the assumption that all uncultivated land identified by barangay captains along the alignment of MRSR were brought into production. Over the years, the farmers' incremental net income would gradually increase as farmers fulfilled other conditions, such as securing financial resources for investment. It should be noted, however, that unused land would not be converted to agricultural land unless specified in the land use plans.

Table 24.8-5 Farmers' Annual Incremental Net Income from The Increased Cultivation Area

Crops	cultivation area to be increased (ha) by household survey respondents a	share of crops to be increased cultivation area b	uncultivated land in barangays along the alignment to be cultivated (ha) b x total uncultivated land=c	farmers' net income/ha/year (PhP) d	farmers' total net income/year (PhP) cxd=e
Palay	1490.0	57.2%	10,347.1	20,815	215,375,308
Yellow Corn	460.0	17.7%	2,213.7	23,269	51,510,425
White Corn	450.0	17.3%	2,752.5	23,269	64,048,296
Coconut	180.0	6.9%	1,446.9	77,992	112,843,196
Others	23.4	0.9%	47.5	146,020	6,938,878
Total	2,603.4	100.0%	16,807.6		450,716,102.3

** Uncultivated land of the target barangays estimated by barangay captains is 2,603.4 ha in total.*
** Total net income of Palay, Yellow Corn, White Corn, Coconut and Others is based on social survey.*

24.8.4 Result of Economic Evaluation

(1) EIRR

Economic evaluation for the MRSR was estimated as shown in Table 24.8-6. Table shows that EIRR (12.5%) was greater than social discount rate (10%) and B/C (1.30) was more than 1.0. These results indicate that the improvement of MRSR was appropriate from economic view. The cost-benefit stream of MRSR is shown in Table 24.8-7.

Table 24.8-6 Result of Economic Analysis

Economic Benefit		
EIRR	**B/C**	**NPV (Million PhP)**
12.5%	1.30	894.0

Source: Estimated by JICA Study Team

Table 24.8-7 Cost Benefit Stream for MRSR

Undiscounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Agri Benefit	Benefit	Benefit - Cost
1	2021	0.0	0.0	0.0			0.0	0.0
2	2022	0.0	0.0	0.0			0.0	0.0
3	2023	148.9	0.0	148.9			0.0	-148.9
4	2024	245.3	0.0	245.3			0.0	-245.3
5	2025	1,435.9	0.0	1,435.9			0.0	-1,435.9
6	2026	1,435.9	0.0	1,435.9			0.0	-1,435.9
7	2027	1,435.9	0.0	1,435.9			0.0	-1,435.9
8	2028		0.4	0.4	169.2	158.8	328.0	327.6
9	2029		0.4	0.4	176.5	317.6	494.2	493.8
10	2030		0.4	0.4	184.2	529.4	713.6	713.2
11	2031		0.4	0.4	192.3	529.4	721.7	721.3
12	2032		0.4	0.4	200.7	529.4	730.1	729.7
13	2033		0.4	0.4	209.6	529.4	739.0	738.6
14	2034		0.4	0.4	218.8	529.4	748.2	747.8
15	2035		0.4	0.4	228.5	529.4	757.9	757.5
16	2036		0.4	0.4	238.7	529.4	768.1	767.7
17	2037		0.6	0.6	249.4	529.4	778.8	778.2
18	2038		0.4	0.4	260.5	529.4	789.9	789.5
19	2039		0.4	0.4	272.3	529.4	801.6	801.3
20	2040		0.4	0.4	284.5	529.4	813.9	813.5
21	2041		0.4	0.4	297.4	529.4	826.8	826.4
22	2042		0.4	0.4	310.9	529.4	840.3	839.9
23	2043		0.4	0.4	325.0	529.4	854.4	854.0
24	2044		0.4	0.4	339.9	529.4	869.2	868.9
25	2045		0.4	0.4	355.4	529.4	884.8	884.4
26	2046		0.4	0.4	371.7	529.4	901.1	900.7
27	2047		0.6	0.6	388.8	529.4	918.2	917.6
28	2048		0.4	0.4	406.8	529.4	936.2	935.8
29	2049		0.4	0.4	425.6	529.4	955.0	954.6
30	2050		0.4	0.4	445.4	529.4	974.8	974.4
31	2051		0.4	0.4	466.1	529.4	995.5	995.1
32	2052		0.4	0.4	487.8	529.4	1,017.2	1,016.8
33	2053		0.4	0.4	510.7	529.4	1,040.1	1,039.7
34	2054		0.4	0.4	534.6	529.4	1,064.0	1,063.6
35	2055		0.4	0.4	559.8	529.4	1,089.2	1,088.8
36	2056		0.4	0.4	586.2	529.4	1,115.6	1,115.2
37	2057		0.6	0.6	613.9	529.4	1,143.3	1,142.7
		4,701.9	12.5	4,714.4	10,311.3	15,299.5	25,610.8	20,896.5

Discounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Discounted	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Agri Benefit	Benefit	Benefit - Cost
1	2021	1.00	0.0		0.0			0.0	0.0
2	2022	1.10	0.0		0.0			0.0	0.0
3	2023	1.21	123.1		123.1			0.0	-123.1
4	2024	1.33	184.3		184.3			0.0	-184.3
5	2025	1.46	980.7		980.7			0.0	-980.7
6	2026	1.61	891.6		891.6			0.0	-891.6
7	2027	1.77	810.5		810.5			0.0	-810.5
8	2028	1.95	0.0	0.2	0.2	86.8	81.5	168.3	168.1
9	2029	2.14	0.0	0.2	0.2	82.4	148.2	230.5	230.3
10	2030	2.36	0.0	0.2	0.2	78.1	224.5	302.6	302.5
11	2031	2.59	0.0	0.2	0.2	74.1	204.1	278.2	278.1
12	2032	2.85	0.0	0.1	0.1	70.4	185.6	255.9	255.8
13	2033	3.14	0.0	0.1	0.1	66.8	168.7	235.5	235.3
14	2034	3.45	0.0	0.1	0.1	63.4	153.3	216.7	216.6
15	2035	3.80	0.0	0.1	0.1	60.2	139.4	199.6	199.5
16	2036	4.18	0.0	0.1	0.1	57.1	126.7	183.9	183.8
17	2037	4.59	0.0	0.1	0.1	54.3	115.2	169.5	169.4
18	2038	5.05	0.0	0.1	0.1	51.5	104.7	156.3	156.2
19	2039	5.56	0.0	0.1	0.1	49.0	95.2	144.2	144.1
20	2040	6.12	0.0	0.1	0.1	46.5	86.6	133.1	133.0
21	2041	6.73	0.0	0.1	0.1	44.2	78.7	122.9	122.8
22	2042	7.40	0.0	0.1	0.1	42.0	71.5	113.5	113.5
23	2043	8.14	0.0	0.0	0.0	39.9	65.0	105.0	104.9
24	2044	8.95	0.0	0.0	0.0	38.0	59.1	97.1	97.0
25	2045	9.85	0.0	0.0	0.0	36.1	53.7	89.8	89.8
26	2046	10.83	0.0	0.0	0.0	34.3	48.9	83.2	83.1
27	2047	11.92	0.0	0.0	0.0	32.6	44.4	77.0	77.0
28	2048	13.11	0.0	0.0	0.0	31.0	40.4	71.4	71.4
29	2049	14.42	0.0	0.0	0.0	29.5	36.7	66.2	66.2
30	2050	15.86	0.0	0.0	0.0	28.1	33.4	61.4	61.4
31	2051	17.45	0.0	0.0	0.0	26.7	30.3	57.1	57.0
32	2052	19.19	0.0	0.0	0.0	25.4	27.6	53.0	53.0
33	2053	21.11	0.0	0.0	0.0	24.2	25.1	49.3	49.2
34	2054	23.23	0.0	0.0	0.0	23.0	22.8	45.8	45.8
35	2055	25.55	0.0	0.0	0.0	21.9	20.7	42.6	42.6
36	2056	28.10	0.0	0.0	0.0	20.9	18.8	39.7	39.7
37	2057	30.91	0.0	0.0	0.0	19.9	17.1	37.0	37.0
			2,990.2	2.2	2,992.4	1,358.3	2,528.1	3,886.4	894.0

Net Present Value (Million peso)	894.0
B/C Ratio	1.30
EIRR	12.5%

Source: Calculated by JICA Study Team

(2) Sensitivity Analysis

The sensitivity analyses were carried out as shown in Table 24.8-8. This aims to evaluate the relevance of the MRSR under some risks. For example, there may be the case that, the estimated costs would increase. Other cases would be that the expected benefits in terms of reduction of VOC and TTC may not be attained as expected. In this regard, the following nine (9) cases were evaluated.

As a result, the strictest condition which is Cost 20% Plus and Benefit 20% Less shows that the EIRR value is way lower than the social discount rate (10%). However, improvement of MRSR is expected to contribute in peace building and in the development of agriculture and fishery sectors.

Table 24.8-8 Result of Sensitivity Analyses

Sensitivity Analysis		Benefit		
		0%	**-10%**	**-20%**
Cost	0%	12.5%	11.4%	10.3%
	+10%	11.5%	10.5%	9.4%
	+20%	10.7%	9.7%	8.6%

24.9 Conclusion and Recommendation

24.9.1 Conclusion

The project is proved to be technically, environmentally and economically feasible, therefore, it is recommended that the project should be realized as soon as possible.

24.9.2 Recommendations

1) Project Implementing Office

The project implementing office is recommended to be the DPWH Central Office. BARMM MPW should act as a co-implementing office and it should learn how to implement large scale foreign-assisted projects through the implementation of this project.

2) Conduct of the Full-scale Feasibility Study

Under this Pre-feasibility Study, some of the technical investigations were not implemented due to the nature of the pre-feasibility study. Hence, the following technical investigations should be undertaken during the feasibility stage:

a) Topographic Survey (center-line survey, cross section survey, bridge site topographic survey)

b) Bridge site borings, Test Pitting/Auger Borings, Material/Sources

c) Traffic Count Survey should be undertaken at major locations to check if traffic behaviors are the same as the action plan study.

3) Confirmation of the proposed Protected Area in Ligawasan Marsh

There is a proposal from NEDA 12 to declare portion of Ligawasan Marsh as protected area. Although initial assessment revealed that the proposed road is outside the Key Biodiversity Area (KBA) which is proposed as protected area, a closer discussion should be sought with MENRE-BARMM during the FS stage. It was learned that MENRE-BARMM assumed jurisdiction of the marsh since January 2021 from DENR-12.

During the FS, the alignment shall be further refined to minimize encroachment in the marsh such as by following the river alignment and studying suitable structures.

CHAPTER 25
ACTION PLAN OF THE WATER SUPPLY IMPROVEMENT IN GREATER COTABATO

25.1 Introduction

25.1.1 Project Background

Metro Cotabato Water District (MCWD) created in 1976 is the sole utility company supplying potable water in Cotabato City and neighboring areas of Sultan Kudarat and Datu Odin Sinsuat in Maguindanao. It has a capacity of producing 40,000 m3/day from three (3) sources, namely: 1) Deep Wells; 2) Spring Water in Datu Odin Sinsuat municipality which can produce 16,000 m3/day; and 3) Surface Water in Dimapatoy River which can produce 200 liters/sec with treatment plant. However, 30% of the water production are wasted (Non-Revenue Water), hence only 28,000 m3 are produced for 34,640 HH. Currently only 49% of households in Cotabato City are supplied with water from MCWD while 51% are not supplied. Based upon those conditions, MCWD needs financial and technical assistance both in rehabilitation of existing facilities and future expansion of their system.

25.1.2 Objectives of the Project

The objectives of the project are as follows:

- To improve and increase the water services of Metro Cotabato Water District and ensure safer operation.
- To sustain the good quality of potable water to its consumers
- To provide sustainable power supply to the system for efficient delivery of water service
- To provide riverbank protection at the upstream portion of Dimapatoy River (one of the sources of water of MCWD) to prevent erosion.

25.1.3 Outline of the Project

(a) Rehabilitation of Existing Facilities

With regards to rehabilitation of existing facilities, MCWD identified three (3) projects listed in below, mostly responding to their facility in Dimapatoy.

METRO COTABATO WATER DISTRICT
Governor Gutierrez Avenue
Cotabato City

Proposed Projects	Estimated Cost	Remarks
1.) Pipe Replacement of Dilapidated Pipes (Age: 30 - 40 years Old)	P 141,905,600.00	For Reduction of Non-Revenue Water (Leakages or water waste)
2.) Solar Panel for Electric Power Production w/ accessories (1000KW)	70,000,000.00	For reduction of power expense of more than P36Million annually
3.) Riverbank Protection for Dimapatoy River: Height 3M. ;Length 500M.	16,800,000.00	To prevent meandering and diminishing water volume of the river.
TOTAL	P 228,705,600.00	

Note: MCWD proposals for submission to J.I.C.A. (for feasibility study / possible financing)

Source: Metro Cotabato Water District

Figure 25.1-1 Request of Support from MCWD for Rehabilitation of Existing Facilities

As of 2018, more than 40% of water production by MCWD comes from Dimapatoy water supply system and it is exclusive water source for MCWD other than spring waters and deep wells. Therefore, it is safe to say rehabilitation of facilities in Dimapatoy water system is urgent and essential.

(b) Establishment of Master Plan for Water Supply System

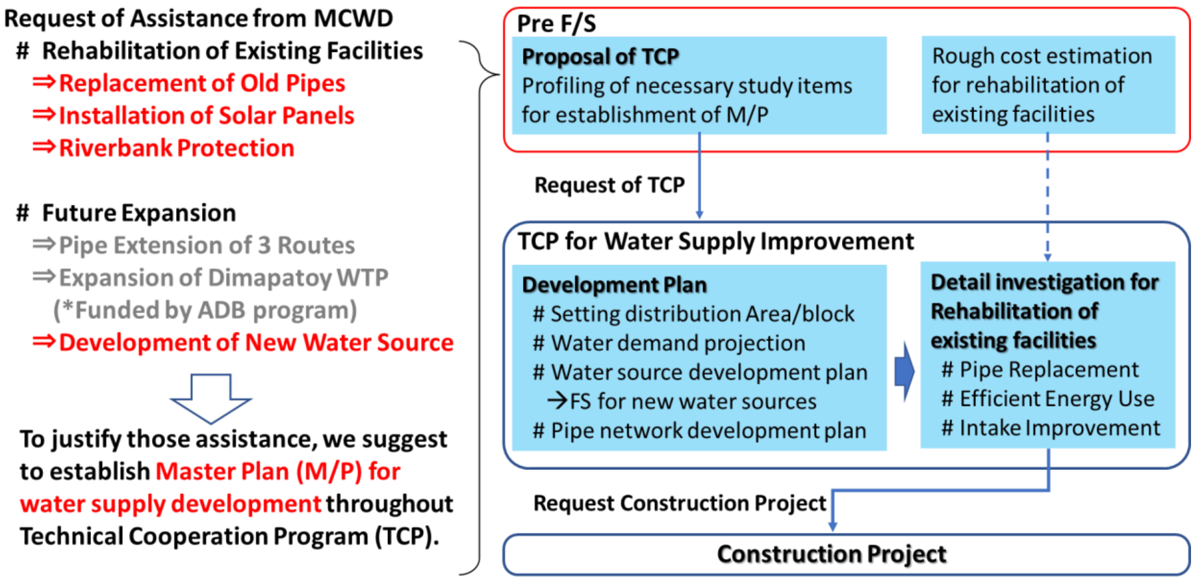
MCWD has their Business Development Plan and several proposed projects for pipe extension, increase of treatment capacity and water source development. However, technical analysis is still insufficient for profiling and prioritizing the proposed development projects. Therefore, establishment of an integrated technical master plan is necessary for proper development/expansion of their water supply system.

(c) Study for Development of New Water Resource

MCWD has proposed plans for development of new water source from major rivers flowing along Cotabato City, Rio Grande de Mindanao and Tamontaka river. Feasibility of developing those new water resource shall be studied in the water supply system master plan.

(d) Implementation Steps

After this pre-feasibility survey, another comprehensive study project shall be conducted for establishment of development plan and detailed investigation for rehabilitation of existing facilities. Following the survey result, scope of construction project will be determined Figure 25.1-2 shows relationship of project needs and implementation steps.



Source: JICA Study Team

Figure 25.1-2 Diagram of Project Needs and Implementation Steps

In this pre-feasibility study, necessary study items for the comprehensive study project are proposed. Also, rough cost for rehabilitation of existing facilities will be estimated, even although the detailed scope of the construction project shall be investigated in the comprehensive study project.

25.2 Establishment of Water Supply Development Master Plan

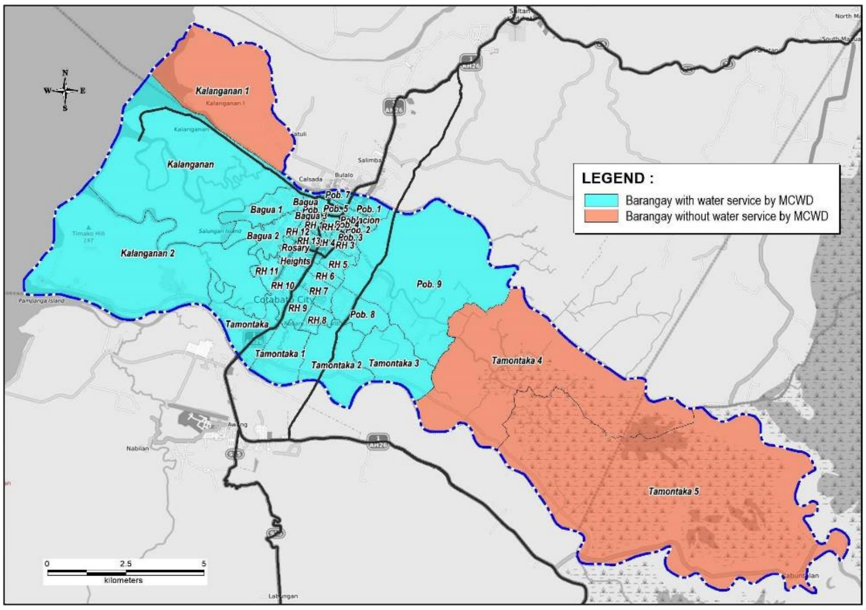
25.2.1 Analysis on Present Situation and Issues

(a) Existing Business Development Plan by MCWD

MCWD has their Business Development Plan and several proposed projects for pipe extension, increase treatment capacity and water source development. However, technical analysis is still insufficient for profiling and prioritizing the proposed development projects. Therefore, establishment of an integrated technical master plan is desired for proper development/expansion of their water supply system.

(b) Service Area

The franchise area of MCWD is shown in the map of Figure 25.2-1. However, this map represents administrative boundary of the served Barangays including less populated areas. Therefore, "Design Distribution Area" shall be studied for technical planning of water supply development.



Source: JICA Study Team

Figure 25.2-1 MCWD Franchise Area

The Design Distribution Area is determined for effective and practical water system operation including following factors:

- Population density
- Connectivity with the existing network
- Consistency with urban development plan / land use plan
- Social aspects, especially when the operation area covers multiple municipalities

(c) Water Demand Forecast

As of 2018, MCWD has 34,776 service connections while Cotabato City has 65,680 households, which is calculated from population of 328,400 assuming average size of family members is 5. These numbers suggest that MCWD was only 29,960 which represent 52% of the household number.

In Chapter 14, water demand projections are calculated as 176,200m^3/day in 2028 and 244,900m^3/day in 2040 as shown in Table 25.2-1.

Table 25.2-1 Water Demand Projection based on 100% Population of the Service Area

year	2028					2040				
	Population	Domestic		Non-Domestic	Total Demand	Population	Domestic		Non-Domestic	Total Demand
Area	Nr	lcd	m3/day	%	m3/day	Nr	lcd	m3/day	%	m3/day
Cotabato City	380,500	150	57,075	23	70,202	474,700	150	71,205	30	92,567
Others	589,000	150	88,350	20	106,020	812,400	150	121,860	25	152,325
Total	969,500		145,425		**176,222**	1,287,100		193,065		**244,892**

Source: JICA Study Team

However, these values are based on the whole population of Cotabato City and other five surrounding municipalities, 969,500 in 2028 and 1,287,100 in 2040. As stated in **(b) Service Area**, Design Distribution Area shall be specified practical percentage of service population shall be considered especially for low-income areas or remote areas from city center.

For example, assuming the rate of served population will be improved from current 52% in Cotabato City to 70% (2028) and 80% (2040) and from current 0% in surrounding municipalities to 20% (2028) and 50% (2040), the water demand is calculated as 70,300m^3/day in 2028 and 150,200m^3/day in 2040.

Table 25.2-2 Water Demand Projection considering Practical Rate of Served Population

year / Area	2018			2028			2040		
	Population	Served Population		Population	Served Population		Population	Served Population	
	Nr	%	Nr	Nr	%	Nr	Nr	%	Nr
Cotabato City	328,400	52	**170,768**	380,500	70	**266,350**	474,700	80	**379,760**
Others	-	-	**-**	589,000	20	**117,800**	812,400	50	**406,200**
Total	328,400		**170,768**	969,500		**384,150**	1,287,100		**785,960**

year / Area	2028					2040				
	Population	Domestic		Non-Domestic	Total Demand	Population	Domestic		Non-Domestic	Total Demand
	Nr	lcd	m3/day	%	m3/day	Nr	lcd	m3/day	%	m3/day
Cotabato City	266,350	150	39,953	23	49,142	379,760	150	56,964	30	74,053
Others	117,800	150	17,670	20	21,204	406,200	150	60,930	25	76,163
Total	384,150		57,623		**70,346**	785,960		117,894		**150,216**

Source: JICA Study Team

This rate setting affects much to the water demand projection and required capacity of water treatment facilities, hence it shall be studied and discussed in the future survey project.

(d) Non-Revenue Water and Required Water Production Capacity

In 2018, MCWD produced water of 14,707,193 m^3/day (cu.m./day) and 10,386,756 m^3/day was consumed. Which means, the rate of Non-Revenue Water (NRW) was approximately 30%.

Assuming that the current 30% rate of NRW will be reduced to 20% in 2028 and 15% in 2040, the required water production is estimated to be 86,000m^3/day in 2028 and 176,00m^3/day in 2040 from the as shown in Table 25.2-3.

Table 25.2-3 Required Water Production Capacity

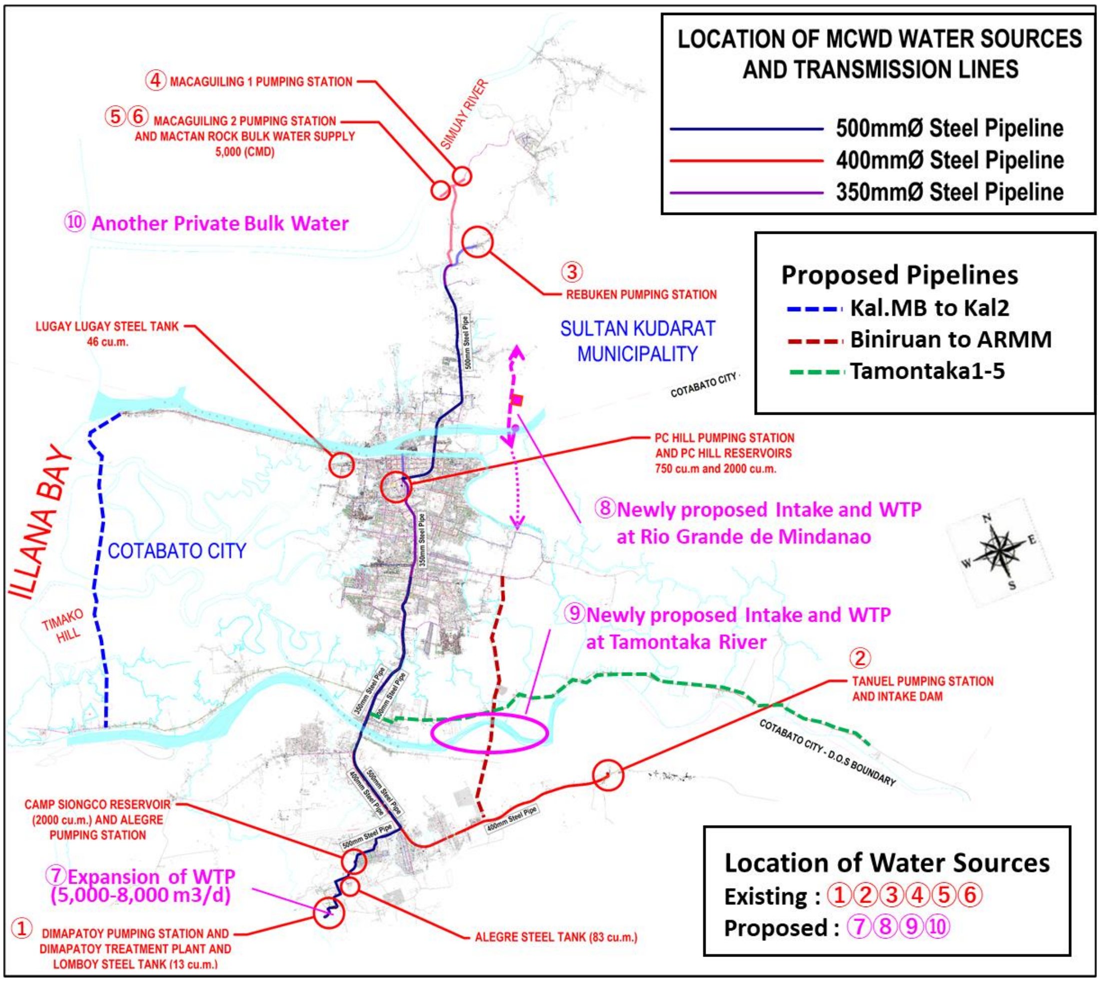
Conditions	unit	2028	2040
Total Water Demand	m3/day	70,346	150,216
NRW	%	20	15
In-Water Treatment Plant Losses	%	2	2
Required Water Production Capacity	m3/day	**86,000**	**176,000**

Source: JICA Study Team

To ensure the reduction of NRW to 20% in 2028 and 15% in 2040, the causes of current NRW shall be analyzed and improvement plan shall be developed in the future survey project.

(e) Existing Facilities and Future Projects

Location of existing major facilities of MCWD water system and proposed projects are indicated in the map below. Currently, MCWD has 6 water sources namely, Dimapatoy, Tanuel, Rebuken, Macaguiling1, Macaguiling2 and Mactan Rock Bulk Water Supply. Water production records of each water source are summarized in Table 25.2-4.



Source: Organized by the JICA Study Team based on the data from Metro Cotabato Water District

Figure 25.2-2 Existing Facilities and Proposed Project by MCWD

As of 2018, annual water production is 14,707,193(m^3) in all water resources combined. Water production in daily average is 40,293(m^3), if simply annual production is divided by 365. This number suggests current water production is short of around 45,700 (m^3) to the required water production capacity of 86,000 (m^3) in 2028. Of course, this is rough calculation under the limited availability of data in pre-feasibility study. Detailed data collection and survey are needed in the comprehensive study.

Table 25.2-4 Summary of Existing and Proposed Water Resources

	Name of Water Sources	Type of Water Source	Water Production (cu. m.) Annual in 2018	Water Production (cu. m./day) Daily Average in 2018	Water Production Capacity (cu.m./day)
①	Tanuel P.S.	Spring	5,765,981		To be surveyed
②	Dimapatoy P.S.	Surface	5,975,846		To be surveyed
③	Rebuken P.S.	Deep well	798,965		To be surveyed
④	Macaguiling 1 P.S.	Deep well	472,126		To be surveyed
⑤	Macaguiling 2 P.S.	Deep well	187,691		To be surveyed
⑥	Bulk Water Supply (Mactan Rock-TGV)	Surface	1,506,584		5,000
	Sub Total		14,707,193	40,293	
⑦	Dimapatoy Expansion	Surface			5,000-8,000
⑧	WTP Rio Grande de Mindanao	Surface			To be studied
⑨	WTP Tamontaka River	Surface			To be studied
⑩	Other Private Bulk Water	Surface			To be studied

Source: JICA Study Team

Besides major facilities for intake and treatment, MCWD has a network of transmission lines and distribution pipes including reservoir tanks. In addition to existing lines, MCWD has 3 proposed plans for pipeline extension. However, detail of those extension projects is not clear at this point, especially relations with expansion of service area and water source development.

25.2.2 Study Items for Technical Cooperation Program

(a) General

To establish practical and efficient development plan of water supply system, following studies shall be conducted.

- Review of Basic Data
- Determination of Design Distribution Area
- Water Demand Projection
- Goal Setting for NRW Rate
- Study on Development of New Water Source
- Study on Pipe Net-Work Expansion

(b) Investigation and Data Collection on Current Water System Conditions

Prior to the study for establishment of development plan, following information shall be summarized by data collection and site investigation.

- Capacity and Operation Conditions of Existing Facilities
- Number of Service connection per Barangay / Distribution blocks
- Conditions of meters, in relation with Non Revenue Water issue.

(c) Determination of Design Distribution Area

As mentioned in 25.2.1 (b) Service Area, target service area shall be discussed and determined. Following areas can be considered as potential areas for expansion:

- Areas where densely populated already but no access of tap water
- Not densely populated now, but rapid growth is expected by urban plan

In this process, involvement of relevant stakeholders such as LGUs and Barangays are essential.

(d) Water Demand Projection

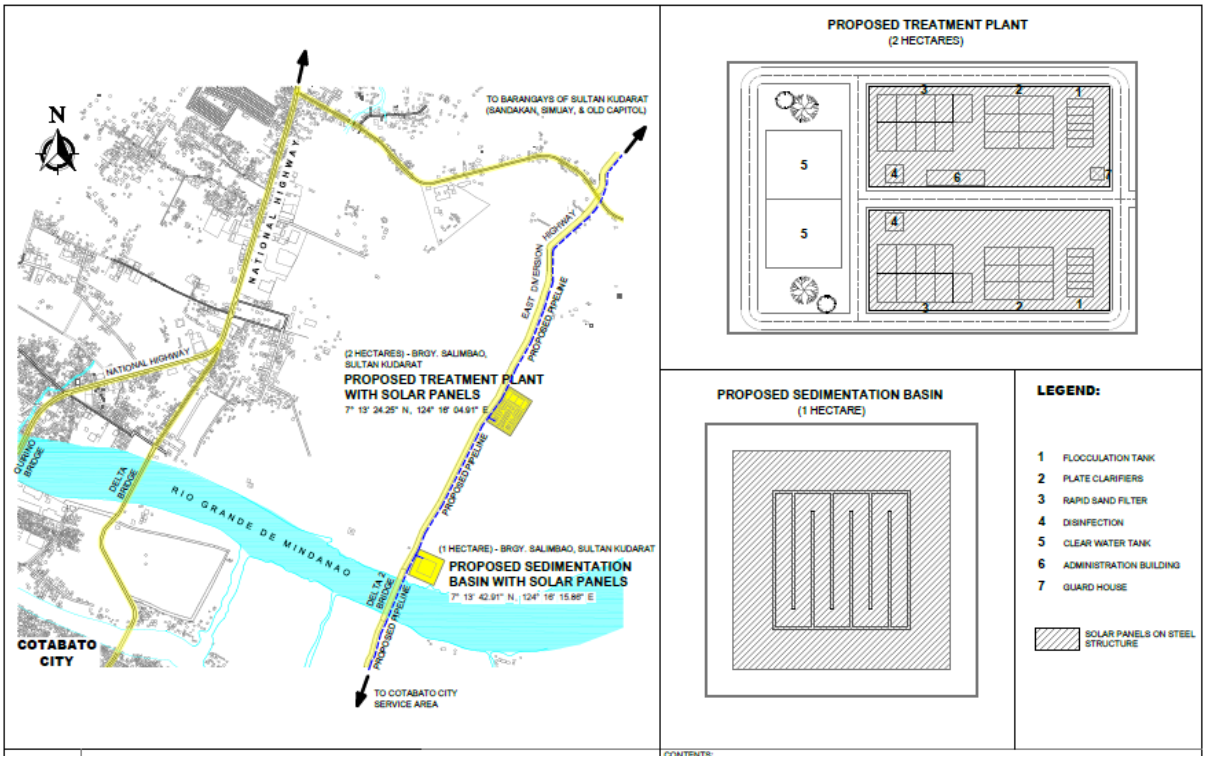
Water demand per capita was confirmed as 150 (L/day) in the preceding data collection survey and population projection per Barangay can be obtained from the said survey. As mentioned in 25.2.1 (c) Water Demand Forecast, based on the design distribution area, target service population shall be determined and water demand projection will be calculated.

(e) Goal Setting for NRW Rate

As mentioned in 25.2.1 (d) Non-Revenue Water and Required Water Production Capacity, the current rate of Non-Revenue Water (NRW) was approximately 30%. In the comprehensive study, causes of NRW shall be analyzed and road-map for reduction of NRW and goal setting of NRW rate shall be discussed. With newly set NRW goals, required water production capacity at target year (2028 and 2040) will be determined.

(f) Study on Development Plan for Water Source Development

MCWD has plans for development of new water source from major rivers flowing along Cotabato City, Rio Grande de Mindanao and Tamontaka river. The proposed plan for development of Rio Grande de Mindanao was shown in Figure 25.2-3, which was provided by MCWD in June 2021. The proposed plan consists of intake from the river, treatment plant and conveyance pipes stretches to south (to existing pipe net-work in Cotabato City) and north (to Sultan Kudarat).



Source: Metro Cotabato Water District

Figure 25.2-3 Proposed Plan for New Water Intake along Rio Grande de Mindanao

MCWD also revealed another plan in August 2021, which is to intake water from Tamontaka river. Detail of the plan is not yet studied. Feasibility of those plans shall be examined and discussed in the comprehensive study, based upon the design distribution area and required water production capacity.

(g) Study on Development Plan for Pipe Network

development plan for pipe network shall be studied. As mentioned earlier, MCWD has 3 proposed plans for pipeline extension. However, those extension projects shall be examined in consideration with study results of water source development and design distribution area.

25.3 Replacement of Old Pipes

25.3.1 Analysis on Current Conditions and Issues

MCWD was established in 1976 as the sole utility company supplying potable water in Cotabato City and neighboring areas of Sultan Kudarat and Datu Odin Sinsuat in Maguindanao. Major pipes which were constructed at an early stage of MCWD development are exceeding 30-40 years old. Many of those pipes have scaling which reduces the diameter of pipe up to 25% (from 16 inches to 12 inches for example), hence the water supply system cannot perform to the best of its capacity. Leakage and potential disruption of pipe networks are a threat to the system too.

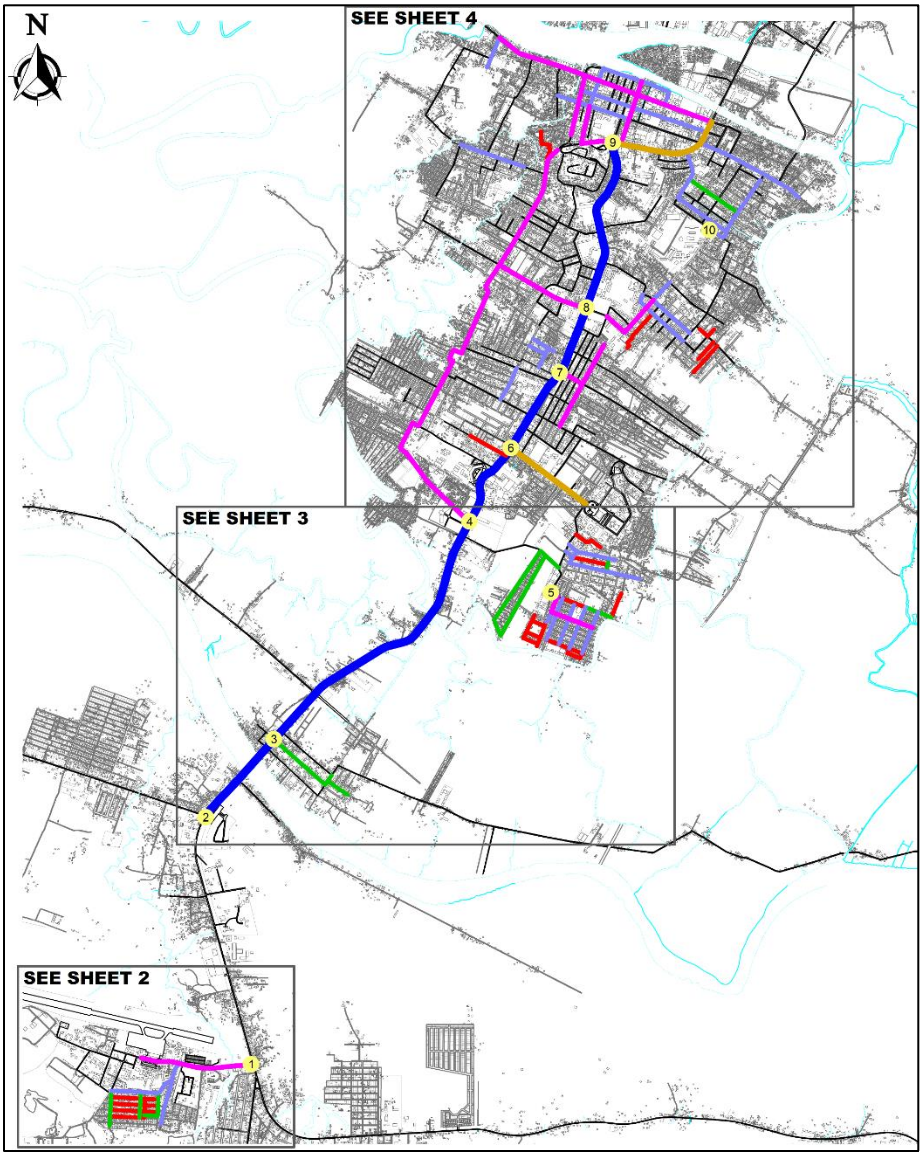
MCWD listed up the pipes to be replaced by their ages, as shown in the Figure 25.3-1. Location of Aged Pipes Listed by MCWD is shown in Figure 25.3-2.

Metro Cotabato Water District: Dilapidated Pipes Subject for Pipe Replacement (Age: 33 - 43 Years Old) as of May 2021

Year Installed	Size (inches)	Length (Lm)	Material	Age	Location	Estimated Cost
1981	2"Ø	2,216	uPVC Pipe	40	Along Notre Dame Village	6,648,000.00
1983	2"Ø	321	uPVC Pipe	38	1st St.: Don Sero St. to Alipoon Residence	963,000.00
1984	2"Ø	293	uPVC Pipe	37	Rufo Mañara Street	879,000.00
1985	2"Ø	255	uPVC Pipe	36	TV Juliano Avenue to Mabini Street	765,000.00
1987	2"Ø	573	uPVC Pipe	34	Telecom	1,719,000.00
1987	2"Ø	808	uPVC Pipe	34	Em's Bario	2,424,000.00
1981	3"Ø	2,214	uPVC Pipe	40	Along Notre Dame Village	6,642,000.00
1987	3"Ø	425	uPVC Pipe	34	Doña Theresa St. to Corner A. Badoy St.	1,275,000.00
1987	3"Ø	759	uPVC Pipe	34	Tamontaka Mother	2,277,000.00
1987	3"Ø	808	uPVC Pipe	34	Em's Bario	2,424,000.00
1978	4"Ø	471	uPVC Pipe	43	Pascual Subdivision	1,648,500.00
1981	4"Ø	2,214	uPVC Pipe	40	Along Notre Dame Village	7,749,000.00
1982	4"Ø	822	uPVC Pipe	39	SK Pendatun to Polysack	2,877,000.00
1982	4"Ø	388	uPVC Pipe	39	ND Avenue to Corner Don Abelardo St.	1,358,000.00
1982	4"Ø	433	uPVC Pipe	39	Don Abelardo: ND Ave. Anacleto Badoy St.	1,515,500.00
1983	4"Ø	282	uPVC Pipe	38	SK Pendatun St. to Rajah Tabunaway Blvd.	987,000.00
1983	4"Ø	449	uPVC Pipe	38	Rajah Tabunaway Blvd.: Cor. Bonifacio St. to boundary of Minrico Compound	1,571,500.00
1983	4"Ø	212	uPVC Pipe	38	Mabini St.: PC Hill to Corner SK Pendatun	742,000.00
1983	4"Ø	232	uPVC Pipe	38	Kibatang St.	812,000.00
1984	4"Ø	964	uPVC Pipe	37	Magallanes St. (Don Rufino Alonzo St.)	3,374,000.00
1984	4"Ø	552	uPVC Pipe	37	Corner Makakua St. to Del Pilar St.	1,932,000.00
1985	4"Ø	177	uPVC Pipe	36	De Mazenod Ave.: Cor. Sesame St. to 1081 St.	619,500.00
1985	4"Ø	421	uPVC Pipe	36	Don Sero St.: De Mazenod to Cor. Datu Liwa Candao St.	1,473,500.00
1985	4"Ø	360	uPVC Pipe	36	1081 St.: De Mazenod to Cor. Datu Liwa Candao St.	1,260,000.00
1985	4"Ø	554	uPVC Pipe	36	Mampen Usman (Tulingan)	1,939,000.00
1987	4"Ø	508	uPVC Pipe	34	Anacleto Badoy: Cor. Atienza St. to Cor. De Mazenod Ave.	1,778,000.00
1987	4"Ø	45	uPVC Pipe	34	Nayon Shariff Kabunsuan St. to Datu Liwa Candao St.	157,500.00
1987	4"Ø	807	uPVC Pipe	34	Em's Bario	2,824,500.00
1998	4"Ø	264	uPVC Pipe	23	Delcano Street, Rosary Heights 10	924,000.00
1981	6"Ø	473	uPVC Pipe	40	Governor Gutierrez Ave. to ND Village	2,365,000.00
1981	6"Ø	3,377	uPVC Pipe	40	Datu Udtog Matalam Ave. to Bagua Spring	16,885,000.00
1981	6"Ø	700	uPVC Pipe	40	Ramon Rabago St. to TV Juliano Avenue	3,500,000.00
1982	6"Ø	701	uPVC Pipe	39	Jose Lim St.: Cor. Mabini St. to Cor. Kibatang St., Lugay-Lugay	3,505,000.00
1982	6"Ø	188	uPVC Pipe	39	Rosales St.: Sinsuat Avenue to Rosal Street	940,000.00
1983	6"Ø	976	uPVC Pipe	38	Jose Lim Sr. Street	4,880,000.00
1983	6"Ø	223	uPVC Pipe	38	Quezon Ave.: Corner Sinsuat Ave. (entering Mañara Stair, Bonifacio Street)	1,115,000.00
1983	6"Ø	472	uPVC Pipe	38	Makakua St. Corner Quezon Ave. to Rajah Tabunaway Blvd.	2,360,000.00
1983	6"Ø	219	uPVC Pipe	38	Bonifacio St.: PC Hill to Corner SK Pendatun Street	1,095,000.00
1983	6"Ø	202	uPVC Pipe	38	Mabini Street: SK Pendatun to Jose Lim Street	1,010,000.00
1983	6"Ø	830	uPVC Pipe	38	Awang Airport	4,150,000.00
1985	6"Ø	495	uPVC Pipe	36	De Mazenod Avenue: Corner 1081 St. to front of DPWH	2,475,000.00
1988	6"Ø	670	uPVC Pipe	33	Rosal Street	3,350,000.00
1981	8"Ø	472	uPVC Pipe	40	Governor Gutierrez Avenue	2,643,200.00
1983	8"Ø	860	uPVC Pipe	38	Quezon Avenue: Cor. Jose Lim St. and Sinsuat Ave.	4,816,000.00
1983	16"Ø	6,064	Steel Pipe	38	SPDA Road Junction to Downtown (DXMS Section)	154,632,000.00
Total:		**35,749**				**271,279,700.00**

Source: JICA Study Team

Figure 25.3-1 List of Aged Pipes by MCWD



Source: JICA Study Team

Figure 25.3-2 Location of Aged Pipes Listed by MCWD

25.3.2 Study Items in Technical Cooperation Program

(a) General

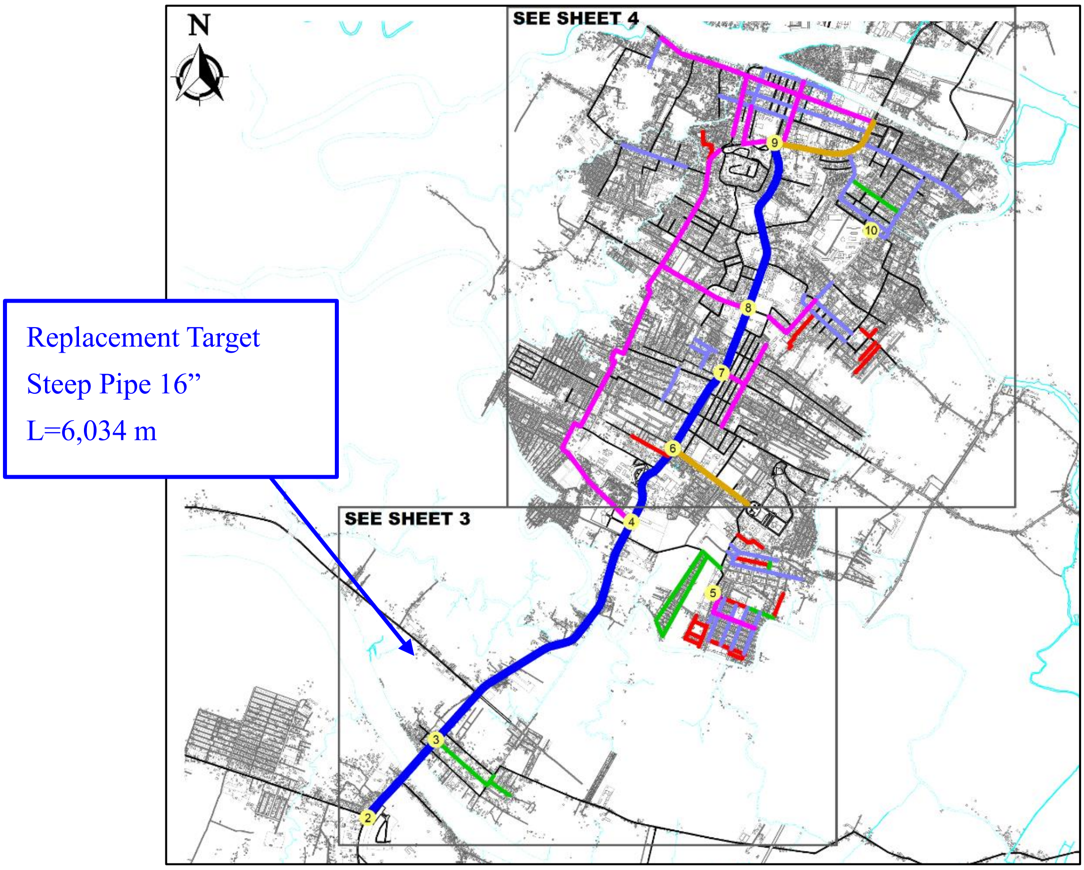
To find out optimal configuration of power system and necessary equipment and construction works for it, further study is needed including following items.

- Development of pipe replacement/extension plan including pipe network analysis with future demand, study on redundancy (Loop/Bypass) and distribution blocks
- Priority screening not only by pipe age but disruption, construction plan considering location of stop valves
- Improvement of pipe management system, mapping system and planning method based on asset management
- Reduction of pump use by gravity type distribution tanks

25.3.3 Potential Project for Grant Aid Construction

(a) General

Although detailed scope of pipe replacement shall be determined throughout the proposed TCP project, most probably the trunk line pipe of Diameter 16 inches, which connects Dimapatoy pump station to city center, will be the primary target of the replacement works.



Source: JICA Study Team

Figure 25.3-3 Target of Pipe Replacement

(b) Pipe Material

Steel Pipe is one of the traditional conveying materials in the industry of water and wastewater. Although these are widely used throughout the world and are comparatively inexpensive than ductile iron pipes.

On the other hand, Ductile Iron Pipe (DCIP) is defined as a rich graphite cast iron that has a nodular or spheroidal form. This molecular structure makes it less brittle and provides an impact resistance resulting in a longer life span of the pipe. Hence, along with its other advantages, it created a rapid increase in demand and production as it could be transported, handled and installed with no damage to the pipe.

Mentioning the above pipe materials, detailed distinction between them are compared with various characteristics as shown in the Table 25.3-1.

Table 25.3-1 Characteristics of Each Pipe Material

Characteristics	Ductile Iron Pipe	Steel Pipe
Burst Strength against internal pressure	Has a safety factor of up to 2.0 in the working and surge pressure	Has a safety factor of 1.33 to 2.0 in the working and surge pressure depending on the percent yield used
Deflection strength against superimposed loads in trench	Modulus of elasticity typically ranges from 23,500 ksi to 24,500 ksi and can deformed easily without the pipes pulling out	Modulus of elasticity is about 30,000 ksi and can deflect and might break due to its stiffness
Resistance to Corrosion	High corrosion resistance due to its protective zinc layer on its outside surface and cement mortar lining on the inside surface which are applied during the manufacturing process	Easily corrodes on both external and internal surfaces due to the presence of moisture and air that simply react to steel unless be coated against corrosion
Seismic Resistance	Has the ability to follow ground movement and pipe bending during earthquakes due to high tensile strength and flexibility of the joints	May bend or break during ground motion due to its stiffness and inflexibility of the joints
Flow Capacity	No significant change in the flow capacity	Flow capacity can decreases due to higher friction head losses when the internal surface gets corrosion
Durability	Its life expectancy can reach up to 100 years	Has an average of 20 to 50 years of life span*
Installation	Easy to install for pipes and have a wide variety of joints and standard fittings which are flexible making the pipe rerouting possible	Welding works at site might lengthen the installation process
Cost	Price might be higher for pipes and appurtenances shipped overseas and installation but pumping and maintenance cost will be lesser in the long run	Pipe cost and its appurtenances might be inexpensive as with its installation cost will increase due to necessity of welding and painting works at site

* The lates corrosion-resistant painting technology may allow longer life span of steel pipe up to 100 years, however, those factors are excluded in this table since special painting works are needed at site and applicability in the Philippines is not confirmed.

Source: JICA Study Team

Optimal solution for selection of pipe material might be different by pipe size and construction conditions though, in this study, ductile iron pipe is selected for the replacement of existing steel pipe with following considerations.

1. Compared to steel pipe, ductile iron pipe is easier and quicker to install using with designated joint accessories without welding works at site, hence, installation process can be shorter than steel pipes. This difference of jointing method also affects to durability of pipes. Ductile iron pipe has long life expectancy of up tp 100 years.Steel pipe can maintain similar life expectancy with the latest painting technology though, necessity of welding works at site may raise uncertainty in quality of corrosion-resistance capacity in the Philippines. Despite

of higher material cost, ductile iron pipe could be, it could be cost effective option in terms of installation , operation and maintenance over its long service life and function.

2. Another advantage of ductile iron pipe is its flexibility during earthquakes or any ground movements. The Philippines belongs to the Pacific Ring of Fire where frequent volcanic eruptions and earthquakes occur. In order to lessen the damage on the buried pipes, ductile iron pipe is a way better option as the joints are designed to be flexible for both tensile and compressive forces. In the event of an earthquake, ground deforms causing the ductile iron pipe to deflect without causing any pullout. Moreover, studies show that the 9.0 magnitude quake in Japan in 2011 and 8.0 magnitude quake in Wenchuan, China in 2008 all indicate a lowest damage rate for ductile iron pipe and are still operational.

Hence, the use of ductile iron pipe and its appurtenances are highly recommended for its high efficacy of conveying water for growing residential and commercial establishments in Cotabato.

Source: JICA Study Team

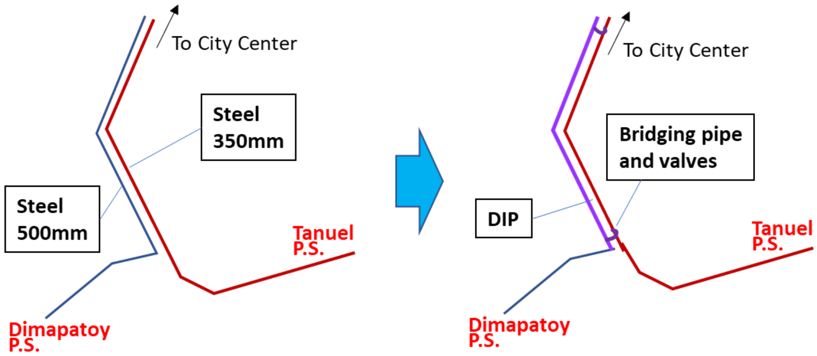
Figure 25.3-4 Sample Image of Ductile Cast Iron Pipe

(c) Improvement of Redundant Pipe Network

In designing of water supply pipelines, the distribution system is considered not only with its topology but also with its layout. In the case of replacing the 16 inches diameter pipe along Sinsuat Avenue, a looped system, combined with double-track pipe, will be applied assuming that there are only few or no pipe dead-ends, resulting for the water to move freely throughout the system. Generally, this could result in a higher cost because of the need for more pipes and appurtenances to bridge or to create the loops.

Fortunately, adapting to this kind of system involved several advantages. If one of two pipe-track of the water distribution fails or undergoes a system maintenance, that section of the pipe can be isolated without disrupting the water service to a great number of users within the network or interrupted water supply will be minimized.

Moreover, the combination of loop and double-pipe track layout make the water velocity low which can reduce head losses resulting in greater capacity despite having a high water demands especially like in the growing city of Cotabato.



Source: JICA Study Team

Figure 25.3-5 Sample Image of Double Track Pipe Layout

(d) Water Pipeline Bridge

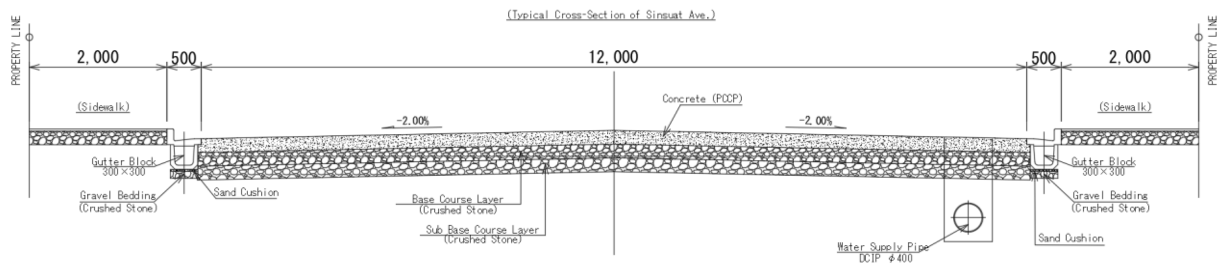
The replacement of the current water supply pipe within the project will not only be laid below the road surface but also to the existing pipe bridge. In order for the pipes to run over the Tamontaka River and Tarbeng Creek, a pipe bridge was constructed to continue the supply of water within the area.

Since ductile iron pipe is heavier than steel pipe (Dia.500 case for example, Ductile Iron pipe 93.4kg/m vs Steel pipe 74.3kg/m), the existing pipe bridge might not carry the load of ductile iron pipe.Furthermore, the required size of the proposed ductile iron pipe and its appurtenances can contribute to the change of the load to be carried by the pipe bridge. The consideration of modifying and/or adding a new pipe bridge is not urgent but needs to be carefully evaluated knowing that the replacement of the pipe should consider the water demand of the growing city of Cotabato which can greatly affect the size of the pipe.

Figure 25.3-6 Existing Pipe Bridge Crossing Tamontaka River

(e) Rough Cost Estimation

In consideration with conditions discussed above and standard construction practices in the Philippines, typical cross section of pipe installation would be as follows:



Source: JICA Study Team

Figure 25.3-7 Typical Cross Section of Pipe Replacement Works

In consideration with conditions discussed above and standard construction practices in the Philippines, typical cross section of pipe installation would be as follows.

Table 25.3-2 Rough Cost Estimation of Replacement Trunk Line, 16" Steel Pipe

Direct Cost	Total (PHP)
Pipe Material	24,752,720
Earth Work	3,036,642
Pipe Work	2,752,654
Road Work	9,637,456
Sub Total	40,179,472
Indirect Cost	
20% of Direct Cost (Tentatively)	8,035,894
Grand Total	*48,215,366*

Source: JICA Study Team

25.4 Efficient Energy Use

25.4.1 Analysis on Current Conditions and Issues

(a) Power Supply Conditions in the Province of Cotabato

SOCCSKSARGEN is a region of the Philippines, located in central Mindanao, and is officially designated as Region XII. The name is an acronym that stands for the region's four provinces and one of its cities: South Cotabato, Cotabato, Sultan Kudarat, Sarangani and General Santos City. The region is more formally known by its older name Central Mindanao. The regional center is Koronadal City located in the province of South Cotabato. Cotabato City, though geographically within the boundaries of the province of Maguindanao, itself is part of SOCCSKSARGEN, and is independent of that province. Maguindanao province is, in fact, a part of the Autonomous Region in Muslim Mindanao (ARMM) which has its seat in Cotabato City. SOCCSKSARGEN and the province of Maguindanao were once part of the original Cotabato province.

There were three (3) Electric Utility Company servicing the Province of Cotabato, namely the MAGELLCO, CLPC, and COTELCO.

The Maguindanao Electric Cooperative (MAGELCO) serves a major part of the province of Maguindanao and some parts of the province of North Cotabato. MAGELCO provides electric service to seventeen (17) municipalities of Maguindanao and six (6) municipalities of the province of North Cotabato. Although part of Maguindanao, the municipalities of Sultan Kudarat and Datu Odin Sinsuat get their electricity from a private utility firm, the Cotabato Light and Power Company.

Cotabato Light and Power Company (CLPC) is an electric utility and a member company of Aboitiz Power group who gets power resources from the National Grid Corporation of the Philippines (NGCP). It also operates a bunker fuel-fired stand-by power engines to address emergency situations like power failures, trip-offs and fluctuations. Its office is located in Cotabato City, with service area covering Cotabato City and parts of Datu Odin Sinsuat and Sultan Kudarat municipalities.

Cotabato Electric Cooperative, Inc. (COTELCO) is a non-stock and non-profit electric distribution utility that serves eleven (11) municipalities and one (1) city of the Province of Cotabato, namely: Kabacan, Mlang, Matalam, Carmen, Banisilan, Tulunan, Makilala, Magpet, Kidapawan, Pres. Roxas, Antipas, and Arakan. The main office is located in Matalam, Cotabato, while outlying offices are situated in the municipalities of Kabacan, Mlang, Antipas and Kidapawan City while service centers are ready to serve member-consumers located elsewhere.

Historically, Mindanao relied mainly on renewable sources for its power generation with more than half, as high as 65% in 2011, contribution to the total power generation mix of the island. However, the share of renewables decelerated over the years with the entry of additional capacities from coal power plants starting in 2015. In 2017, contribution from renewables stood at almost 40.0 percent of total power generation. With the island’s abundant hydro resources, about 80.0 percent of generation from renewables had been sourced from hydro.

Currently, Mindanao is enjoying excess supply of power, more than enough to meet the present and short-term power supply requirements of the grid. However, the island’s power demand is expected to significantly increase due to foreseen robust growth of its local economy, coupled with the construction boom from the Build, Build, Build Program of the government. As of December 2017, the committed power projects covering the period 2017-2025 in the island of Mindanao have a total capacity of 1,332.43 MW, about half coming from coal, while hydropower accounts for nearly 44.3 percent. On the other hand, indicative power projects stand at 1,980.62 MW, nearly 60.0 percent is coal power projects.

With an annual average growth rate of 4.3 percent, electricity demand in Mindanao (covering both on-grid and off grid areas) more than tripled from 1990 to 2017. Over the planning period, electricity demand continues to grow at 9.8 percent in High Growth Scenario (HGS) and 7.3 percent in Low Growth Scenario (LGS). Prospective economic growth across regions is the key factor of the rise in electricity demand. In HGS, all Mindanao regions register more than seven-fold increase in their electricity demand, with exception of Northern Mindanao and Soccsksargen with demand rises by nine (9) times. Northern Mindanao, Davao and Soccsksargen regions continue to be the major users of electricity with combined share of around 78.0 percent (both scenarios) of total electricity demand in 2040. The surge in demand from these regions has been driven mainly by the presence of heavy industries and reflecting the flow of investment to these regions.

Power outages occur due to contact with trees or small animals or due to short circuits and ground faults that occur in electric power facilities.

(b) Use of Renewable Energy in the Philippines

The Philippines utilizes renewable energy sources including hydropower, geothermal and solar energy, wind power and biomass resources. Among the renewable energy sources available in the country, geothermal shows to be the cheapest and most (economically) attractive energy source followed by wind, hydropower, and lastly, solar PV.

The passage of Republic Act No. 9513 or the Renewable Energy (RE) Act in 2008, established the framework for accelerated development and advancement of renewables, and the development of strategic program to increase its utilization in the country.

In accordance with the law, the Department of Energy (DOE) spearheaded the formulation of the National Renewable Energy Program (NREP), in consultation with its stakeholders. The NREP aims to triple the country's renewable energy capacity. The program is aligned with the government's thrust to increase the country's energy self-sufficiency, ensure energy security, and promote sustainable development.

The NREP lays down the foundation for development of renewable energy in the country, stimulating investments in the RE sector, developing technologies, and providing the impetus for national and local renewable energy planning that will help identify the most feasible and least-cost renewable energy development options.

National Renewable Energy Program (NREP) intends to:

1. Increase geothermal capacity by 75.0 percent.
2. Increase hydropower capacity by 160 percent.
3. Deliver additional 277MW biomass power capacities.
4. Attain wind power grid parity with the commissioning of 2,345MW additional capacities.

5. Mainstream an additional 284 MW solar power capacities and pursue the achievement of the 1,528 MW aspirational target.
6. Develop the 1st ocean energy facility for the country.

To realize the goals of the NREP, the following shall be carried out:

1. Institutionalize a comprehensive approach to address the challenges and gasps that would prevent and/or delay wider application of Renewable Energy technologies in a sustainable manner; and
2. Outline the action plans necessary to facilitate and encourage greater private sector investments in Renewable Energy development.

The estimates for the expected capacity additions are based on the Renewable Energy Service/Operating Contracts which have been awarded and are being evaluated by the Department of Energy. These are presented by Renewable Energy sector in Table 25.4-1. Table 25.4-2 to Table 25.4-4, on the other hand, present the capacity additions by location.

Table 25.4-1 Renewable Energy-based Capacity Installation Targets, Philippines

Sector	Installed Capacity, (MW) as of 2010	Target Capacity Addition by				Total Capacity Addition (MW) 2011-2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	1,966.0	220.0	1,100.0	95.0	80.0	1,495.0	3,461.0
Hydro	3,400.0	341.3	3,161.0	1,891.8	0.0	5,394.1	8,724.1
Biomass	39.0	276.7	0.0	0.0	0.0	276.7	315.7
Wind	33.0	1,048.0	855.0	442.0	0.0	2,345.0	2,378.0
Solar	1.0	269.0	5.0	5.0	5.0	284.0[11]	285.0
Ocean	0.0	0.0	35.5	35.0	0.0	70.5	70.5
TOTAL	5,438.0	2,155.0	5,156.5	2,468.8	85.0	9,865.3	15,304.3

Source: DOE-Renewable Energy Plans and Programs (2011-2030)

Table 25.4-2 Renewable Energy-based Capacity Installation Targets, Luzon

Sector	Installed Capacity, (MW) as of 2010	Target Capacity Addition by				Total Capacity Addition (MW) 2011-2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	899.0	100.0	720.0	0.0	0.0	820.0	1,719.0
Hydro	2,346.0	182.0	2,169.5	1,510.0	0.0	3,861.5	6,207.5
Biomass	9.0	97.3	0.0	0.0	0.0	97.3	106.3
Wind	33.0	841.0	840.0	432.0	0.0	2,103.0	2,136.0
Solar	0.0	228.05	0.0	0.0	0.0	228.05	228.05
Ocean	0.0	0.0	35.5	0.0	0.0	35.5	35.5
TOTAL	3,287.0	1,438.4	3,765.0	1,942.0	0.0	7,145.4	10,432.4

Source: DOE-Renewable Energy Plans and Programs (2011-2030)

Table 25.4-3 Renewable Energy-based Capacity Installation Targets, Visayas

Sector	Installed Capacity, (MW) as of 2010	Target Capacity Addition by				Total Capacity Addition (MW) 2011-2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	964.0	70.0	140.0	65.0	60.0	335.0	1,299.0
Hydro	13.0	84.5	102.4	81.8	0.0	268.7	281.7
Biomass	29.0	142.6	0.0	0.0	0.0	142.6	171.6
Wind	0.0	217.0	0.0	10.0	0.0	227.0	227.0
Solar	0.0	34.0	0.0	0.0	0.0	34.0	34.0
Ocean	0.0	0.0	0.0	11.0	0.0	11.0	11.0
TOTAL	1,006.0	548.1	242.4	167.8	60.0	1,018.3	2,024.3

Source: DOE-Renewable Energy Plans and Programs (2011-2030)

Table 25.4-4 Renewable Energy-based Capacity Installation Targets, Mindanao

Sector	Installed Capacity, (MW) as of 2010	Target Capacity Addition by				Total Capacity Addition (MW) 2011-2030	Total Installed Capacity by 2030
		2015	2020	2025	2030		
Geothermal	103.0	50.0	240.0	30.0	20.0	340.0	443.0
Hydro	1,040.0	74.8	889.1	300.0	0.0	1,263.9	2,303.9
Biomass	0.0	36.8	0.0	0.0	0.0	36.8	36.8
Wind	0.0	0.0	15.0	0.0	0.0	15.0	15.0
Solar	1.0	7.0	5.0	5.0	5.0	22.0	23.0
Ocean	0.0	0.0	0.0	24.0	0.0	24.0	24.0
TOTAL	1,144.0	168.6	1,149.1	359.0	25.0	1,701.7	2,845.7

Source: DOE-Renewable Energy Plans and Programs (2011-2030)

The entry of the above-cited RE-based capacities is highly dependent on the successful implementation of the NREP as well as the policy and incentive mechanisms in the Renewable Energy Law. Particular attention shall be given to the timely conduct of grid impact studies required for all facilities connecting to the grid.

(c) Renewable Energy in Mindanao

With the greening of the energy sector, the use of Renewable Energy (RE) remains to be a global interest. The crucial policy mechanisms are now in place bringing in the much-needed investments and stirring public interest in RE development.

To accelerate further the use of renewables, the Department of energy (DOE) recently issued the Department Order (DO) 2018-03-003 or the "Creation of a Centralized Review and Evaluation Committee (CREC) for the purpose of integrating the current committees administering the review and evaluation of renewable energy, petroleum, downstream natural gas, and coal service contract applications, the award, amendment and termination of contracts". Said committee is now responsible for the management of energy projects covering exploration, development, utilization, distribution and conservation.

In the country's pursuit of low carbon economy, the DOE will continue to take bold targets in harnessing the following renewable sources of energy:

Geothermal. There are seven (7) potential geothermal power projects located in Northern Mindanao, Davao and Socckssargen Regions with an estimated aggregate potential capacity of 80 MW. Also, the Mt. Apo Geothermal Production field has a 30-MW capacity expansion project, which is expected to be completed in December 2021, thus increasing its total installed capacity to 138.48 MW. On the other hand, the 60-MW Parker Geothermal Power Project in South Cotabato is awaiting the awarding of service contact upon completion of documentary requirements.

Hydropower. Mindanao ranks second (next to Luzon) in terms of hydropower potential and installed capacity. For the planning horizon, about 1,012 MW of combined capacity from 81 hydropower potential projects are expected to be in place. In addition, there are 33 pending hydropower energy service contracts/applications with a total estimated potential capacity of 160.36 MW. Majority of these projects are found in Bukidnon, Davao, South Cotabato, and Sultan Kudarat.

Wind. The wind resource assessment conducted by the National Renewable Energy Laboratory (NREL) of the United States – Department of Energy revealed that Northern Mindanao has the largest potential for wind energy development. Wind potential projects are also present in the provinces of Agusan del Norte and Surigao del Norte. And to maximize wind potential for power generation, the DOE will carry out wind resource assessment as a continuing initiative within the planning horizon.

Solar. Over the past few years, the cost of solar technologies continued to drop, consequently increasing its competitiveness vis-à-vis conventional energy sources. And once solar, power projects are built, its fuel remain free and inexhaustible. In the country, solar energy projects are investment-favorite and would play a crucial role in the country's total electrification program for the households.

Region	Location	Plant	Potential Capacity (MW)
X	Misamis Oriental	Tagoloan Solar Power Project	13.14
		Bulua Solar Power Project	0.50
		Iponan Solar Power Project	0.50
		Gingoog City Solar Power Project	10.00
		Laguindingan Solar Power Project	40.00
		Laguindingan Solar Power Project	20.00
		Claveria Solar Power Project	61.10
	Bukidnon	Manolo Fortich Solar Power Project	60.00
	Lanao del Norte	Iligan Solar Power Project	0.03
XI	Davao del Sur	Darong Solar Power Project	35.00
	Davao Oriental	Davao Oriental Solar Power Project	60.00
	Davao del Norte	Tagum Solar Power Project	0.84
XII	South Cotabato	South Cotabato Solar Power Project	20.00
		Mabuhay Solar Power Project (Phase I)	44.00
		Conel Solar Power Project (Phase II)	16.00
	Sarangani	Alabel Solar Power Project	15.00
		Alabel Solar Power Project	160.00
CARAGA	Agusan del Norte	Butuan City 1 Solar Power Project	10.00
ARMM	Lanao del Sur	ICOM Solar Power Project	50.00
	Maguindanao	Maguindanao Solar Power Project	20.00
Total			**636.11**

Source: Mindanao Energy Plan 2018-2040

Figure 25.4-1 Potential Solar Projects in Mindanao

A total of twenty (20) solar power projects with combined capacity of 636.11 MW are programmed for implementation within the planning horizon. The largest of which is located in the province of Sarangani with a total capacity of 175 MW. Moreover, a total of 12 pending solar energy service contract applications are being processed with an estimated potential capacity of 161.5 MW. The provinces of Bukidnon and Misamis Oriental host majority of these projects.

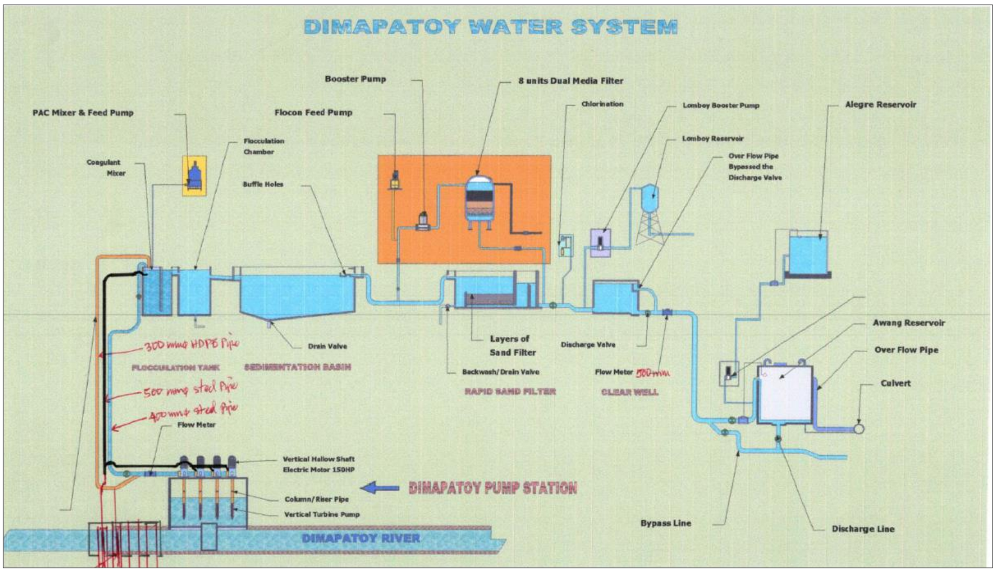
Ocean. Mindanao hosts the 6-MW Gaboc Channel Ocean Energy Project located in Surigao del Norte. Since this technology is currently at an early stage of development in the country, the DOE will continue to monitor developments and international trends to improve expertise in terms of technological development, including establishing benchmarks and best practices to develop our vast ocean energy potential.

Biomass. As Mindanao being considered the country's main source of agricultural products, enhancing its agricultural production would result in increased sources for biomass energy. Aside from committed and indicative biomass power projects, there are pending biomass project applications with an aggregate capacity of 33.19 MW mostly located in South Cotabato, which can boost power supply contribution from renewables within the planning period.

Biofuels. A Roadmap was formulated to support the nationwide implementation of the biofuels blend from 2017 to 2040 in compliance with the Biofuels Act of 2006. Under the said Roadmap, biodiesel blend will be maintained at 2.0 percent for the period 2017 to 2019. For the mediums and long-term periods, the DOE plans to revisit the blending requirements and availability of feedstock. On bioethanol blend, which is currently at 10 percent, the government will review the bioethanol mandate and continuously conduct research and development om potential feedstock sources.

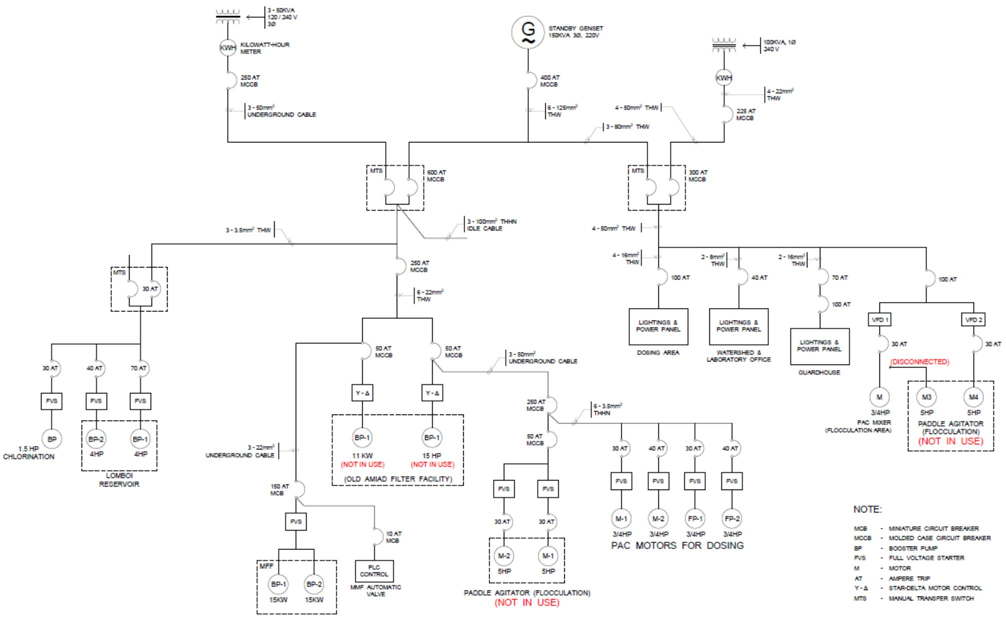
(d) Conditions of Power Consumption in Dimapatoy Water Treatment Plant

Process flow and configuration of electrical equipment in Dimapatoy water treatment plant (WTP) consists of as shown below.



Source: Metro Cotabato Water District

Figure 25.4-2 Process Flow of Dimapatoy WTP



Source: Metro Cotabato Water District

Figure 25.4-3 Single Line Diagram of Dimapatoy WTP

Design power demand of the WTP is in 146kW based on the load schedule below. Power source is depending on commercial electricity provided by MAGELCO and CPLC.

Table 25.4-5 Load Schedule of Dimapatoy WTP

LOAD SCHEDULE								
Station: DTP								
Description	Rated Power	Phase	Volt	Rated Ampere	Circuit Breaker			Size of Wire
					AT	AF	Pole	
Booster Pump-1 (Stand-By)	4 HP	3	230	11.7	70	100	3P	3-3.5mm² THHN & 1-3.5mm² THHN
Booster Pump-2	4 HP	3	230	11.7	40	50	3P	3-3.5mm² THHN & 1-3.5mm² THHN
Booster Pump Chlorine	1.5 HP	1	230	8.4	30	50	2P	2-3.5mm² THHN & 1-3.5mm² THHN
Booster Pump-1 AMIAD	11kW	3	230	36.7	50	50	3P	3-16mm² THHN & 1-8.0mm² THHN
Booster Pump-2 AMIAD	15 HP	3	230	39.8	50	50	3P	3-16mm² THHN & 1-8.0mm² THHN
Booster Pump-1 MMF	15kW	3	230	51.9	150	225	3P	3-22mm² THHN & 1-14mm² THHN
Booster Pump-2 MMF	15kW	3	230	51.9				
PAC Mixer 1	3/4 HP	3	230	3.7	30	50	3P	3-3.5mm² THHN & 1-3.5mm² THHN
PAC Mixer 2	3/4 HP	3	230	3.7	30	50	3P	3-3.5mm² THHN & 1-3.5mm² THHN
PAC Feed Pump-1	3/4 HP	3	230	3.7	30	50	3P	3-3.5mm² THHN & 1-3.5mm² THHN
PAC Feed Pump-2	3/4 HP	3	230	3.7	30	50	3P	3-3.5mm² THHN & 1-3.5mm² THHN
PAC Mixer at Flocculation	3/4 HP	3	230	3.7	30	50	3P	3-3.5mm² THHN & 1-3.5mm² THHN
Flocculation Mixer 1	5HP	3	230	15	30	50	3P	3-3.5mm² THHN & 1-3.5mm² THHN
Flocculation Mixer 2	5HP	3	230	15	30	50	3P	3-3.5mm² THHN & 1-3.5mm² THHN
Flocculation Mixer 3	5HP	3	230	15	30	50	3P	3-3.5mm² THHN & 1-3.5mm² THHN
Flocculation Mixer 4	5HP	3	230	15	30	50	3P	3-3.5mm² THHN & 1-3.5mm² THHN
Dosing Area Lighting & Power	7kW	1	230	30	100	100	2P	2-16mm² THHN & 1-8.0mm² THHN
Water Quality Office Lighting & Power	6kW	1	230	26	40	50	2P	2-8.0mm² THHN & 1-5.5mm² THHN
Guard House Lightings & Power	5kW	1	230	21.7	100	100	2P	2-16mm² THHN & 1-8.0mm² THHN
TOTAL				368.3				

Source: Metro Cotabato Water District

As per MCWD operation for WTP, all PAC motors are operating only during high turbidity at water source and Booster Pumps are alternately running.

Due to power interruption in Cotabato City and surrounding municipalities, MCWD often need to cut its production capacity. As of 2021, average consumption of electricity for Dimapatoy WTP is 85kW. This suggests that the WTP operates at 60 percent of its full capacity in average.

Based upon the current conditions and issues, improvement of power system of the WTP is essential for stable and efficient operation of Cotabato water supply system. Especially, in consideration with the government's policy for encouraging usage of renewable energy, installation of power generation system with solar panel or other renewable energy source is highly recommended to cover shortage of commercial electricity.

25.4.2 Study Items in Technical Cooperation Program

(a) General

To find out optimal configuration of power system and necessary equipment and construction works for it, further study is needed including following items.

・Detail study of power demand in Dimapatoy WTP
・Target Setting for Usage of Renewable Energy
・Potential Power Generation Capacity and Required Area of Solar Panel
・Potential Power Generation Capacity of Micro Hydraulic Generator
・Study on Required Battery Capacity

- Simulation on Electricity Bill
- Preliminary Design and Cost Estimation

(b) Detail study of Power Demand in Dimapatoy WTP

Although the load schedule of current WTP is obtained as shown in Figure 25.4-4, following factors shall be examined for preliminary design.

- MCWD has an expansion plan of the WTP with capacity of 5,000-8,000(m3/d)
- Daily demand fluctuation to find out maximum gap of power demand and supply.

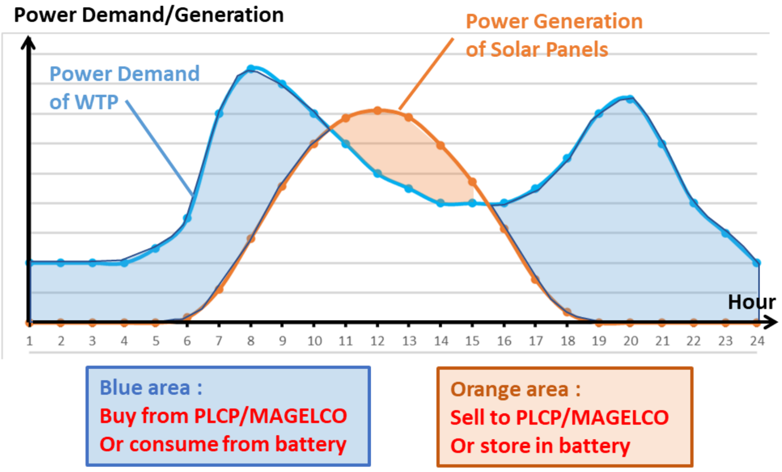
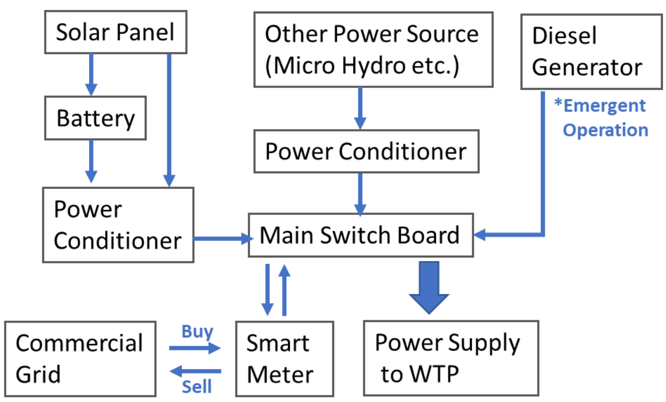


Figure 25.4-4 Conceptual Image of WTP demand and Solar Power Generation

(c) Target Setting for Usage of Renewable Energy

The improved power supply shall be combination of commercial power and renewable energy. Covering all power demand by renewable energy may not be economical, so that optimal balance of commercial power and renewable energy shall be discussed based on power demand.



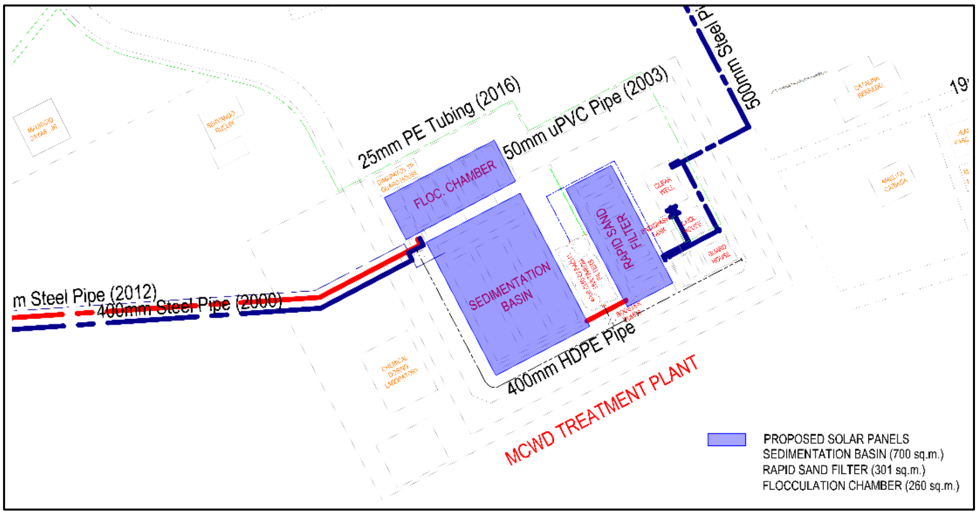
Source: JICA Study Team

Figure 25.4-5 Conceptual Image of Power Supply System for WTP

(d) Potential Power Generation Capacity and Required Area of Solar Panel

MCWD has an initial layout plan for solar panel installation, in which solar panels simply cover the flat roof area of the WTP as shown in Figure 25.4-6. However, following topics shall be studied:

- Potential power generation with the proposed layout
- If installing panels to all the roof area is feasible or not based on site investigation.
- If there are other space in the WTP site which can be used for installation of solar panels.



Source: Metro Cotabato Water District

Figure 25.4-6 Solar Panel Installation Proposed by MCWD

(e) Potential Power Generation Capacity of Micro Hydraulic Generator

Since the Dimapatoy water system includes intake facilities along Dimapatoy river, it's suitable for installation of micro hydraulic generation system.

- Detailed survey and data collection to estimate potential water head and flowrate
- Potential power generation based on the estimated water head and flowrate
- Installation layout considering affection to the intake facilities
- Data collection for generator products and manufacturers

(f) Study on Required Battery Capacity

Based on power demand with daily fluctuation and potential power generation for re-energy, capacity battery shall be calculated to fill the gap of power and power supply.

(g) Simulation on Electricity Bill

Simulation of electricity bill shall be done with several options of power system configurations (capacity of power generators, capacity of battery, purchasing and selling rate to the power company etc.).

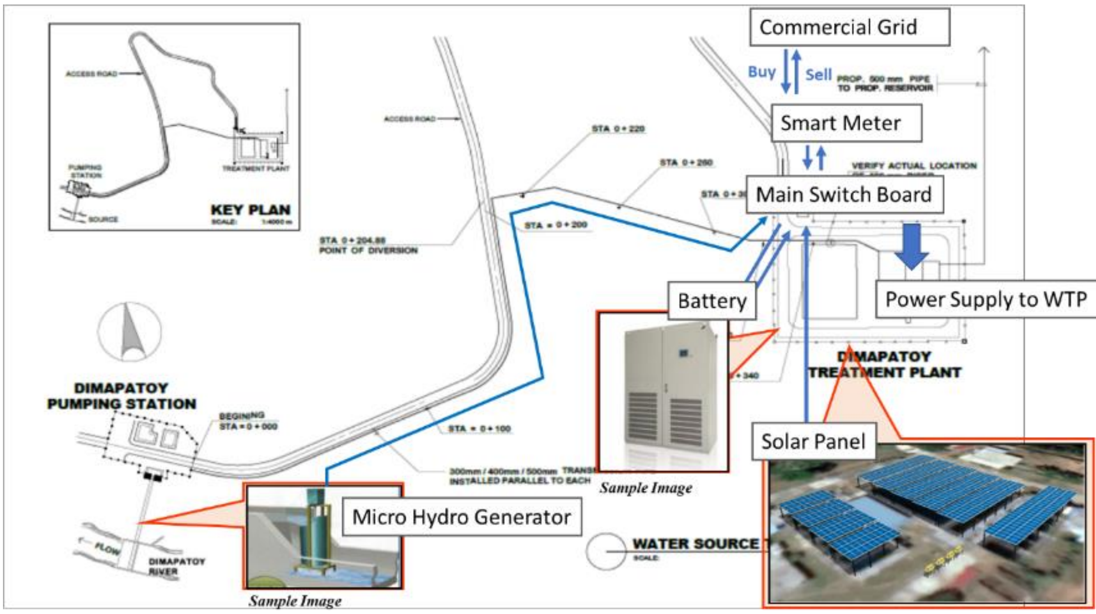
(h) Preliminary Design and Cost Estimation

Preliminary design and cost estimation shall be done including cabling works. Especially, cabling works between WTP and intake facility, where micro hydraulic generator could be installed, is approximately 500m distant.

25.4.3 Potential Project for Grant Aid Construction

(a) Concept of the Proposed System

Key issue for successful use of solar panel is how to develop a power system which can adjust the gap between power demand of WTP and power generation by solar panels.



Source: JICA Study Team

Figure 25.4-7 Conceptual Image and Layout of Power Supply System for WTP

(b) Solar Panel

Assuming that all flat roof area of the existing WTP can be utilized for solar panel installment, potential generation capacity is calculated as 222.75(kWp) with accredited panel product from Japanese manufacture.

Source: Manufacturer

Figure 25.4-8 Example of Solar Panel Layout

Sample configuration of the solar panel system is shown in Table 25.4-6, however, detail shall be discussed in the future study.

Table 25.4-6 Sample Configuration of Solar Panel System

Solar System Capacity Size	222.75 kWp (495 units Panasonic 450W PERC Modules)
Key Equipment: Photovoltaic module: SMA Inverter:	 PANASONIC : AE14H450VHC9B SMA STP 60 (4units)
Installation Type	Roof Mounting Type
Mounting structure	Aluminum Mounting System
Solar Cable	1500Vdc rated, 100°C max. conductor operating temperature. Double insulated with electron beam cross-link copolymer outer sheath, ozone resistant, UV resistant, halogen-free and flame resistant.

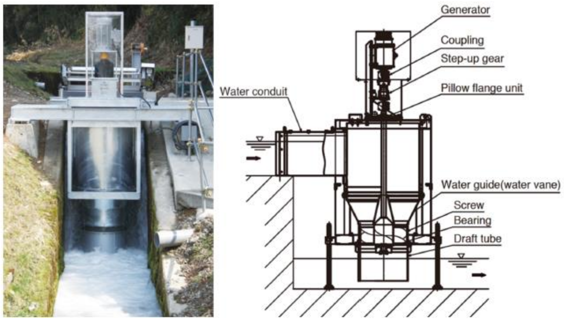
Source: Manufacturer

Source: Manufacturer

Figure 25.4-9 Sample Products of Solar Panel and Inverter

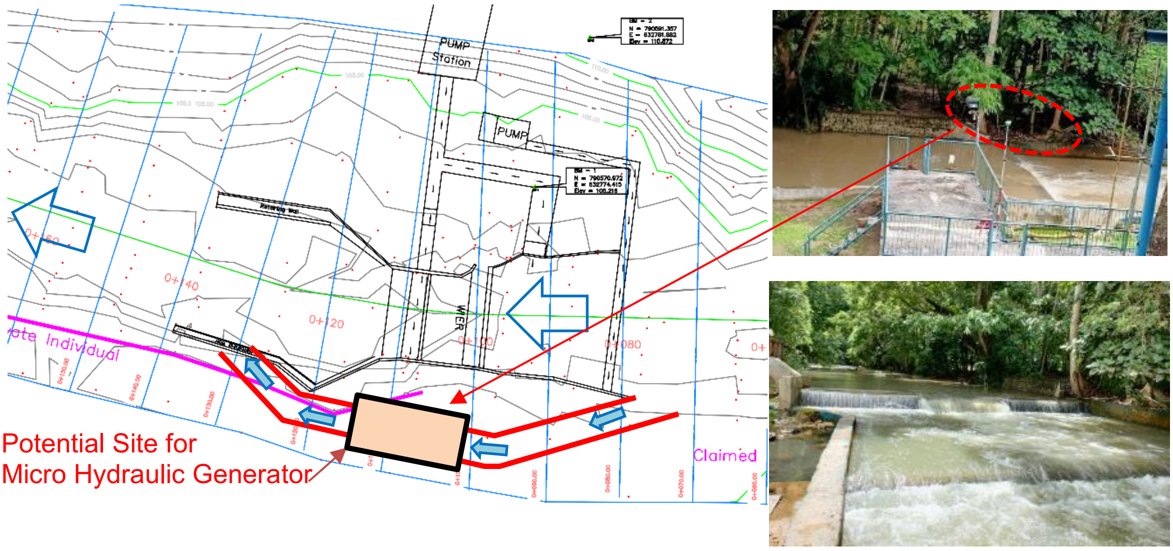
(c) Micro Hydraulic Generator

Micro hydraulic generator could be installed in Dimapatoy intake site utilizing height difference of water head difference by the intake weir. The generator facility shall be located by side of the weir to avoid interference with water supply facilities, as shown in Figure 25.4-11. On the installation of the generator facility, waterway shall be constructed at the side of the weir to draw the water flow required for power generation.



Source: HOKURIKU SEIKI CO., LTD.,

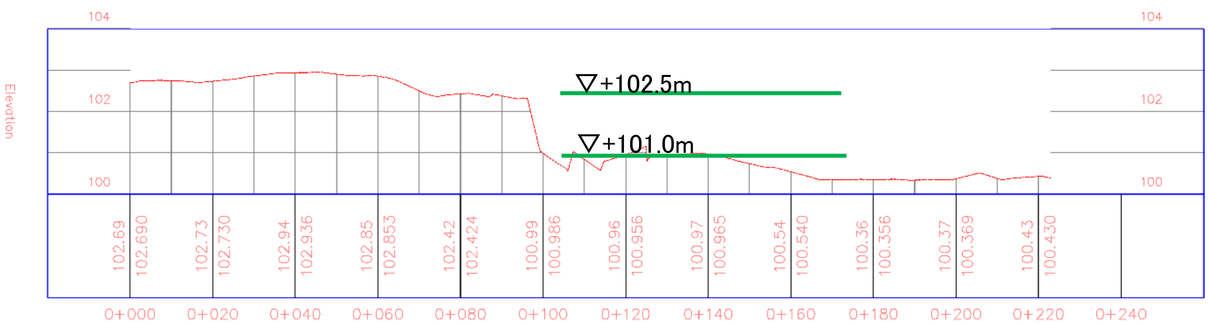
Figure 25.4-10 Sample of Hydraulic Turbine



Source: JICA Study Team

Figure 25.4-11 Potential Site for Micro Hydraulic Generator

From the survey data, height difference between up and down stream of intake weir is estimated to be around 1.5 m so effective head is set as 1.5 m.



Source: JICA Study Team

Figure 25.4-12 Elevation Difference in Up and Down Stream of Intake Weir

River flow is not managed at the site so that flow rate for the power generation is set as 1.0 m3/s tentatively considering residual water inspected by visual observation.

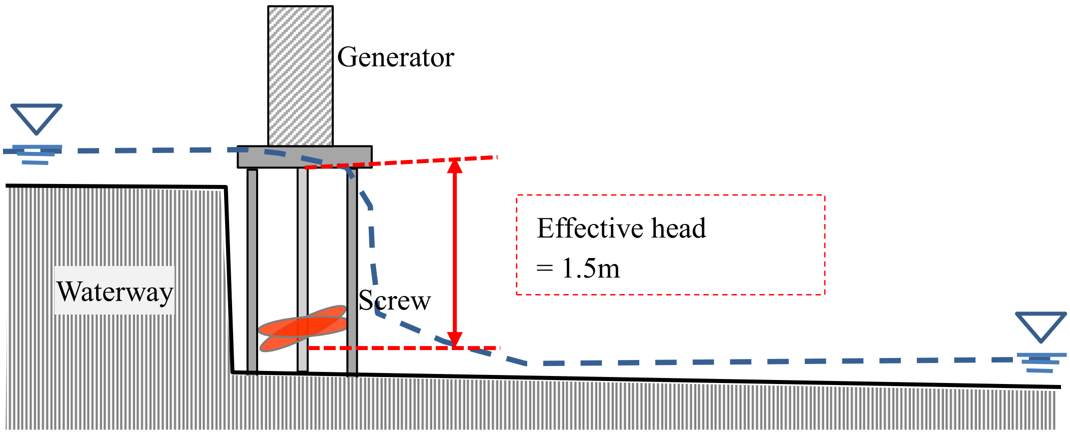
Under above situation, vertical type of screw turbine is selected tentatively as a small-scale hydropower generation considering high generation efficiency with low head and small flow rate, simple structure, easy installation and easy maintenance.

Configuration of micro hydraulic generator would be as shown in the Table 25.4-7.

Table 25.4-7 Sample Configuration of Micro Hydraulic Generator

Item	Value	Note
Effective head: He	1.5m	
Power discharge (flow rate): Qp	1.0 m3/s	Tentative value
Efficiency of turbine and generator: η_{tg}	60%	Case in Japan
Maximum power output: P	8.8 kW	P = 9.8 x Qp x He x ηtg
Flow utilization factor: FUF	50%	Considering dry season and rainy season
Annual Available Generated Energy	38,600 kWh/year	P x FUF x 8,760 (365days x 24h)

Source: JICA Study Team



Source: JICA Study Team

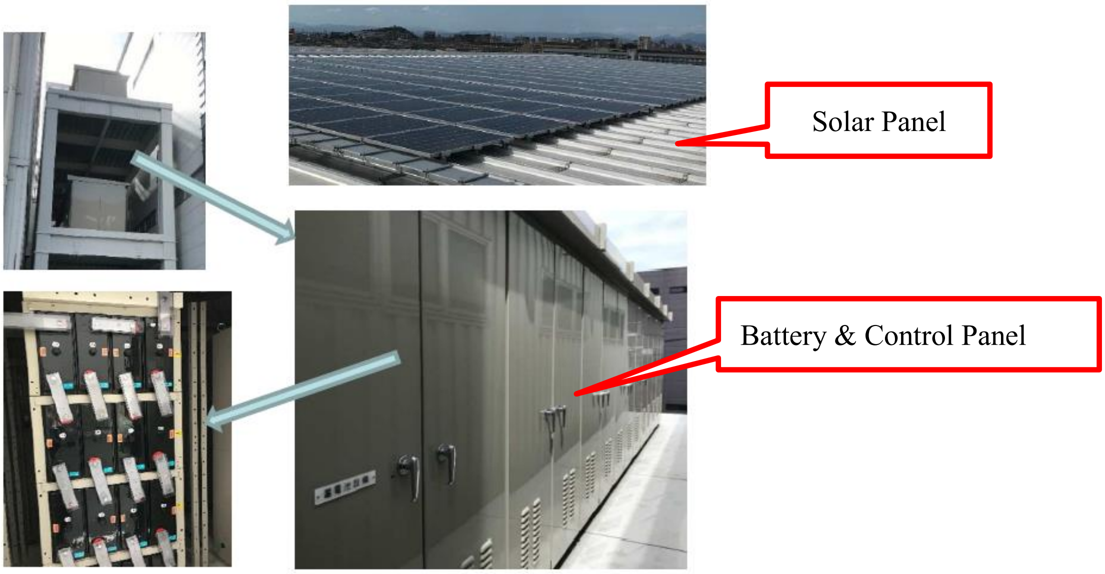
Figure 25.4-13 Sample Image of Micro Hydraulic Generator

Waterway shall be constructed by concrete with adequate dimension such as 1.5 m H, 1.0 m H and 40.0 m L.

Maximum power output is calculated as 8.8 kW. If the power generation capacity is increased to 25 kW, it may be possible to cover the nighttime power demand by micro hydropower generation. However, it is necessary to inspect the feasibility with topographical conditions and hydraulic conditions. In addition, inspection of the possibility of cascading generation method is needed as an electrical survey.

(d) Battery

Based on power demand with daily fluctuation and potential power generation for re-energy, capacity battery shall be calculated to fill the gap of power and power supply. Assuming that necessary output of battery is 85 kW * 12 hours (night-time), capacity of the battery is 375 kW/1462 kWh.



Source: Manufacturer

Figure 25.4-14 Sample Image of Battery System

(e) Rough Cost Estimation

Based on items discussed in (a)-(d), cost of the potential project for power system improvement using renewable energy sources is calculated as follows.

Table 25.4-8 Rough Cost Estimation for Future Construction

Direct Cost	Total (PHP)	L/C (PHP)	F/C (JPY)
Solar Panel	18,182,000		40,000,000
Battery System and Control Panels	72,727,000		160,000,000
Micro Hydraulic Generator	8,182,000		18,000,000
Construction (20% of Equipment Cost)	19,818,200	19,818,200	
Sub Total	118,909,200		
Indirect Cost			
20% of Direct Cost	23,781,840		
Grand Total	*142,691,040*		

Source: JICA Study Team

25.5 Intake Improvement

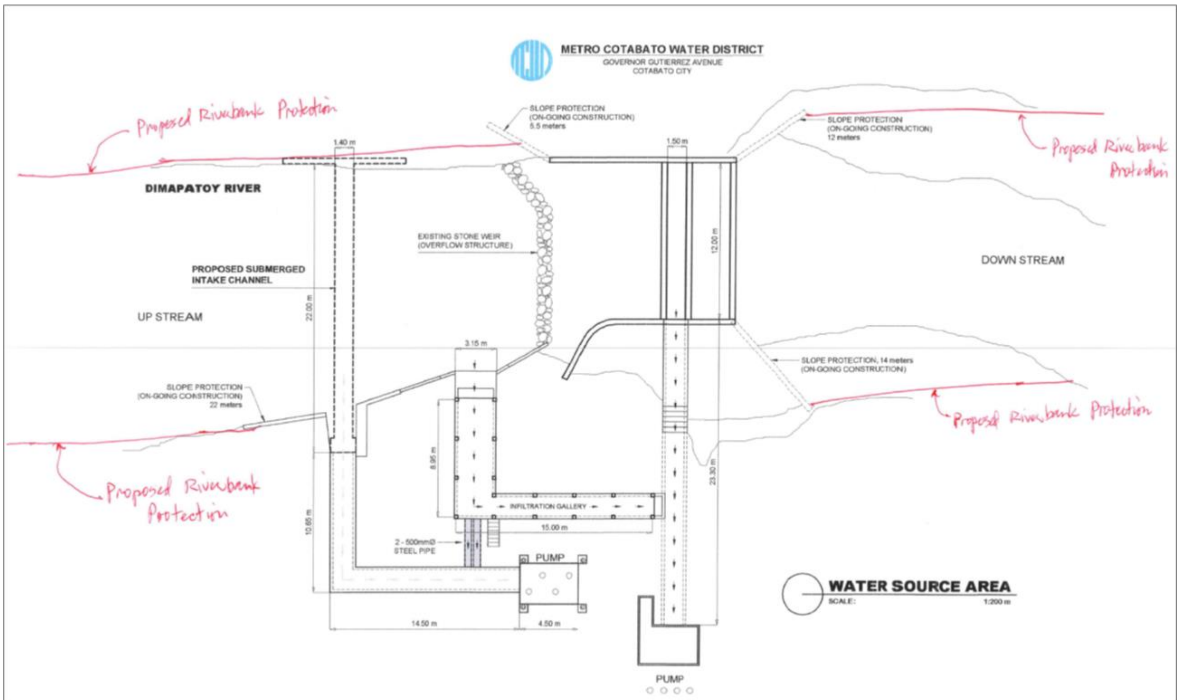
25.5.1 Analysis on Current Conditions and Issues

(1) Current Conditions of the Dimapatoy Intake

The Dimapatoy River is one of the major sources of water supply in the Cotabato City and five (5) adjacent municipalities. The facility of MCWD at Dimapatoy produces the largest volume of water which was about 6.0 Million cubic meter in 2018. It is located in Datu Odin Sinsuat (DOS) Municipality, about 9 km south of Cotabato City. The facility is experiencing several issues which affect its ability to produce maximum water output. For instance, both sides of the river in the immediate vicinity of the facility are exposed to erosion. Although at the downstream of the river, construction work is on-going to protect the approximately 14 meters bank of the river, the upper stream requires protection wall as well and it is proposed to provide protection wall of approximately 500 meters upstream and downstream. Due to the limited budget of MCWD however, the proposed protection wall at the upper stream has not been touched.

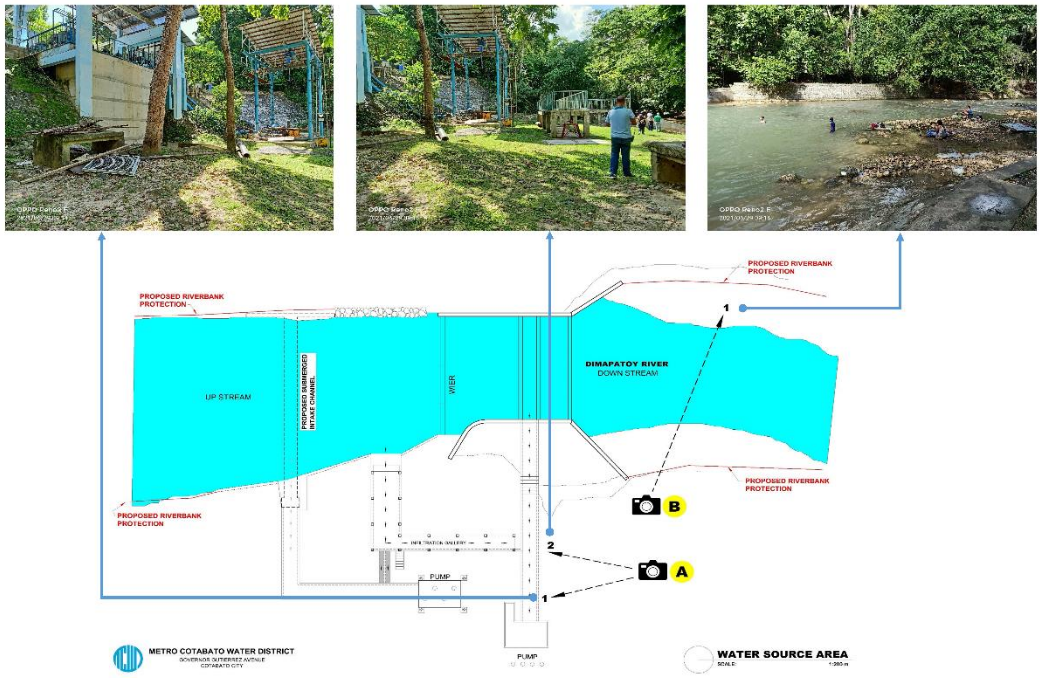
Water is one of the basic needs of the population. As one of the major sources of water supply in Cotabato City, the problem of erosion of the riverbank of Dimapatoy River should be resolved as soon as possible. There may be other sources of water, however, those sources cannot provide the required volume of water to be served throughout Cotabato City. Even with the services provided from the Dimapatoy River, water supply is still not sufficient.

As of this day, the structures within the vicinity of the Dimapatoy River intake is the Dimapatoy Pumping Station and the on-going construction work of approximately 14 meters protection wall along the riverbanks of the downstream part of the intake.



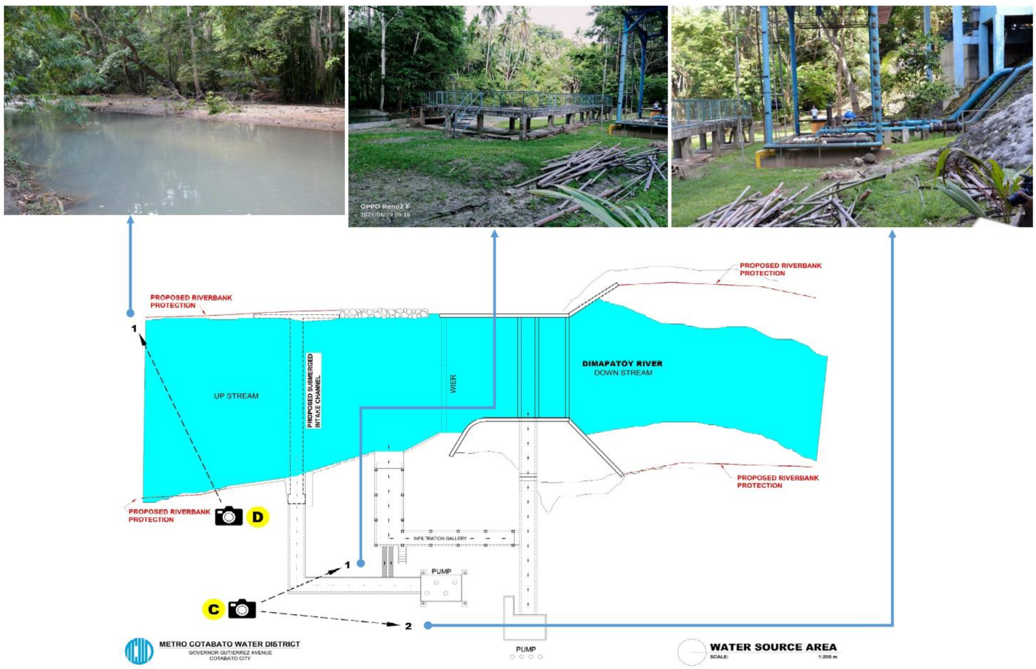
Source: JICA Study Team

Figure 25.5-1 Layout Plan of Dimapatoy Intake



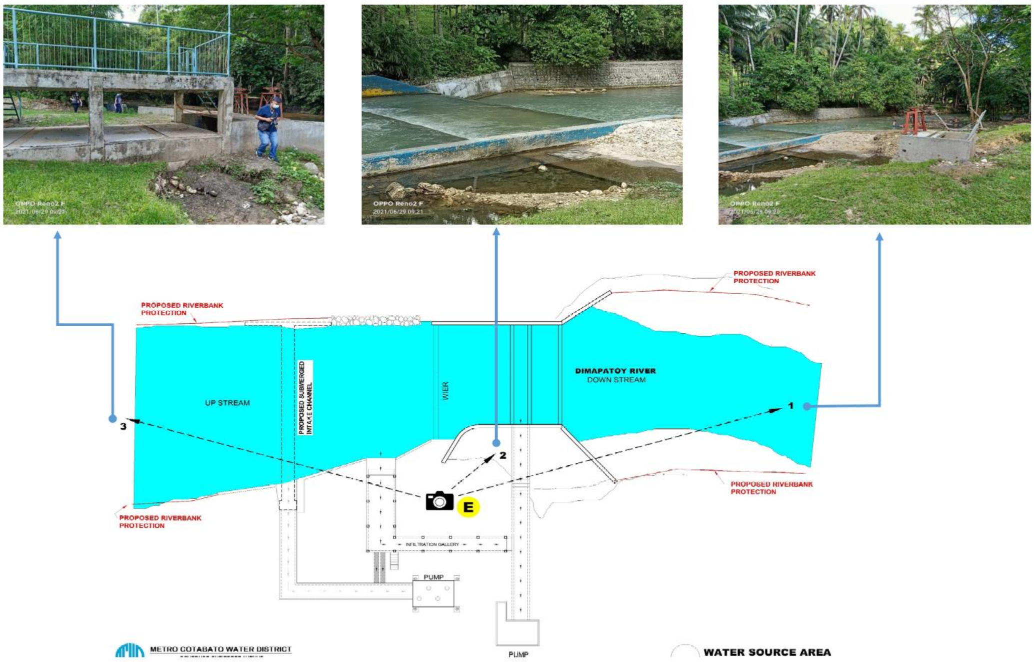
Source: JICA Study Team

Figure 25.5-2 Photos around Dimapatoy Intake (1/5)



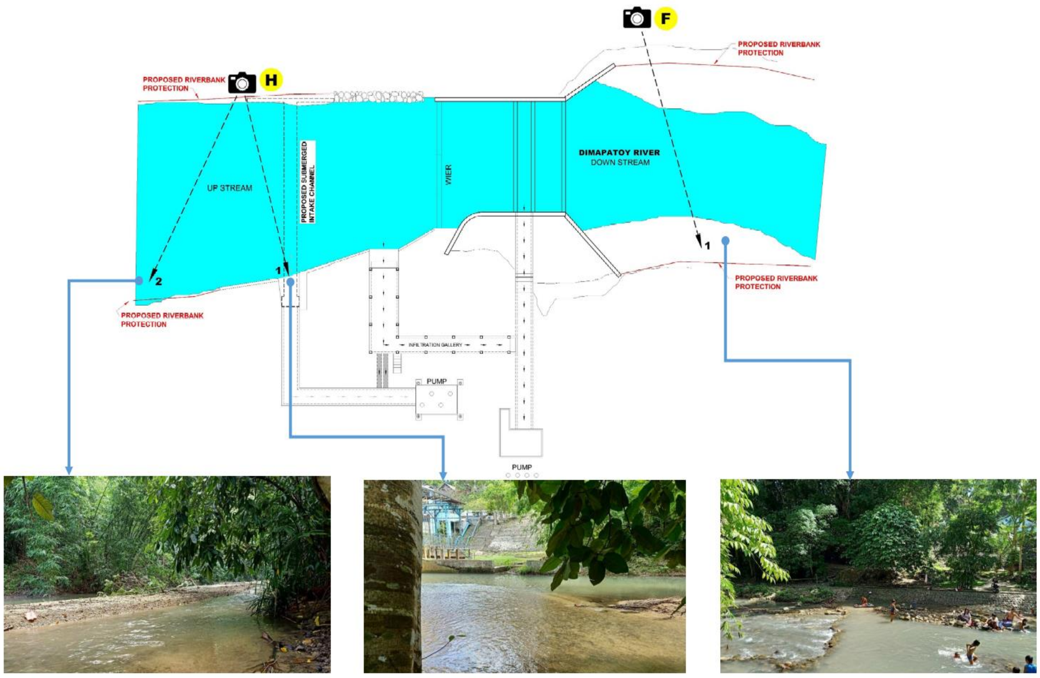
Source: JICA Study Team

Figure 25.5-3 Photos around Dimapatoy Intake (2/5)



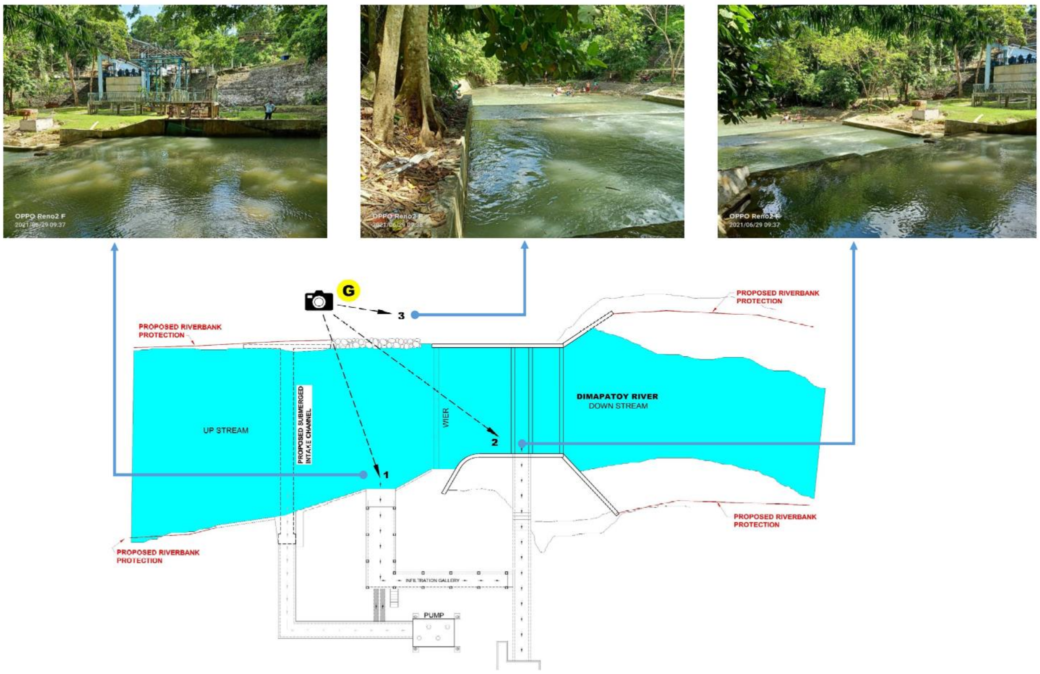
Source: JICA Study Team

Figure 25.5-4 Photos around Dimapatoy Intake (3/5)



Source: JICA Study Team

Figure 25.5-5 Photos around Dimapatoy Intake (4/5)



Source: JICA Study Team

Figure 25.5-6 Photos around Dimapatoy Intake (5/5)

(2) Issues on the Dimapatoy Intake

According to the interview with MCWD, following issues are observed in Dimapatoy intake facilities.

- Erosion of Dimapatoy river which is the primary source of water hence riverbank protection is urgently needed.
- Riverbank protection is necessary to prevent meandering and diminishing of the river.

25.5.2 Study Items for Technical Cooperation Program

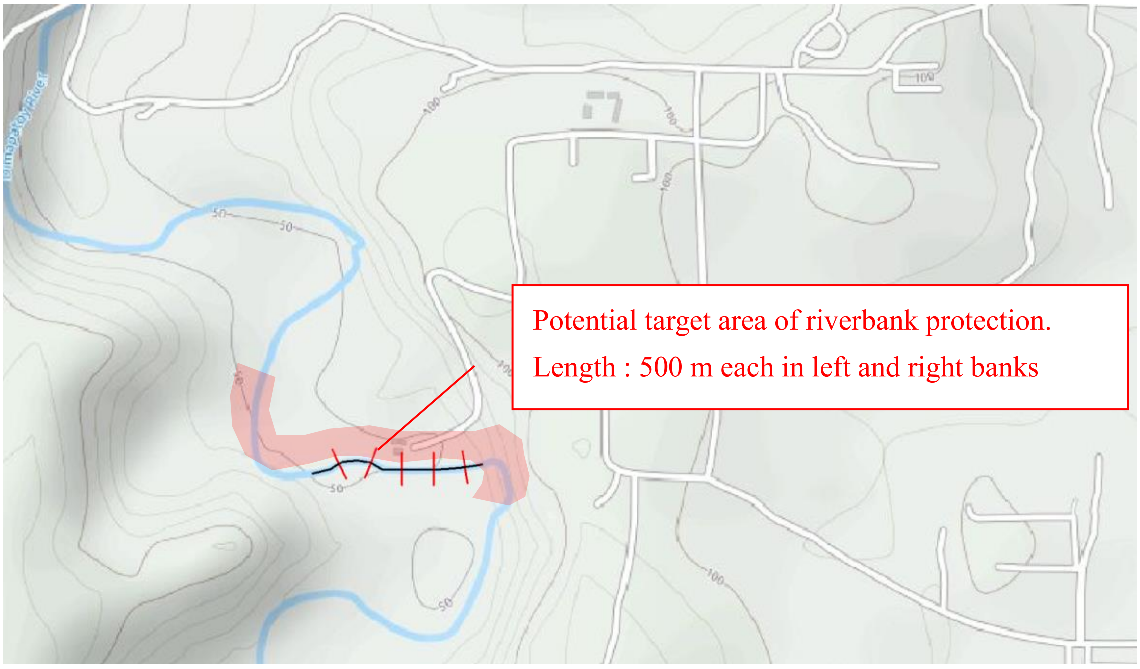
According to MCWD, riverbank protection is necessary “to prevent meandering and diminishing water volume of the river”. To specify this issue, Interview on details of the issue, following data shall be collected for the outline design.

⇒ Records of water level (HWL and LWL) ,flow rate and flow velocity
⇒ Records of intake volume (Maximum/Minimum)
⇒ History of flood event and riverbank erosion

25.5.3 Potential Project for Grant Aid Construction

Although detailed scope of riverbank protection shall be determined throughout the proposed TCP project, typical cross section and rough construction cost can be estimated from tentative topographic survey data.

Since the major purpose of riverbank protection is to prevent meandering and diminishing of the river, the banks shall cover river sections up to the location where the river line makes sharp turns, as shown in Figure 25.5-7.



Source: JICA Study Team

Figure 25.5-7 Rough Layout Plan of River Bank Protection Works

Riverbank structures shall be determined by calculation of up-lift effect of flood water current and geotechnical study though rough estimation could be done just considering typical cross section of the river from topo survey and HWL (high water level). Type of the riverbank structures is estimated as concrete walls with slope gradient of 1:0.5, in consideration with existing projects in the similar geological conditions.

As mentioned, recent topographical survey results will be used in order to provide rough cost estimation considering appropriate protection walls based on Table 25.5-1. The topographic survey plan of the river is shown in Figure 25.5-8 and the specific cross sections from upstream and downstream portions are shown in Figure 25.5-9.

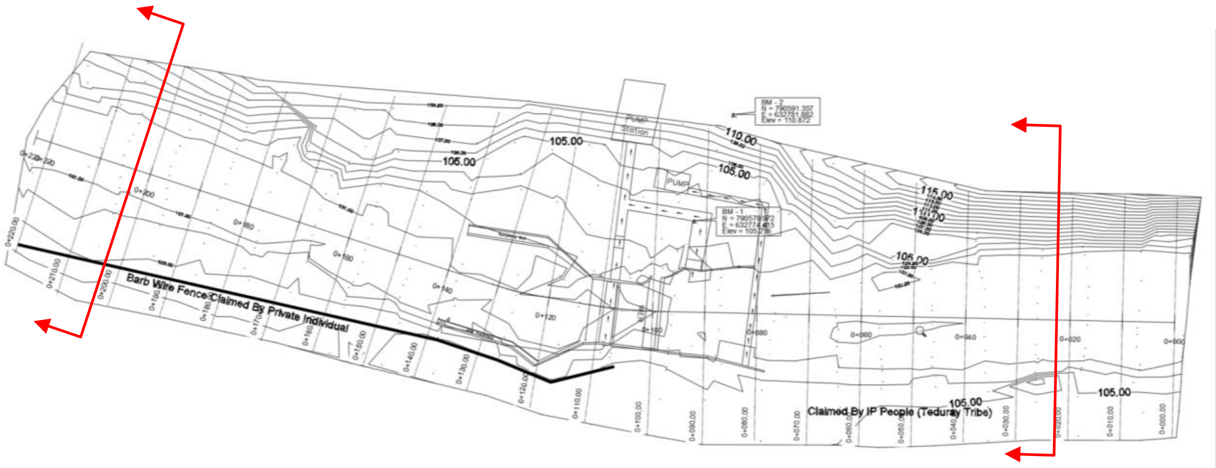


Figure 25.5-8 Dimapatoy River Topographic Plan

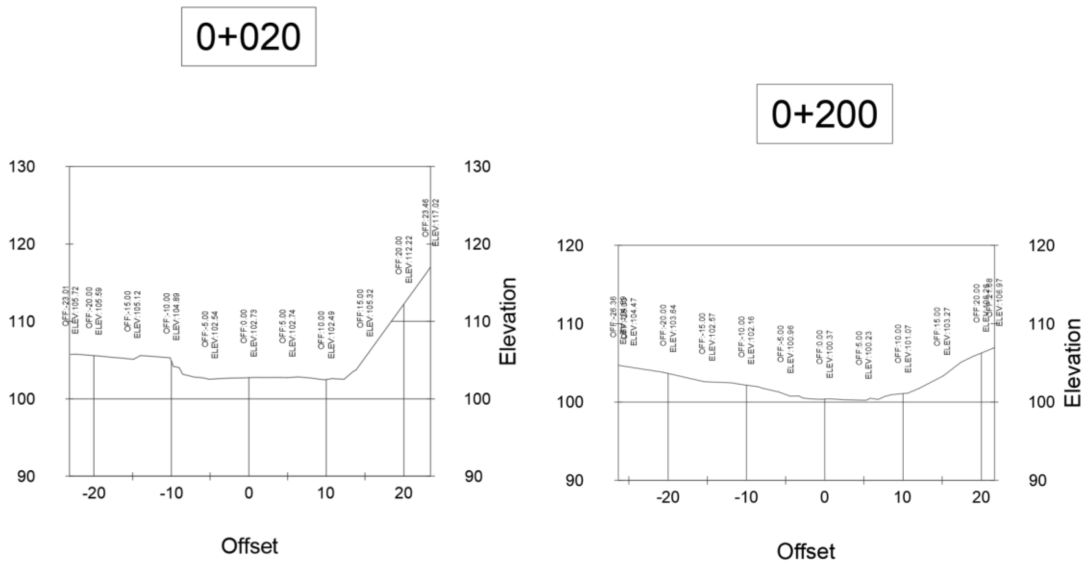
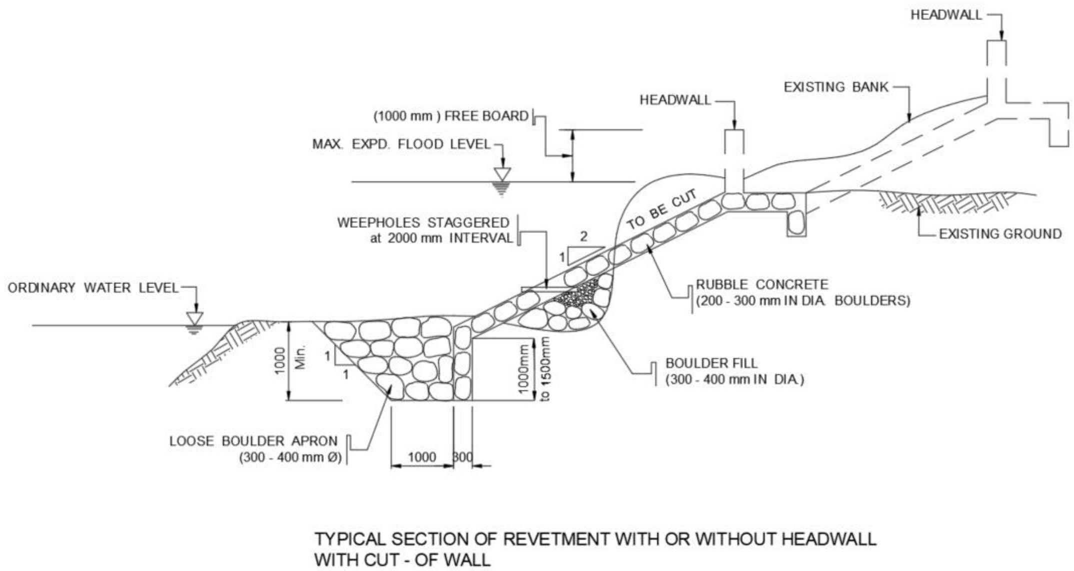


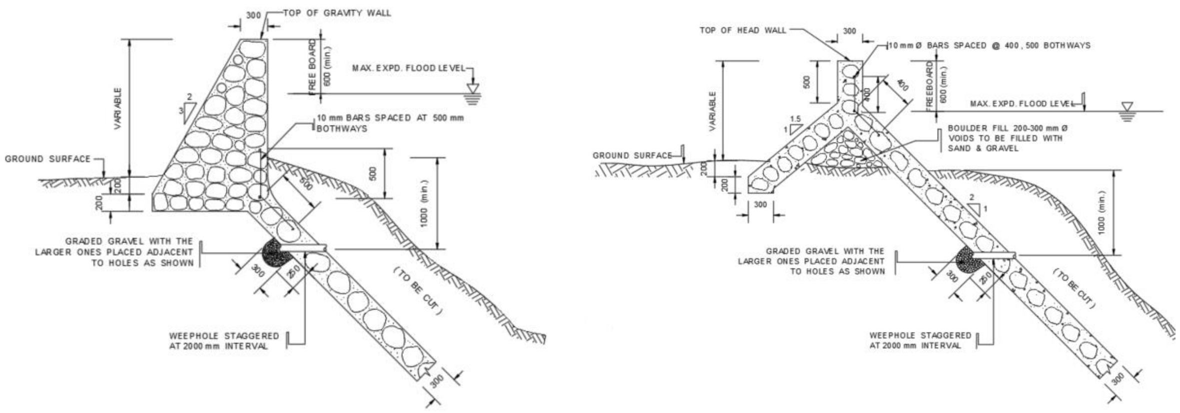
Figure 25.5-9 Dimapatoy River Cross Section at STA. 0+200 (Downstream)

Figure 25.5-10 below are the typical cross sections to be considered in choosing the appropriate protection wall along the riverbanks:

Revetment with or without Headwall with Cut-off Wall



Concrete Revetment Type I and II



Cut-off Wall Foundation with Foot Protection

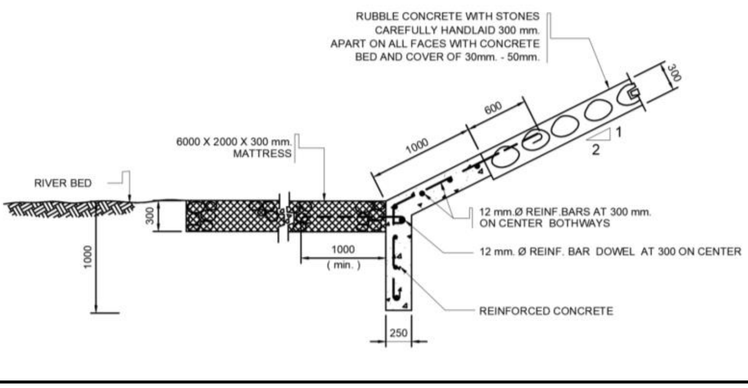
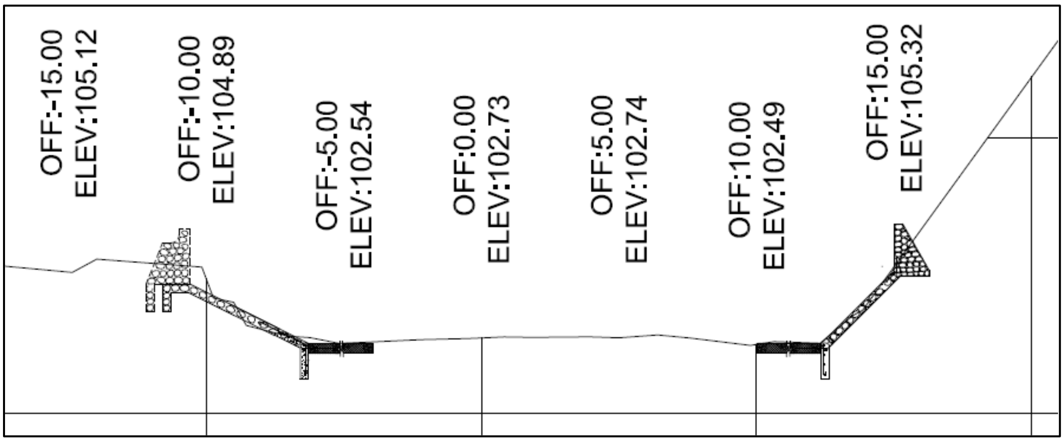


Figure 25.5-10 Typical Cross Sections of Protection Wall

Among the tabulated options for the protection wall, Gabion Revetment is the best option. In a certain article on the internet entitled “Ways to Control River Bank Erosion”, it says that gabion is best in situations where the river bank needs a strong and permanent erosion control. Also, compared to other five (5) options, application of Gabion Revetment is the most economical in construction cost and labor cost.



Source: JICA Study Team

Figure 25.5-11 Typical Cross Section in Upper Stream of Dimapatoy Intake

Assuming that this cross section represents all stretch of the 500 m length of the proposed levee, rough cost estimation of the river bank protection works will be as shown below.

Table 25.5-1 Rough Cost Estimation of Riverbank Protection
(To be studied detail in the future project)

Direct Cost	Cost (PHP)
Mobilization/Demobilization/Preparation	16,923
Earth Work	232,724
Concrete Work	131,170
Protection Work	463,516
Sub Total	844,333
Indirect Cost	
20% of Direct Cost (Tentatively)	168,867
Total Cost per 10m	*1,013,200*
Levee Length = 500m	-
Grand Total	*50,660,000*

Source: JICA Study Team

25.6 Cost Estimation of the Project

25.6.1 Cost of Comprehensive study

Combining necessary survey activities for establishment of development master plan and detail investigation for rehabilitation of existing facilities, expected manning schedule for the comprehensive study is as shown in the Table 25.6-1.

Table 25.6-1 Expected Manning Schedule of Comprehensive Study

	List of International Expert	Year 1												Year 2			M/M	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	P	J
Assignment in Philippines	Team Leader/Water Supply Expert1																0.00	
	Water Supply Expert2																0.00	
	Pipe Network Plan & Design																0.00	
	River Structure Plan & Design																0.00	
	Power Supply Plan & Design																0.00	
	Operation & Maintenance Expert																0.00	
	Social & Environmental																0.00	
	Construction Plan/Cost Estimation																0.00	
	Coordinator																0.00	
																	0.00	
Assignment in Japan	Team Leader/Water Supply Expert1																	2.00
	Water Supply Expert2																	1.50
	Pipe Network Plan & Design																	1.00
	River Structure Plan & Design																	1.00
	Power Supply Plan & Design																	1.00
	Operation & Maintenance Expert																	1.50
	Social & Environmental																	1.00
	Construction Plan/Cost Estimation																	1.50
	Coordinator																	1.00

Source: JICA Study Team

25.6.2 Cost of Rehabilitation Project under ODA Assistance

Combining three components for rehabilitation of existing facilities namely replacement of old pipe, efficient energy use and intake improvement, rough estimation of construction cost under ODA assistance is as shown in the Table 25.6-2. This rough estimation shall be examined and revised in the comprehensive study.

Table 25.6-2 Rough Cost Estimation for Rehabilitation Project under ODA Assistance

Construction Cost	Total (PHP)
Replacement of Old Pipe	48,215,366
Efficient Energy Use	142,691,040
Riverbank Protection	50,660,000
Sub Total	*241,566,406*
Other Expenditure	Total (PHP)
Design and Supervision	24,156,641
Contingency	13,286,152
Grand Total	*279,009,199*

Source: JICA Study Team

25.7 Environmental and Social Considerations

The level of environmental and social consideration for the project "Water Supply Improvement in Greater Cotabato (MCWD Project)" as part of the Urban Infrastructure Development in Greater Cotabato City Study is at "pre-feasibility study level". Environmental and Social considerations is essential as an integral part of project development from the earliest stages such as pre-feasibility study level, to provide information about the general environmental and social setting of the project area.

Further study and evaluation shall be implemented during the Feasibility Study (F/S) stage in the future. Therefore, relevant studies in environmental and social considerations of this report are also pre-feasibility study level and shall be followed-up and updated by F/S.

25.7.1 Project Component

MCWD Project's intended impact are improved water services in Cotabato City and neighboring municipalities of Datu Odin Sinsuat (DOS) and Sultan Kudarat; continuous supply of potable water; uninterrupted power supply to run the water pumps for sufficient supply of water; and riverbank protected from erosion.

This is a pre-feasibility study without fixed conditions such as associated projects by other proponents, relevant activities including soil borrow pits, quarry pits, construction roads, camp yards etc., and pre-acquired land for the project, therefore, further study and confirmation shall be implemented during next phase which is the F/S. As far as the action plan study in this survey is concerned, implementation timing is not decided, and other specific planned or reasonably defined developments are not found. Therefore, the survey focuses on direct impact caused by the project during action plan study stage, and the possibility of cumulative impact will be considered during F/S.

Below table shows the project components identified by the MCWD respond to the existing problems of their facility in Dimapatoy.

Table 25.7-1 Project of MCWD

Project Component
1). Replacement of Dilapidated Pipes (30-40 years old)
2). Solar Panel for Electric Power Production (with accessories 2,000KW)
3). Riverbank Protection for Dimapatoy River (50 meters)

Source: JICA Study Team

25.7.2 Environmental Study Area

In order to conduct initial environmental and social impact assessment at action plan study, LGUs in and around the proposed project area are selected as the study area. The Project will cover 3 LGUs, namely City of Cotabato, Municipalities of Datu Odin Sinsuat and Sultan Kudarat, as shown in Table 25.7-2 and Figure 25.7-1. The study area for secondary data collection of environmental and social baseline covers the geographic jurisdictions of the corresponding project components.

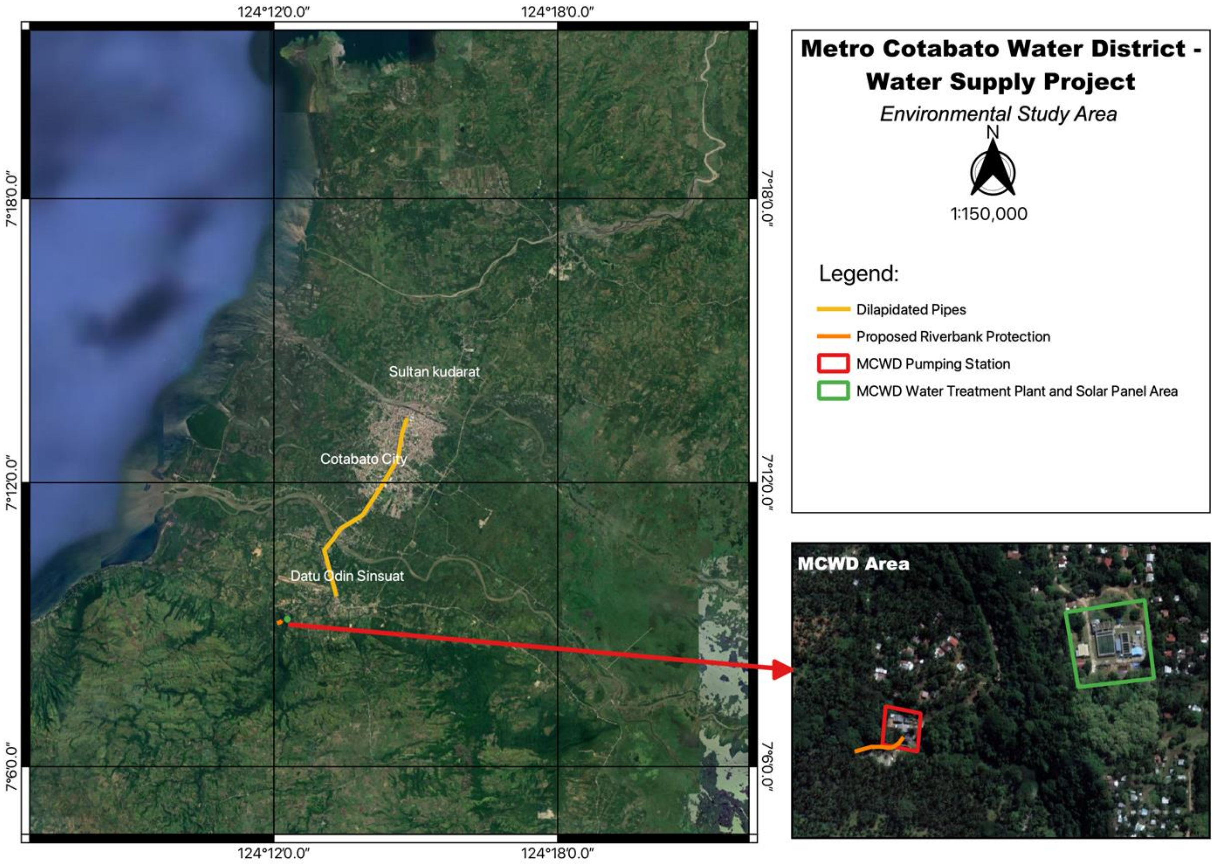
The study area involving site visits, public consultations and initial environmental and social impact assessment at action plan study covers the entire section of the Project.

Table 25.7-2 LGUs in the Proposed Project Area

Region	Province	Municipality/City	Barangay	Project Component
BARMM	Maguindanao	Cotabato City	Bagua Mother	- Replacement of dilapidated pipes -Service area
			Bagua I, II & III	
			Kalanganan Mother	
			KALANGANAN II	
			Poblacion Mother	
			Poblacion II, IV, V, VI, VII, IX	
			Rosary Heights Mother	
			Rosary Heights I, II, III, IV, V, VI,VII, VIII,IX,X,XI,XII,XIII	
			Tamontaka Mother	
			Poblacion I, III	
			Tamontaka I, II, III, IV, V	
		Datu Odin Sinsuat	Awang	- Replacement of dilapidated pipes -Service area - Construction of additional Water Treatment Plant -Installation of Solar Panel - Riverbank Protection
			Capiton	
			Tanuel	
			Dulangan	
			Semba	
			Tambak	
			Tamontaka, Dos	

Region	Province	Municipality/City	Barangay	Project Component
		Sultan Kudarat	Banubo	- Replacement of dilapidated pipes -Service area
			Bulalo	
			Calzada	
			Dalumangcob	
			Gang	
			Katuli	
			Limbo	
			Macaguiling	
			Rebuken	
			Salimbao	

Source: JICA Study Team, 2021



Source: JICA Study Team, 2021

Figure 25.7-1 Environmental Study Area

25.7.3 Baseline of Environmental and Social Conditions

The following descriptions are collected information on pollution items, natural environment, reserved areas of natural protection and cultural heritages, land use, living areas of indigenous people, and social conditions of land acquisition and involuntary resettlement.

(1) Natural Environment

a) Air Quality

Based on the air quality monitoring in January-February 2018 at Cotabato Station conducted by EMB Region XII, PM10 parameter was within the National Ambient Air Quality Guideline Values (NAAQGV) of the DENR. PM10 is the only parameters being monitored by the station. Other parameters such as Sulphur Dioxide (SOx), Nitrogen Dioxide (NOx), Carbon Monoxide (CO), Ozone (O3) and Lead (Pb) were not regularly monitored.

Table 25.7-3 2018 Air Quality Indices (PM10)

PM10 (24 hour)

Air Quality Levels	Ug/Ncm
Good	0 - 54
Fair	55 - 154
Unhealthy for Sensitive Groups	155 - 254
Very Unhealthy	255 - 354
Acutely Unhealthy	355 - 424
Emergency	425 - 504

Source: DENR-EMB NAAQGV, Philippine Clean Air Act of 1999

Table 25.7-4 PM10 Air Quality Monitoring

Station Number:		COTABATO STATION							
Address:		Cotabato City							
SAMPLE CONDITION:									
A									
		Sunny							
A		B			C		D		
No unusual		Sand/Dust			Construction		Farming Operation		
Condition					Nearby				
E		F			G		H		
Fire Nearby		Sampler			Rain		Others		
		Malfunction							
REMARKS		Results relates only as samples as collected.							
Result of Sampling				PM 10		SO_2		NO_2	
PM10	SO2	NO2		26.3	Ug/Ncm		ppm		ppm
(PASSED)									
SAMPLE COLLECTION DATA									
	DATE			TIME		TEMP	PRESSURE	FILTER	VOL.
	YEAR	MONTH	DAY	HOUR	MIN.			WEIGHT (mg)	STD
FINISH	2018	Feb.	1	0640H		29.2	0.990	147.298	17.510
START	2018	Jan.	31	1130H				146.849	

Source: EMB Region XII, 2018

b) Noise and Vibration

According to the Road Network Development Project in Conflict-Affected Areas in Mindanao Project (2019), local people experience elevated level of noise problem due to construction and eventually operation of the project components and facilities. Monitoring data along the project sites are not measured at the time of action plan study. National standard of NPCC and IFC/WB are as shown in the following tables.

Table 25.7-5 NPCC Noise Standard

Category	Maximum Allowable Noise (dBA) by time periods		
	Daytime (9:00 AM – 6:00 PM)	Morning/Evening (5:00 AM to 9: AM/ 6:00 PM to 10 PM)	Nighttime (10:00 PM to 5:00 AM)
AA	50	45	40
A	55	50	45
B	65	60	55
C	70	65	60
D	75	70	65

- Class AA – a section of contagious area which requires quietness, such as areas within 100 meters from school site, nursery schools, hospitals and special house for the aged
- Class A - a section of contagious area which is primarily used for residential area
- Class B - a section of contagious area which is primarily a commercial area
- Class C - a section of contagious area reserved as light industrial residential area
- Class D - a section which is primarily reserved as heavy industrial area

Source: DENR-EMB

Table 25.7-6 IFC/WB's EHS Standard (Noise)

Receptor	One Hour LAeq (dBA)	
	Daytime 07:00 -22:00	Nighttime 22:00 – 07:00
Residential; industrial; educational	55	45
Industrial; commercial	70	70

Source: International Finance Corporation

c) Offensive Odor

There are observed offensive odor in the area close to existing dumping site of the Cotabato City. Below shows the location of the SWM facility and its distance vis-a-vis where the highly dense communities are.

Figure 25.7-2 Solid Waste Management Facility of Cotabato City

d) Water Quality

Studies on water quality in Cotabato City and its environs are very critical in shaping policies and legislations in line with the maintenance of the river and in keeping the health and sanitation of the communities mostly along and within the river system. The water may become contaminated with coliform bacteria which may lead to various public health concerns. In a study conducted by Notre Dame University (NDU) in 2012, data were generated to come up with the physico-chemical and bacteriological analyses of the waters in the major rivers of Cotabato City. The study covers the following rivers: Rio Grande de Mindanao along Quirino Bridge and Matampay Bridge, Rio Grande de Tamontaka, and Esteros river.

Among the key findings of the said study were:

Table 25.7-7 Physico-chemical and bacteriological analyses of Rio Grande de Mindanao

Depth	The depth of the rivers ranges from 45.0 – 53.7 m. The river along Esteros is the shallowest (29.4 m) while the deepest is along Quirino (53.7 m).
Temperature	Water temperature was measured in situ at 9 -10 AM. The water temperature of the four rivers ranges from 29–30 0C.
pH	The pH of the rivers ranges from 7.35 – 7.54 which is considered to be slightly alkaline.
TSS	Tamontaka river has 18mg/L total suspended solids, Rio Grande has 28 mg/L, Esteros has 37 mg/L, and Matampay has 39 mg/L. It shows that Matampay river has the highest TSS and Tamontaka has the lowest.
Turbidity	The turbidity value of Matampay river is 40.8 NTuS, Esteros with 10.4 NTuS, Quirino with 5.7 NTuS and Tamontaka with 1.2 NTuS. water. Among the four rivers, Matampay river is most turbid and Tamontaka is least turbid.
Salinity:	The rivers along Quirino and Matampay have the salinity value of 0.2 ppt while Esteros and Tamontaka do not contain dissolved salts.
Dissolve Oxygen	The rivers have high DO values (Quirino, Matampay, Esteros and Tamontaka is 6.23 mg/L, 5.9mg/L, 5.0 mg/L, and 6.06 mg/L respectively). This means that there is adequate amount of oxygen necessary to support aquatic life.
Biological Oxygen Demand	The BOD values of the rivers show that these rivers are not considered to be polluted The BOD values of Quirino, Matampay, and Esteros rivers is 3.33 mg/L while in Tamontaka river is 3.0 mg/L.
Coliform bacteria	Coliform bacteria are present in all water samples.

Source: Water Analysis of Cotabato City Rivers and its Implication to Human and Aquatic Life, July 2012, Corcoro, Alombro, Herrera, NDU-CAS

Table 25.7-8 Water Quality Monitoring Results for Cotabato Rivers, 2012

Parameters	Unit	Results: Cotabato City Rivers (see above table)	Guidelines *	WHO's Global Overview of National Regulations and standards for Drinking-Water Quality (2018)	Remarks
pH	-	7.35 – 7.54	**6.5-9.0**	6.5 - 8.5	Above the standard
DO	mg/L	6.23 mg/L, 5.9mg/L, 5.0 mg/L, and 6.06 mg/L	**minimum 5**		Above the standard
BOD	mg/L	3.33 mg/L	7		Below the standard
Total Suspended Solids (TSS)	mg/L	18mg/L; 28 mg/L; 37 mg/L; 39 mg/L	80	-	Below the standard
Total Dissolved Solids (TDS)	mg/L	6.23 mg/L, 5.9mg/L, 5.0 mg/L, and 6.06 mg/L	-	-	Good quality
Fecal coliform	MPN/ 100mL		200	Must not be detectable in any 100 ml sample (recommended median value – 0 per 100 ml)	Present in all study sites
Nitrates	mg/L		7	50mg/l	
Phosphates	mg/L		0.5	-	
Surfactants as MBAS	mg/L		1.5	-	
Oil and Grease	mg/L		2	Non set (recommended median value - 0.1mg/l)	
Ammonia	mg/L		0.05	Non set (recommended median value - 0.2mg/l)	

Notes: * DAO 2016-08 (Water Quality Guidelines and General Effluent Standards for Class C waters).
** Method Detection Limit
- No specified standards/values/unit
Bold font – Values are not consistent with the guidelines

Source: DENR-EMB and JICA Study Team 2021

Table 25.7-9 Metro Cotabato Water District Coverage (Projections)

Section	Covered Barangays	2015	2020	2025	2030	2035
Section 1	Kalanganan 2, Mother Brgy. Tamontaka, Tamontaka 1, Tamontaka 2, Tamontaka 3, Rosary Heights 10, Rosary Heights 11	3,994	4,630	5,368	6,223	7,214
Section 2	Rosary Heights 8, Rosary Heights 9, Rosary Heights 6, Rosary Heights 7, Poblacion 8, Poblacion 9	4,390	5,089	5,900	6,839	7,928
Section 3	Rosary Heights 4, Rosary Heights 5, Rosary Heights 2, Rosary Heights 3, Mother Barangay Poblacion, Poblacion 2, Poblacion 3, Poblacion 4	5,448	6,316	7,322	8,488	9,840
Section 4	Mother Barangay Rosary Heights, Rosary Heights 1, Rosary Heights 13, Poblacion 1, Poblacion 7, Poblacion 5, Poblacion 6	4,989	5,784	6,705	7,773	9,011
Section 5	Rosary Heights 12, Bagua 3, Mother Barangay Bagua, Bagua 2, Lugay-Lugay (Bagua 1), Mother Barangay Kalanganan	4,355	5,048	5,852	6,784	7,865
Total		**23,176**	**26,867**	**31,147**	**36,107**	**41,858**

Source: Feasibility Study, Cotabato City Septage Management Program, 2019, MCWD

Table 25.7-10 Utility Services, by Classification

Utility Services	Water	Electricity
Classification	**Average rate per cu.m. in Peso**	**Ave. rate per kilo watt in Peso**
Residential	18.40	31.458
Commercial	36.80	32.898
Industrial	36.80	26.247
Semi Commercial	27.60	
Minimum consumption	180.40	

Source: Colight as of July 2013, MCWD

e) Hydrology

Geographically, Cotabato City is situated in low-lying delta. The city being surrounded by two major rivers, the Rio Grande de Mindanao and Rio Grande de Tamontaka makes it a delta. As such, as much as seventy percent of the city in below sea level. Most of the city is prone to flash floods, which have made development difficult and expensive. This has also hindered development thrust in the outlying and lower elevation areas of the city.

The city is crisscrossed by meandering and braided creeks and rivers like the Matampay, Parang, Timako, Esteros and Miwaruy. These water bodies serve as sources of both agricultural, industrial and domestic water requirements of some rural barangays. These rivers also serve as the natural drainage flow of the city's wastes.

In Datu Odin Sinsuat (DOS), the hydro-geological feature is such that the surface is irregular especially in the south-western portion. The south-eastern part is plain area in which lowland crops are mostly grown.

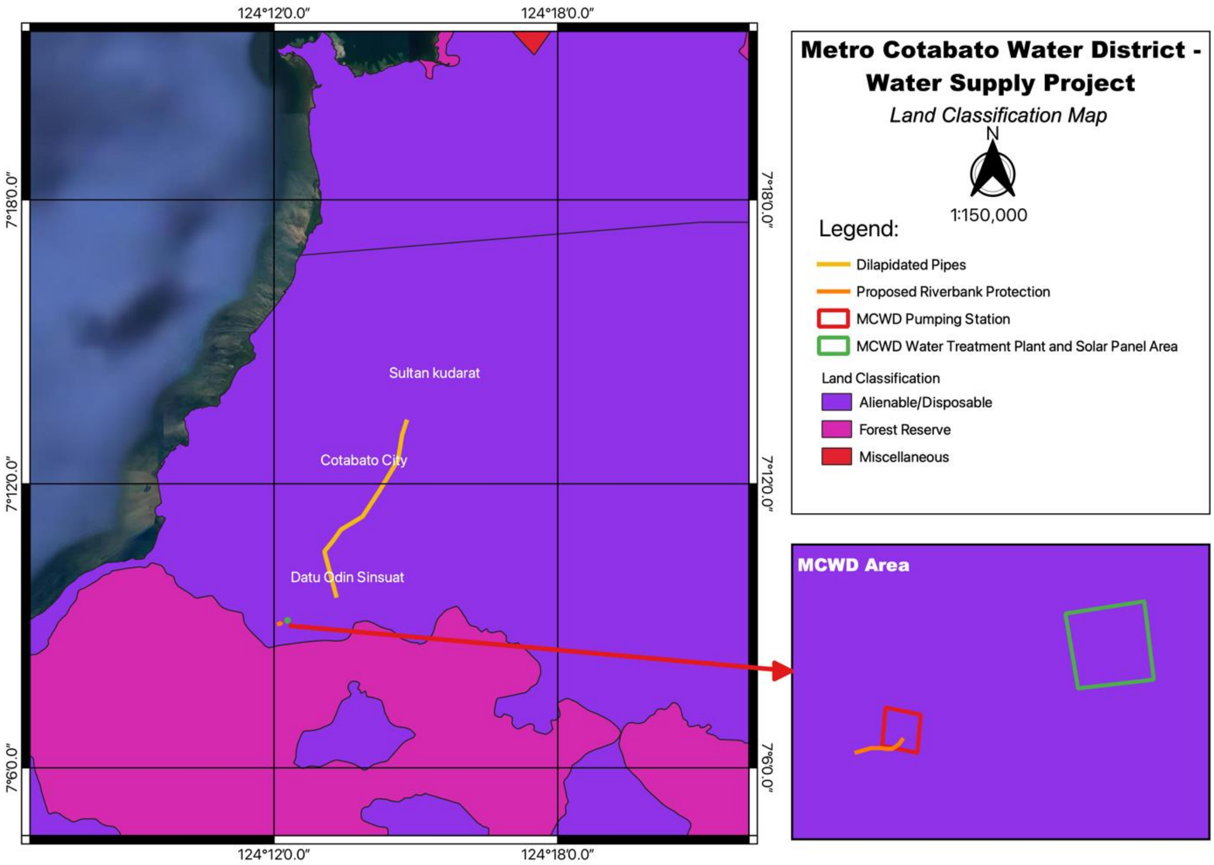
A proposed sea port would be put up off the coast of Kalanganan to further spur development of the city. The barangays of Kalanganan would be the immediate beneficiaries of whatever development that may attach to it. Without doubt high intensity uses would evolve in the area. Thus, convergence of different land and water uses would be identified on the area for agro-industrial uses. At the coastal area of Kalanganan and along its riverbanks, mangrove planting would suitable and recommended. If assessed as feasible, a marine fish sanctuary could also be established at the offshore area of Kalanganan.

Rivers and creeks traversing the city would remain as a transport route to different barangays in the city by rural residents, farmers and fisherfolks of this city as well as adjacent municipalities. Some residents of adjacent municipalities ship their products through these rivers and creeks.

f) Land Classification and Cover

Under the 1987 Constitution lands are classified either as public domain or private lands. Public Domain are considered lands for public use or for government use and those which are unappropriated. Unappropriated use is further classified into Non-Disposable and Non-Alienable; and Alienable and Disposable (A & D). Alienable and disposable lands refer to those lands of the public domain which have been the subject of the present system of classification and declared as not needed for forest, mineral purposes or national parks.

The project area covering three (3) municipalities/city (Cotabato City, Sultan Kudarat and Datu Odin Sinsuat) is covered under A & D land classification (Figure 25.7-3). The location of the MCWD facilities where project component will be undertaken is within A & D or private land. A & D land includes those land for agriculture, residential use, institutional use, educational use, commercial use and industrial areas.



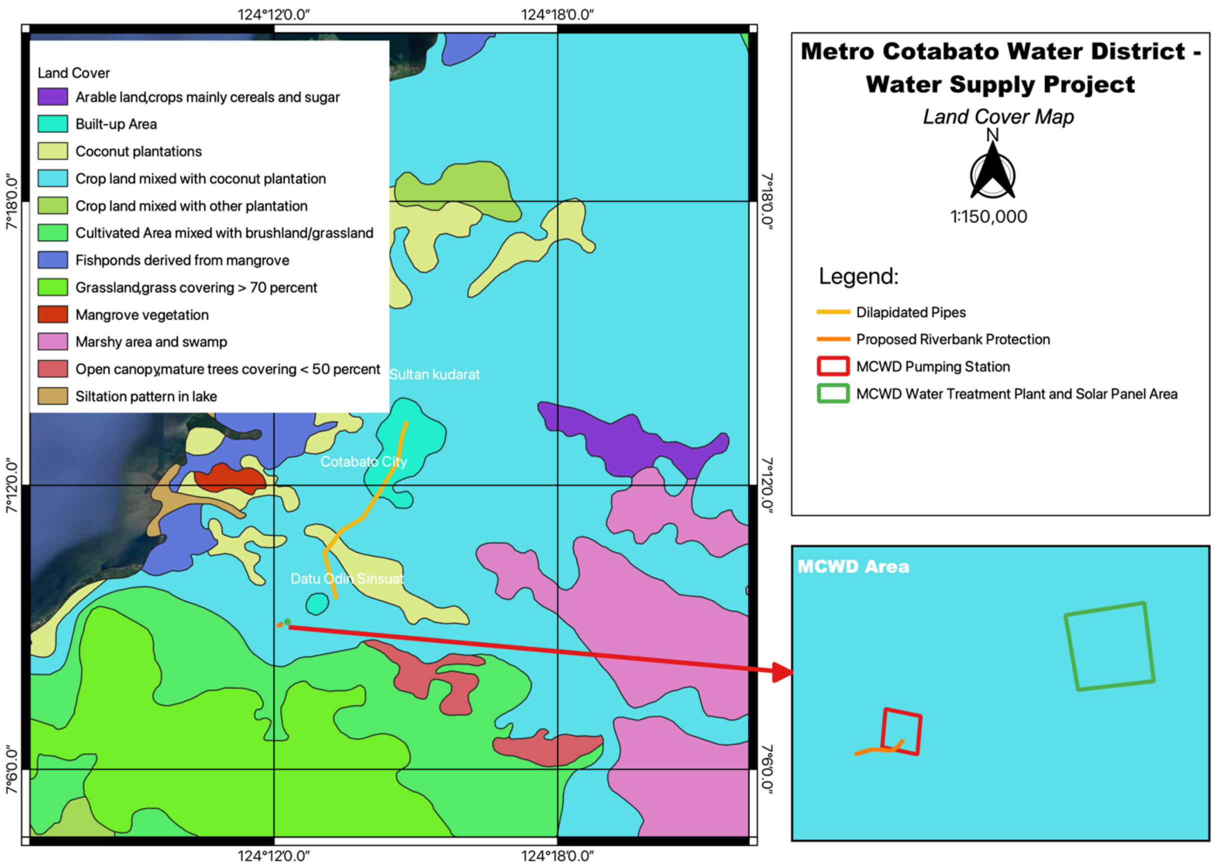
Source: JICA Study Team, 2021

Figure 25.7-3 Land Classification Map (NAMRIA, 2015)

In terms of land cover (Figure 25.7-4), project area is primarily covered by coconut plantation and cropland mixed with coconut plantation.

Built-up area is characterized by the presence of buildings (roofed structures). Concentration of settlements and other urban uses are in the central portion while the southwestern and southeastern portion have mixed uses of agricultural land settlements.

Mangrove vegetation and siltation pattern in lake are mostly located along the shoreline in Cotabato City while Marshy area and swamp were situated in some areas of Datu Odin Sinsuat. Fishponds derived from mangrove also have a significant area within the project site.



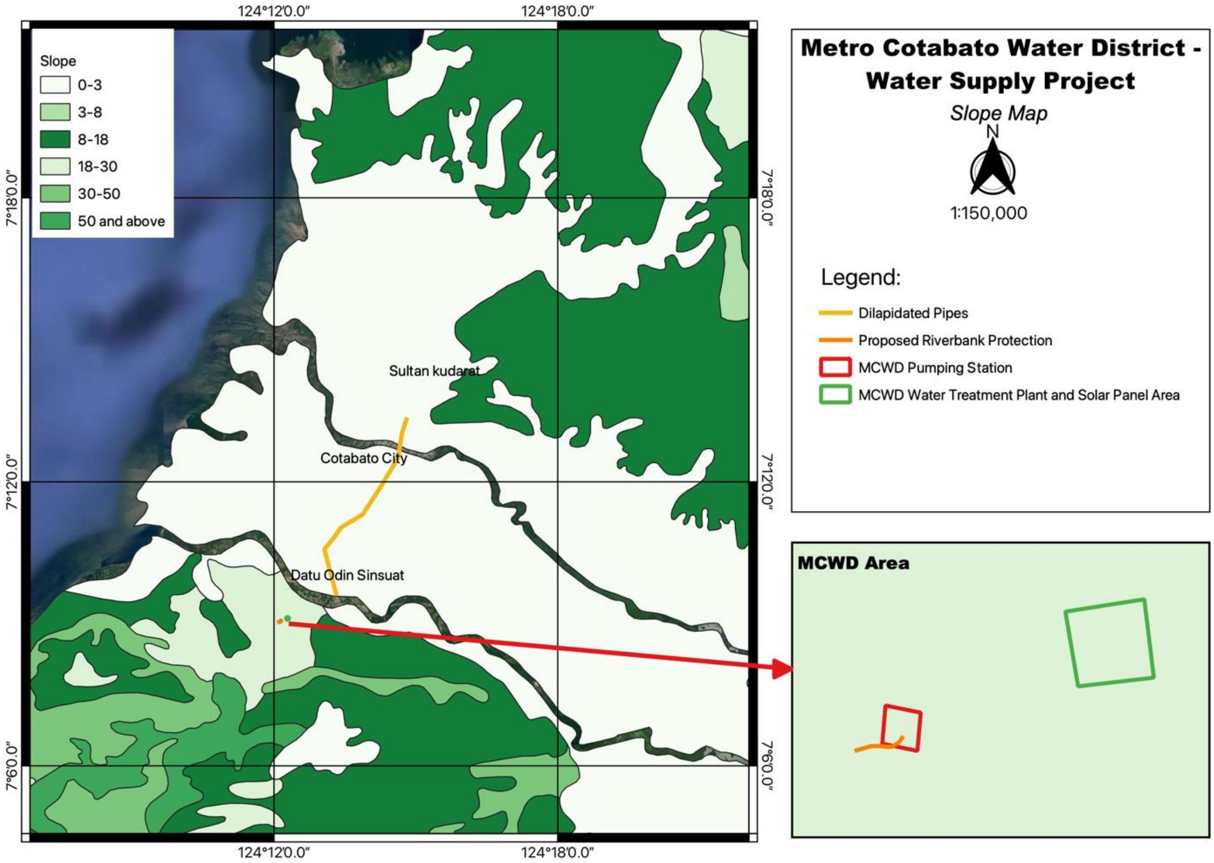
Source: JICA Study Team, 2021

Figure 25.7-4 Land CoverMap (NAMRIA, 2015)

g) Topography and Geology

The city is situated in the lowest portion of Maguindanao province. The City of Cotabato with its 37 barangays spans an area with marked landscapes of flat, level to nearly level, very gently sloping to gently undulations to moderately sloping or rolling. It is basically a delta formed by two big rivers, the Tamontaka River and the Rio Grande de Mindanao. Basically 70% of its total land area is below sea level. There are only 2 existing elevated areas in the city, the PC Hill and the Timako Hill with an altitude of 90 and 150 feet, respectively.

Figure 25.7-5 presents the slope characterized by the project area. It shows that the proposed project component as well as the MCWD service area does not fall under critical slope areas. Slope ranges to level to nearly level (0-3%), gently sloping to rolling (3-8%), and rolling to moderately steep (8-18%).



Source: JICA Study Team, 2021

Figure 25.7-5 Slope Map

During the earthquake of 1976, nine (9) significant infrastructures in the city were damaged and two (2) ground rupturing were recorded. Most of these earthquakes related misfortune was located within the Central Business District (CBD). The CBD covers the area bounded by Quezon Avenue on the south and east. Shariff Kabunsuan Boulevard on the north and Mabini St. on the west. The damage infrastructures (buildings) either had its pillar sank or totally collapsed. Studies conducted later by the Department of Environment and Natural Resources-Mines and Geosciences Bureau reveals that the CBD is susceptible to liquefaction. Liquefaction is a process that transforms the behavior of a water-saturated deposit from a solid to liquid. The vulnerable deposits for liquefaction are sand layers below the water table and poorly densified.

As it is, development cost in the CBD is high since building owners/ proponents will have to put more piles and contract a certified structural engineer to designed an appropriate foundation or support that would go along with the shaking of the ground just to be assured that the occupants would be safe once fortuitous events such as ground trembling occurs. Existing roads in CBD may be vulnerable to earthshaking as the previous earthquake has recorded ground rupturing in the area.

h) Ground Subsidence

The city has been identified to be within the earthquake belt. This was clearly demonstrated during the 1976 earthquake that caused vast destruction of lives and properties.

The susceptibility of the soils in the area to be eroded were those that are Erosion Potentials located along the banks of the Matampay River, Tamontaka River and the Rio Grande de Mindanao. Barangays located along low-lying areas occasionally experience flash floods brought about by heavy rains. It is also noted, however, that more than half of the city's land area is below sea level, thus seemingly an appropriate drainage system could prevent flooding and clogging of waterways. Potential flooding areas are those found in almost all four directions in the north, south, east and west. The meandering and occasional braided courses of rivers like Rio Grande de Mindanao, Tamontaka River, Tarbung, Kakar, Matampay, Miwaruy, Masukul, Manday, Lugay-lugay, Bagua and Kalanganan Rivers and Pagalamatan Creek could aggravate the flooding hazards of the area where these rivers are found especially during rainy season. Approximately, 85% of the soils in the area have good external and internal drainage while the other 15% have poor external and internal drainage.

i) Bottom Sedimentation

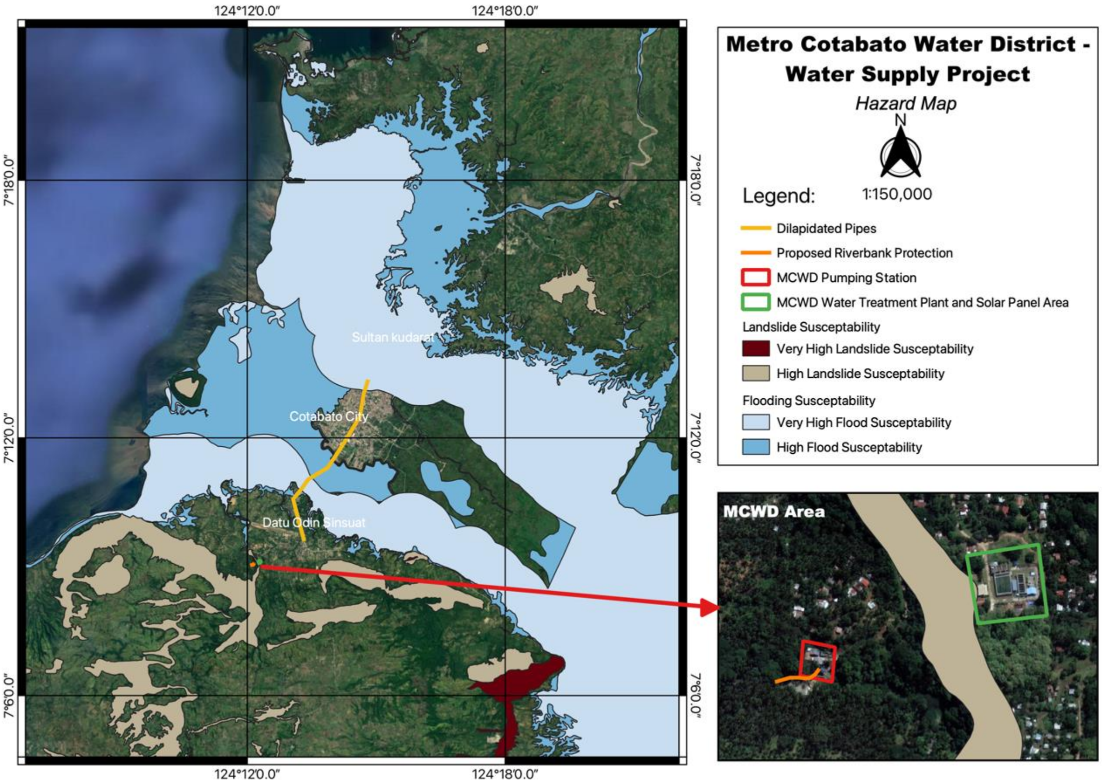
Broadly, there are three (3) soil types present in the area. The most dominant soil type found in Cotabato which make up 80% of the total land area or 14.079 hectares is the Faraon clay type. These are moderately good lands suitable for limited cultivation and less appropriate for urban development due to soil characteristics. Urban development would require very careful, and complex soil utilization practices. This type is found in the innermost portion of the area, the Tamontaka clay type found in the areas along Rio Grande de Mindanao on the north and south directions total to 2,640 hectares or 15% of the city's total land area. This type of soil has high fertility level, good lands which can be cultivated and suited for urban development but requires carefully, planned erosion control measures. The third type of soil embracing an area of 880 hectares or barely 5% of the city's total land area is where settlements and other urban uses are highly concentrated. These are very good lands which can be cultivated safely and require very simple soil management practices and with high density for urban development.

j) Hazards and Disaster

About half of the city's total land area is considered to be below sea level and therefore flood prone whether due to tidal intrusion from sea water or heavy precipitation from within or from upstream. The areas of Barangays Poblacion 8 and 9, Barangays Tamontaka 1, 2, 3, 4 and 5 are inundated whenever heavy rainfall occurs persisting for a considerable number of days. This is further aggravated as the city major river the Rio Grande de Mindanao is heavily silted so much so that the capacity of the river to contain the flow is greatly diminished resulting sometimes to over spilling of water to low leveled barangays of the city. The city is at the receiving end of what is considered the biggest river basin in Mindanao the Cotabato-Agusan River Basin. The government has put efforts to improve the situation. Periodic dredging of silt from Rio Grande de Mindanao has greatly improved the situation.

The occurrences of flooding were attributed to the city's geographical characteristic that is being a delta and the drainage outlet of Liguasan and Agusan Marshes, Pulangi and Allah Rivers, and other major rivers located upstream towards the sea. This has made Rio Grande de Mindanao and Tamontaka River heavily silted thus, causing flooding in the low-lying areas of the city. This situation was further aggravated with the periodic presence of water hyacinth along the Rio Grande de Mindanao. In the last two (2) years, the city has experienced three (3) flooding occurrences and has affected 89% of the city's total barangays. Incidences of flooding in the city is also attributed to the off-course overflowing of Simuay River towards Rio Grande de Mindanao which has contributed greater volume of water to the already limited drainage outflow capacity of the said river due to heavily siltation. The recurring incidences of flooding has resulted a lot of damage to the daily activities of the residents of the city notwithstanding the emotional anxiety every time there is a heavy downpour.

Figure 25.7-6 shows the very high and high susceptibility of the project area to flooding and landslide.



Source: JICA Study Team, 2021

Figure 25.7-6 Hazard Map

k) Environmental Sensitive Areas

Environmentally sensitive areas (ESAs) are landscape elements or places which are vital to the long-term maintenance of biological diversity, soil, water or other natural resources both on the site and in a regional context.

Mangrove Areas

On the western part of the Cotabato city lies the mangrove stand covering an area of 408.64 has or 2.31% of the total area. Mangrove is known to provide nursery grounds for fish, crustaceans and mollusk especially those located along tidal mudflats. Inland mangroves provide protection to communities from storm surges, waves, tidal currents and typhoons. It is also an excellent site as recreational grounds for bird watching and observation of other wildlife such as egrets which is still present in the coastal areas. However, these areas are quite distant to the project sites.

Marine/Coastal Ecosystem

The coastal and marine ecosystem of Cotabato City was once rich with biotic and abiotic component. Mangrove trees extend inland providing a fine habitat to different wildlife. Various species of egrets wander freely, crustaceans and mollusk abound and fishes as well. Niches were rich and diverse complementing each other and ensured their survival. Gradually, anthropogenic activities cross the threshold and sluggishly destroyed the ecological balance that once existed. Some mangrove stands were unsustainably cut to give way to settlements and fishponds, some were even cut for fuel or building materials, all for economic reasons.

In Datu Odin Sinsuat, there has a wide tract of fishery areas. It has four coastal barangays, namely: Tapian, Kusiong, Badak and Linek.

Marine Ecosystem may not have impacts on the project since it is significantly distant to the project area.

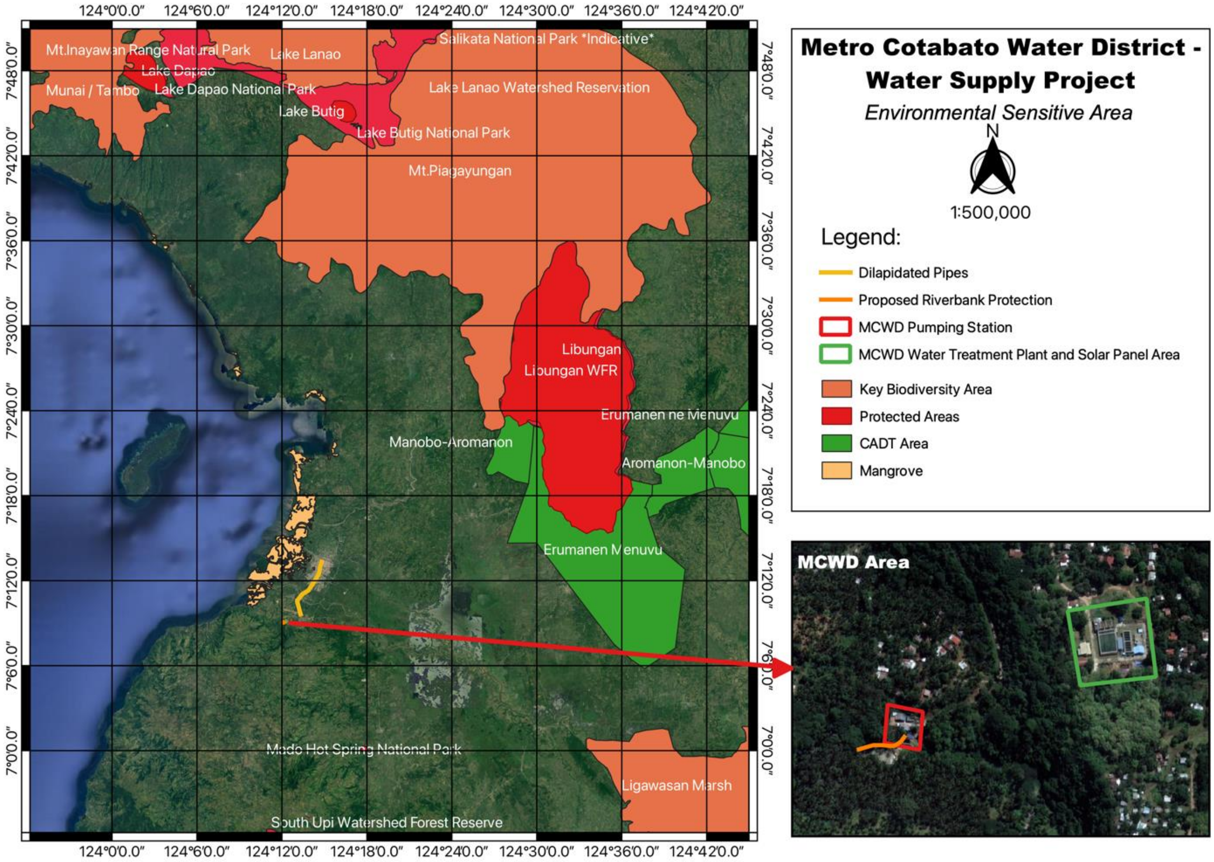
Ancestral Domain

The project will not encroach any ancestral domain or lands, territories and resources of indigenous peoples (Figure 25.7-7).

Protected Area/ Key Biodiversity Area

Protected area are declared s such under RA No. 7586 or the National Integrated Protected Area System (NIPAS) Act or declared as such through other issuances from pertinent national and local government. Although there are protected areas designated by the Philippines government around the project area as shown in Figure 25.7-7, there is no protected area in the project area or the protected area on which the project may have impacts.

The closest is the Dimapatoy Watershed in Brgy. Dinaig Proper with an area of 3,765 hectares with awing 48 hectares as source of potable water in nearby barangays as well as the Cotabato (Datu Odin Sinsuat CLUP). It is not yet delineated under NIPAS as Protected area or Critical Watershed, (as pr NAMRIA databased), but based on local government of Datu Odin Sinsuat, indicated in the Comprehensive Land Use Plan, Dimapatoy watershed is considered as strict nature resource while Mado Hot Spring in Awang as resource reserve areas.



Source: JICA Study Team, 2021

Figure 25.7-7 Environmental Sensitive Area at the Project Site (NAMRIA, Geoportal.gov.ph)

(2) Socio-Economic Conditions

1) Socio-economic Profile of the Project Area

a) Cotabato City

Population and Demography

The city has a land area of 176.00 square kilometers or 67.95 square miles. Its population as determined by the 2020 Census was 325,079. This represented 6.63% of the total population of the SOCCSKSARGEN region. Based on these figures, the population density is computed at 1,847 inhabitants per square kilometer or 4,784 inhabitants per square mile.

Existing Social Infrastructures and Services

- ***Education***

Education has always been regarded as an important priority in governance. Regardless of cultural diversity and traditions, it is made accessible to all. The government is driven to make education a priority as it contributes to peace building and economic development.

Overcrowded schools are a serious problem in Cotabato City school systems student-to-classroom ratio is a concern over the past years. As a result, students find themselves trying to learn while jammed into spaces never intended as classrooms, such as libraries, gymnasiums, laboratories, lunchrooms, and even open spaces. This somehow have an impact in the quality of learning among students.

There are still barangays in the city that have no presence of public schools. Out of the 37 barangays of Cotabato City, 11 do not have any public schools that will cater to the growing number of school-going population. By Year 2030, the school age population projection will reach up to 297,610 individuals.

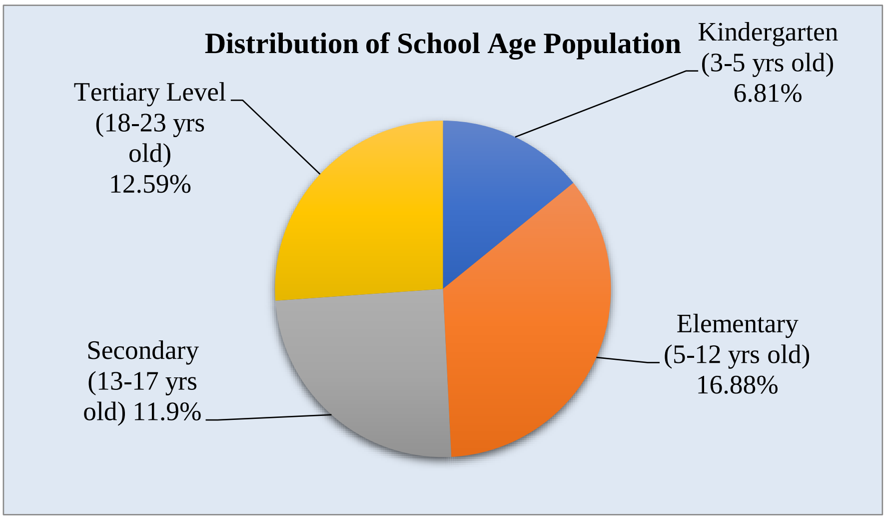
Aside from lack of classrooms, most of these public elementary schools in the city are currently in need of basic school facilities such as computer rooms, comfort rooms, libraries, home economics buildings, and water system. Except for Central Pilot Schools, not all has laboratory facilities and clinics to cater to the medical and first aid needs of the pupils.

The school going age population now refers to those who belong to ages 3 to 23 years old recorded at 144,335 students or 48.18% of the entire population. Males dominate in number in pre-school and elementary while female dominates in secondary and tertiary level. Table 25.7-11 presents the school-age population composition.

Table 25.7-11 Population Composition by School-Age and Sex, Year 2015

AGE GROUP	2015 BOTH SEXES	Male		Female		Sex Ratio
		No.	%	No.	%	
School Age population	144,335	71,175	23.77	73,160	24.43	97.29
Pre-school (3-5)	20,424	10,373	3.46	10,051	3.35	103.20
Elementary (6-12)	50,599	25,531	8.52	25,068	8.36	101.85
Secondary (13-17)	35,611	17,293	5.78	18,318	6.12	94.40
Tertiary (18-23)	37,701	17,978	6.00	19,723	6.59	91.15

Source: Cotabato City Eco-Profile, 2017, CPDO



Source: Cotabato City Eco-Profile, 2017, CPDO

Figure 25.7-8 Percentage Illustration of School Going Age by Level of Education

Figure 25.7-8 shows the percentile distribution of School Going Age by their educational level.

Literacy rate is presented in Table 25.7-12. About 90% of the total population is literate, this means able to read and write.

Table 25.7-12 Population Distribution 10 Years and Over Literacy Rate

Total Population 10 years old and over	No. of population Literate			Simple Literacy Rate		
	Total	Male	Female	Total	Male	Female
230,161	206,529	89,786	95,538	90.00	91.00	88.50

Source: RSE trends 2015

- ***Health Status***

The Cotabato Regional and Medical Center (CRMC), located along Sinsuat Avenue (National Highway) is the only tertiary government hospital in the Greater Cotabato area. It is considered well-equipped and has a total bed capacity of 300.

The CRMC offers a variety of medical services ranging from the simple medical consultation through its Out-patient Department and Emergency Services to treatment of various illnesses requiring particular medical field of specialization. It has basic and modern medical equipment as well.

Cotabato City health services includes one Main Health Center, the Office on Health Services (OHS) of the city government and 43 Barangay Health Centers (BHC's) spread throughout its 37 barangays.

The OHS is manned by 5 medical doctors/physicians providing medical consultation services. The facility can perform minor surgeries and emergency treatments but refer severe cases to higher health facilities especially when it requires particular field of specialization and/or admission. The center's laboratory has basic equipment but are limited only to the conduct of urinalysis, fecalysis, sputum and smear testing. It has no blood testing equipment and other modern and advance diagnostic equipment except for a manual X-Ray machine. It has a dental clinic and a sub-dental clinic situated beside the Rosary Heights Mother Barangay Hall, along Sinsuat Avenue.

Of the existing BHCs, only 17 centers are currently occupying their own buildings. The rest are either sharing spaces with their respective Barangay Halls or situated in makeshift or borrowed buildings/houses each manned by a Midwife.

The general health situation in Cotabato City reflects inadequacy of birthing homes and basic obstetrics care facilities at the community levels and the need to enhance the implementation of basic and primary health care program and services to address the leading causes of mortality and morbidity of all ages in general but more importantly of children and mothers.

- ***Transportation System***

The city's present road network system consists of grid pattern network where there is only one (1) main corridor (Sinsuat Avenue) traversing the city from south to north.

Almost all barangays are interconnected with the main backbone except for one (1) barangay that can only be accessed by water transportation. Public utility vehicles ply the routes along the major roads of the City. Non-motorized vehicles and habal-habal serve the needs of the commuters of the interior barangays. Terminals of these informal mode of transportation are situated along intersections of major city roads.

- ***Protected Services***

A key priority for the police service is to ensure that it deals effectively with terrorism, serious crime and other major challenges to public safety. Protective services include counter-terrorism and extremism, serious organized and cross-border crime, civil contingencies and emergency planning, critical incident management, major crime, public order, strategic roads policing and protecting vulnerable people.

Under the Protective Services Sector, the Philippine National Police office of Cotabato City has 201 police officers. Fourteen (14) are currently detailed to different personalities, seven (7) are scheduled to retire in 2009 and are now processing their retirement papers while 13 are office based personnel assigned at various sub-stations. Only 121 field police officers, spread thinly among 7 sub-stations at strategic locations, were left to maintain and implement the needed protective service in the area. This figure is currently not absolute considering that, from time to time, some of these personnel are sent outside the city for further training and skills enhancement activities.

In terms of logistics, the police have 6 four-wheeled serviceable vehicles and eleven motorcycles distributed in the various police stations. The City Police is equipped with 2 units of closed-circuit television (CCTV) camera but are yet sufficient. Police officers cannot immediately respond due to unavailability of handheld radios to fast-track communication in the police force, especially those assigned in the field.

These manpower and logistical inadequacies resulted to lesser police visibility.

The Barangay Tanod is the freedom and peace-loving citizens organized at the Barangay levels mainly aimed to respond to atrocities and violence at their respective areas. It also aims for civic purposes and community defense in line with the security program of the government. It assists the police and military personnel in some basic crime solution efforts such as gathering crime related information and, further, compliments the PNP in securing the barangays by conducting watch activities. In case of emergencies and disasters, the Tanod provides quick response assistance.

Despite the presence of Barangay Tanod as an auxiliary support to public safety, the index crime rate from 2005 to 2009 showed an alarming increase in terms of grave offenses committed against persons. The figures for non-index crimes or light offenses like slight physical injuries also manifest an undeniable increase. However, it is confusing to observe that the data for crime solution efficiency presents a laudable figure.

In 2008, the felonies rose to a very alarming number of 165 cases for index crimes and 195 cases for non-index crimes for a total of 360 crimes where only 312 of which was accordingly solved while 48 remains unsolved. For the period covering January to February 2009, misdemeanor records listed 57 cases, 49 of which are considered solved.

As one of the five pillars of the Criminal Justice System, the BJMP was created to address growing concern of jail management and penology problem. Primarily, its clients are detainees accused before a court who are temporarily confined in such jails while undergoing investigation, waiting final judgment and those who are serving sentence promulgated by the court 3 years and below.

As provided for under R.A. No. 6975, the Jail Bureau is mandated to take operational and administrative control over all city, district and municipal jails. The Bureau has four major areas of rehabilitation program, namely: Livelihood Projects, Educational and Vocational Training, Recreation and Sports, and Religious/ Spiritual Activities. These are continuously implemented to eliminate the offenders' pattern of criminal behavior and to reform them to become law-abiding and productive citizens.

Manned by only 20 personnel, Cotabato City has only one (1) City Jail located at Rajah Tabunaway Boulevard, Poblacion 5. It has a very limited area against the total number of inmates. Seventy-five (75) inmates fill up in one (1) quarter. Presently, the facility accommodates 143 inmates.

The jail personnel aired concerned that, aside from insufficiency of firearms, the absence of BJMP vehicle hamper their function as jailers. They use or hire passenger vehicles as their mode of transportation for jail related transactions such as ferrying inmates to and from the courts, City Health Office and other destinations.

There is also a need to look into the plight of minor inmates who are not supposed to be mixed with hardened adult criminals.

The Cotabato City Bureau of Fire Protection is composed of three (3) stations inclusive of its headquarter which is located at Rajah Tabunaway Boulevard in Poblacion 5. It is manned by 43 personnel. Substation 1 is situated at Sinsuat Avenue, Rosary Heights Mother with five (5) personnel while Fire Substation 2 with five personnel also is located at Lugay Lugay area in Barangay Bagua 1.

Despite the existence of the City firefighters both from the Bureau of Fire Protection and from the Filipino Chinese Fire Brigade, fire incidence is still alarming. This can readily be attributed to the absence of fire hydrants in strategic locations or unserviceability of the existing ones. The community also needs more fire prevention orientation as well as organization or reactivation of fire/disaster prevention group at the barangay levels.

- ***Sports & Recreation Sector***

Whether you are a varsity athlete, a play-for-fun jock, a casual game player, or someone who just wants to get into shape, Cotabato City has not so many opportunities to stay fit and competitive. City residents need not be an athletic star to get in the game in the City. One can stay in shape with 2 major school sports arena, the Cotabato City State Polytechnic School and the Cotabato City Central Pilot Elementary School outdoor track/oval. The City has 5 basketball and volleyball gymnasium and 4 indoor tennis/badminton courts

The City offers plenty of ways to stay fit in non-competitive settings. Jog or walk in the ORC Compound, in the City Plaza and the People's Palace grounds. One can also take commercial aerobics and cardiovascular training and conditioning at the City Mega Square Commercial Center situated beside the New City Hall at Malagapas, Rosary Heights 10 and at the . The City Government's state-of-the-art body fitness equipment will give your strength and weight training routines a boost.

The YMCA Recreation Center is a popular gathering place for people who intend to spend their time and unwind. There's a lot of activity in this one building: bowling, darts, billiards and others.

For cyber space afficionados, internet cafes are available everywhere and one can hang out in the computer lounges of hotel lobbies and coffee shops and enjoy wireless connectivity or play games.

- ***Utilities Services Facilities***

Power Supply

Electrical needs of the City Cotabato are being provided by the competent Cotabato Light and Power Company.It has a standby diesel facility that provides power during interruptions and power outages. About 19,642 households have accessed to electricity while the rest have other power sources such as kerosene and liquefied petroleum gas (LPG). Only Barangays Poblacion 5 and Rosary Heights 11 have more than a hundred percent access to electrical services. More than 50% of the households in the whole 13 barangays of Rosary Heights are amply provided with electricity.

Water Services/Usage

Potable water supply is being provided by the Metro Cotabato Water District (MCWD). There are a total of 22,898 households having accessed to level 3 water supply system. Of the total 37 barangays, about 4 have level 2 water supply provisions. These barangays are Tamontaka 2 and 3, Poblacion 9 and Kalanganan Mother. Three barangays that do not have accessed to the services of MCWD get their water needs from other sources.

There is one spring located in Bagua 3. However, its water resource is not guaranteed potable water source. Thus, level 2 water system in the city is being connected with the services provided by the local water district. Level 2 water system projects were implemented jointly with the assistance from Growth with Equity in Mindanao (GEM) Program Phase 2 and the local water district. To date, 4 rural and remote barangays of the city have benefited with this assistance. As of 2008, there are a total 37 active level 2 connections. A significant decrease in the number of level 2 connections was seen in Barangay Poblacion 9 which leaves only 3 level 2 active connections. This is attributed to the household's economic status. Each communal faucet is designed to serve 10 households. To date, there are 370 households benefitting from level 2 water facility.

<u>Communication Sector</u>

Among the utility sectors, Communication is the most dynamic for it changes dramatically over time. Previous years, there are 3 landline companies telephone services to the residents of the city. Currently, there are only 2 landline companies left provide telephone services to the city of Cotabato, the Philippine Long Distance Telephone Company (PLDT) and Telof and only urban barangays are provided with landline facilities. Telephone density in 2007 was pegged at 62.5 per 1000 people. More landline telephone users have availed of the mobile telephone services primarily due to convenience, accessibility and affordability the latter offers. Presently, PLDT published landline subscribers totaled to 2,662 with 1,365 residential and 1,297 non-residentials.

To date, there are 31 registered and licensed internet café establishments in the city. The city has 3 AM and 4 FM Radio Stations, 2 cable TV companies and 3 Internet Service Providers (ISP) which either provides dial-up and wireless internet connections.

The city being the primary urban center in Central Mindanao has access to daily national newspapers and the local print media outfit that produces weekly local newspaper. The local newspapers are circulated not only in the city but also in provinces of Cotabato and South Cotabato, Maguindanao and Sultan Kudarat.

In the city of Cotabato, 3 cellular phone companies have a total of 19 cellular transmission towers located in various strategic areas. Globe Telecom has the most number of towers followed by SMART communications and Digitel Mobile Philippines. Most of these towers are installed in areas with higher elevation and strategic enough to serve the company's desired area of coverage. To date, almost all barangays have cell phone signal.

Solid Waste Management

Cotabato City's population has grown over the years. Being the leading institutional, financial and service center in the region, people continue to migrate in the city for employment and other social welfare benefits and services.

As the population of Cotabato City is increasing, naturally the amount of solid waste is also increasing. With such scenario, Cotabato City and even its nearby LGUs are challenged to properly manage their waste collection and disposal.

Studies conducted earlier reveal that a substantial portion of waste is generated from household level followed by the waste coming from the public markets. Waste from commercial, institutional, industrial, agricultural, and city government services trailed next.

To meet the growing problems on solid waste, some barangays, by virtue of Republic Act 9003 or the Ecological Solid Waste Management Act of 2000, have established a solid waste collection system. Barangays Poblacion I, II and V as well as Barangays Rosary Heights I, IX and XIII have set up a full collection system while Barangays Poblacion IV, VII and Barangay Rosary Heights II have a partial collection system.

The Waste Analysis and Characterization Study (WACS) conducted at both public markets disclosed that solid waste generated within the markets is composed largely of biodegradables. Ideally, such solid waste should be diverted from the waste stream to delay the full up and extend the service life of the city's dumpsite. Other studies are being undertaken as to putting up a composting facility in the area of the dumpsite or in a privately owned lands which would be operated by an accredited cooperative or any private entity to receive the biodegradables from the public markets. The establishment of a Central Materials Recovery Facility (MRF) is also seriously considered to cater to the recyclables coming from all sources. Below are tables showing the breakdown of waste in both public markets of the city. A simple WACS was also conducted in selected areas of the city. Table 25.7-13 shows the types of waste being generated in the city and their respective sources.

Table 25.7-13 Solid Waste Characterization by Category

Type of Solid Waste	Percentage Distribution by Source							Average Percentage
	Households	Markets	Food Establishments	Commercial	Schools	Offices	Hospitals	
Compostable	64.44	88.33	52.87	33.33	82.3	26.46	42.62	55.76
Recyclable	22.84	6.86	38.64	56.91	12.45	67.70	30.06	33.64
Non-recyclable	12.72	4.81	8.49	9.76	5.25	5.84	27.32	10.60
Special Wastes	-	-	-	-	-	-	-	100.00

Source: Cotabato City 10 Year Ecological Solid Waste Management Plan/LGU-General Services Office

Local Economy such as Employment and Livelihood

The erstwhile administrative role of Cotabato City as the seat of Central Mindanao (Region XII) paved the way for the establishment of regional offices of National Line Agencies (NLAs) thereby providing employment to its constituents. Together with the Office of the Regional Governor and its component Regional Line Agencies (RLAs) in the Autonomous Region in Muslim Mindanao (ARMM), it comprises a big chunk of employed persons within the labor force. These employees in the government sector have contributed largely to the growth of the city's economy in terms of accessing social and economic services through spending on household needs, consumer goods, use of entertainment facilities, engagement in entrepreneurial concerns and payment of local taxes.

From the private sector, the Commerce and Trade sub-sector represents the major employment provider covering such endeavors as wholesale and retail activities, banking and finance, service facilities, and others. The agriculture sub-sector, in general, has no visible employment participation since most of the concerned populace are self-employed. Fisher folks based in the 3 Kalanganan barangays are engaged in fishing off the coast of Illana Bay while fishpond owners operate their own brackish water fishponds. Even the members of fishpond cooperatives tend to their own fishponds. Workers are hired on piece rate basis as the need arises during harvest, casting of fingerlings at the start of production cycle and maintenance activities. It is more simplified in the case of freshwater fishpond owners as they are all engaged in backyard-raising and do not demand labor support.

The same is true in the case of farmers who also own the land they are tilling. In effect, they are also self-employed. The average family in Cotabato City earns more than what it spends for its basic family needs and services. Going by the generally accepted norm, the average number of family members of 5, has 27,761.00 PhP to use for meeting their personal requirements.

In contrast, the per capita poverty threshold represents the amount needed by an individual to meet his minimum basic needs. The average family in Cotabato City is above the poverty threshold as shown in the poverty incidence of families. This is one reason why the city is classified as a highly urbanizing city in South-Central Mindanao.

Table 25.7-14 Income and Prices Survey for Cotabato City (Year 2008)

Particulars	Reference Period	Amount/Percentage
A. Ave. Annual Family Income	2000	P 138,805.00
B. Average Annual Family Expenditures	2000	P 112,816.00
C. Inflation Rate (2000=100)	2008	14.4%
Particulars	**Reference Period**	**Amount/Percentage**
D. Peso Purchasing Power (2000=100)	2008	P 0.63
E. Annual Per Capita Poverty Threshold	2006	P 17,335.00
F. Poverty Incidence of Families	2006	38.0

Source: National Statistics Office (NSO), National Statistics Coordination Board (NSCB), 2008

b) Sultan Kudarat

Population and Demography

The municipality has a land area of 712.91 square kilometers or 275.26 square miles which constitutes 7.15% of Maguindanao's total area. Its population as determined by the 2020 Census was 105,121. This represented 7.83% of the total population of Maguindanao province, or 2.39% of the overall population of the Bangsamoro Autonomous Region in Muslim Mindanao. Based on these figures, the population density is computed at 147 inhabitants per square kilometer or 382 inhabitants per square mile.

Existing Social Infrastructures and Services

- ***Education***

The Municipality of Sultan Kudarat has six (6) primary schools, thirteen (13) elementary schools (1 private and 12 public) and six (6) high schools (1 private and 5 public) and one (1) private tertiary school located in Barangay Calsada. The total enrollees of the year 2015-2016 was 11,648 of all levels from preparatory down to the college level.

Table 25.7-15 Student-Teacher and Student-Classroom Ratio by Level SY 2016

Student-Teacher and Student-Classroom Ratio by Level SY 2016					
Type/Level	**Total Number Enrolment**	**Number of Teachers**	**Number of Classroom**	**Student-Teacher Ratio**	**Student-Classroom Ratio**
Private					
Preparatory					
Elementary					
Secondary	988	25	25	1:40	1:40
Junior High School					
Grade 7-10					
Senior High School					
Tertiary	77				
Sub-Total	**1,065**	**25**	**25**		
Public					
Preparatory					
Elementary	10,520	234	245	1:45	1:43
Secondary	1,128	28	25	1:40	1:45
Junior High School					
Grade 7-10					
Senior High School					
Tertiary					
Sub-Total	**11,648**	**262**	**270**		

Source: Municipality of Sultan Kudarat CLUP 2017-25 Planning Period, CPDO

- ***Health Status***

The Municipality has 30 barangay health units, one Rural Health Unit (RHU) and one sanitarium hospital manned by one doctor, 7 nurses including the deployment project nurse, one Mid-tech, one sanitary inspector and 22 midwives servicing the 39 barangays of the municipality.

As per record of Municipal Health Office, diarrheal diseases ranked high which constitute 36.50% of the total notifiable diseases reported. Influenza cases comes second and third is pneumonia. TB respiratory diseases have been reported at the age group from 15 years and over. The report indicates that the age group 0-14 is hardly hit by diarrheas and pneumonia diseases which can be associated with drinking water and the unsanitary practices observed in the community.

- ***Transportation System***

Sultan Kudarat, traversed by a national road connecting major cities in Mindanao, is relatively accessible through a well-paved roads connecting to the city of Davao via Cotabato-Davao Road, Cagayan de Oro via Narciso Ramos Highway, General Santos City via Cotabato- Marbel-Ala Road. It is 225km to Davao City, 237km to Cagayan de Oro City and 186 km. to General Santos City. The Municipality is also accessible to Public Transportation such as Buses(Mindanao Star) and other public utility vehicles serving the area.

The municipality has a total of 120.76 km of road networks consist of National, Provincial, Municipal and Barangay Roads with road surface type of concrete, asphalt, gravel and earth. The condition of the roads are relatively fair but undergoing upgrading its road network for public convenience.

At present, there is one (1) overland public transport terminal in the Municipality located in Barangay Crossing Simuay which occupies about one (1) hectare of the Barangay area. The terminal is equipped with facilities to include the following: parking areas for both outgoing and waiting vans, waiting area for passengers, comfort room and public assistance counter. Another terminal is the Sultan Kudarat Transport Company (SUKUTSCO) a privately operated terminal for vans located at Barangay Salimbao occupying an area of 0.35 hectares more to less to cater passengers bound to Pagadian City.

- ***Protected Services***

There are Police Stations located in Dalumangcob, Bulalo, Crossing and presence of outpost to all barangays in Sultan Kudarat. Personnel to population ratio for uniformed personnel is 1:1,402. There is one (1) Jail (detention cell) also located in Dalumangcob.

Fire station is located in Dalumangcob with one (1) fire truck.

- ***Sports & Recreation Sector***

In terms of sports and recreation, facilities are available in some areas in Sultan Kudarat. Table below shows the existing sports and recreational facilities by barangay.

Table 25.7-16 Existing Sports and Recreational Facilities by Barangay

Barangay	Area (Hectares)	Sports Facilities	Recreational Facilities	Ownership	Physical Condition Good, Poor, Critical
Dalumangcob		Basketball Covered Court	-	Public	Good
Dalumangcob		Multi-Purpose Gymnasium	Municipal Plaza	Public	Good
Salimbao		Open basketball Court	-	Public	Good
Salimbao		Public Market			
Limbo		Basketball Court	-	Public	Poor

Source: MPDO, Sports and Recreational Facilities Map

- ***Utilities Services Facilities***

Power Supply

There are three (3) electrical companies serving the municipal town, the Cotabato Light and Power Company (COLIGHT) Maguindanao Electric Company (MAGELCO) and the Cotabato Electric Cooperative (COTELCO). The COLIGHT supplies the power requirement of urban areas of the municipality which consists of the twelve (12) barangays and the remaining barangays except the interior barangays of the Municipality energized by MAGELCO and COTELCO. COTELCO energized some household of Barangays of Panatan and Alamada. COLIGHT, MAGELCO, and COTELCO receives power supplies from the NAPOCOR hydroelectric plant at Iligan City. The only advantage of COLIGHT over MAGELCO and COTELCO is that COLIGHT has stand-by direct electric generator to operate in case the NAPOCOR power fails.

Out of 39 barangay in the municipality there are 23 barangays that are not yet served by the 3 electrical companies due to its remote location. At present, there are 218 households that are served with electricity. There is backlog of 13,312 Households for both Urban and Rural Barangays awaits for electrification. On the other hand, the unserved household are utilizing solar power technology and kerosene.

Water Services/Usage

The 1991 inventory of water supply facilities in the Municipality of Sultan Kudarat reveals that its constituents are basically dependent on the underground water for their daily water consumption. The Cotabato City Water District(CCWD) have make use of the Municipality's underground water resources by constructing their pumping station at the Barangay Rebuken. The CCWD is pumping a volume of 2,700 cubic meter daily and serving 10 barangays of this Municipality with a total number service connection of 2,511 as of 2012.

Communication Sector

The municipality has its own operational communication system popularly known as PLECS or Provincial Law Enforcement Communication System that interlinks municipalities, provinces, regions or with national agencies. The Philippine Long Distance Telephone Company(PLDT) is already serving the municipality particularly at its five southern barangays. The municipality still enjoys the services of the Municipal Telecommunications Office stationed at the Municipal Hall. The Philippines Postal Office have put up three(3) postal offices at the Municipal Hall, Provincial

Capitol, and at Barangay Salimbao purposely to effectively provide better services in this areas. The introduction of two (2) way radio communication have greatly enhance the communication linkages particularly at the far-flung barangays of the Municipality. Television and radio receivers are also common ways of sending message being enjoyed by its populace.

Solid Waste Management

The Municipality is already preparing its Solid Waste Management Plan with the technical capacitating assistance from the USAID- ECOGOV. The plan, if finished and made operational, will serve as the municipality's tool in its effort of sustaining its eco system.

The Municipal Composting Plan was already finished and ready for implementation. It was formulated through the technical assistance provided by the Eco-Gov. It entails a cost of more than Four Million (4,000,000) pesos.

It will be adopting the high-tech MRF facility of the Solid Waste Management Project of the City of Koronadal. It was decided as a result of the study tour sponsored by the Eco-Gov to the selected areas and LGUs in the South Cotabato areas which was participated by the members of the SWMB of the municipality.

The municipality has an estimated solid waste generation of 47,033 kilograms/day. With this it can generate a total bio-degradable solid waste of about 27,853 kilogram/day and 10,166,324 kilograms/year, while non-biodegradable will be 9,407 kilograms/day or 3,433,409 kilograms/day. The residuals and special wastes have a combined weight of 6,886 kilograms/day or 2,169,914 kilograms/year.

The Municipal Solid Waste Management Board (MSWMB) has already identified the area of the proposed Municipal Material Recovery Facility (MRF) and the Sanitary Landfill site.

Preliminary site suitability investigation has been undertaken by the Bureau of Science and Mines of the Department of Environment and Natural Resources. The lot is located at Brgy. Ladia going to its boundary with Brgy. Damaniog.

The proposed site has an area of about nine hectares and with the estimated municipal residual waste generation of about 2,169,919 kilograms/year or 21,700 cum/year. It is estimated to last for about 50 years.

Local Economy such as Employment and Livelihood

The 2010 population projection reveals that the labor force population of the municipality is 47,395 indicating that the major portions of its population are in the labor force. The main bulk of the work force is in the agricultural sector. Of the said figure, the employed labor force have totaled to 19,906 or 42 % of the total labor force of 47,395. The unemployed labor force constitutes about 58 % or 27,489 while the remaining percentage remains as dependents. In terms of participation rate of labor force, the male group has 23,542 and the female group accounted for

23,853. It can be noted that the female workforce is becoming active partner in the municipal economy.

Labor force is simply defined as those persons belonging to ages ranging from 15 to 64 years old. These include employed, self-employed, and non-employed population who falls under the said age bracket. About 47,395 persons or 57% of the total population of 2010 constituted the labor force.

c) Datu Odin Sinsuat (DOS)

Population and Demography

The municipality has a land area of 461.80 square kilometers or 178.30 square miles which constitutes 4.63% of Maguindanao's total area. Its population as determined by the 2020 Census was 116,768. This represented 8.70% of the total population of Maguindanao province, or 2.65% of the overall population of the Bangsamoro Autonomous Region in Muslim Mindanao. Based on these figures, the population density is computed at 253 inhabitants per square kilometer or 655 inhabitants per square mile.

Existing Social Infrastructures and Services

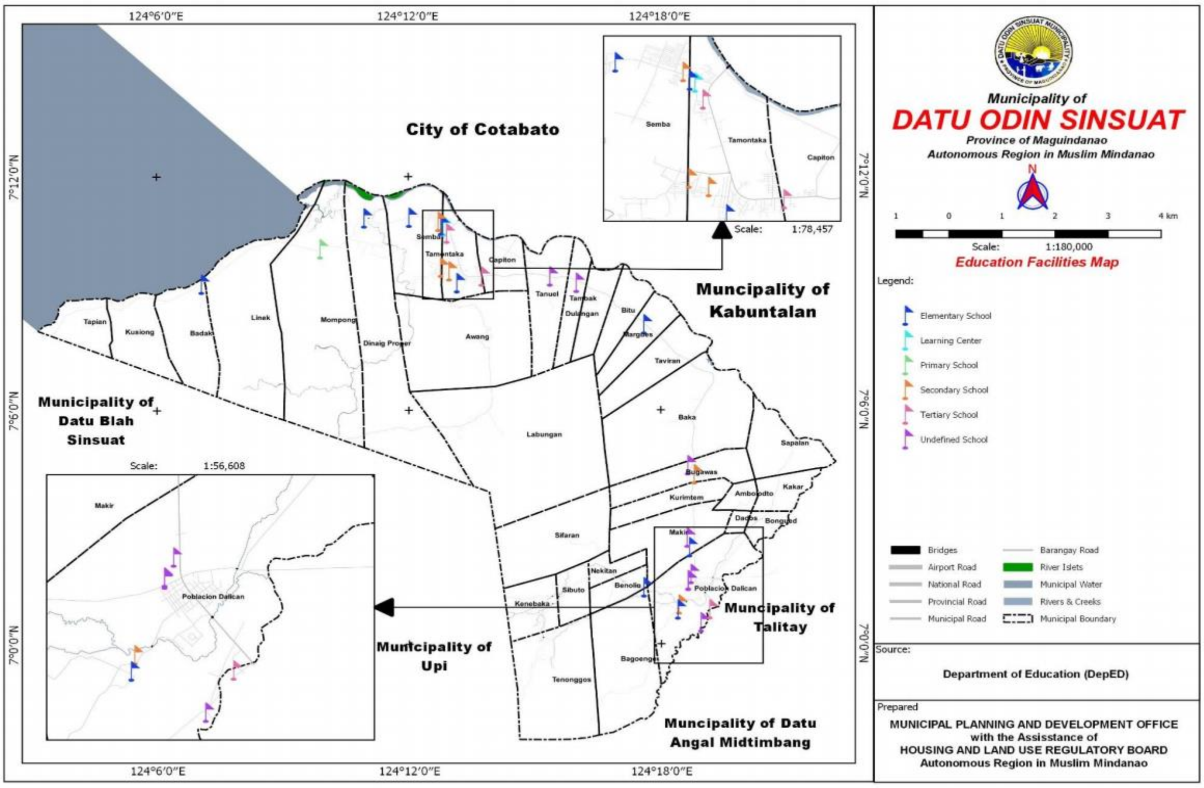
- ***Education***

The schools in the Municipality of Datu Odin Sinsuat Municipality are sub-divided into two districts: South District and North District. In the South District there are 1 primary school, 15 elementary, 4 secondary schools and 1 tertiary (MSU) while in the North District there are 12 primary schools, 13 elementary schools and 5 secondary schools all of which are located in different barangays of the municipality. The total number of schools in both districts is 51. Meanwhile, literacy profile of the municipality is presented below in Table 25.7-17 while education facilities is presented in Figure 25.7-9.

Table 25.7-17 Literary Profile

Indicator	Municipal						Provincial					
	Male		Female		Both Sex		Male		Female		Both Sex	
	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %	No.	Rate %
Literate	33,999	93	34,957	92	68,956	93	375,941	90	368,947	89	744,888	89
Illiterate	2,421	7	2,869	8	5,290	7	43,259	10	46,157	11	89,416	11
Total (Pop > 10 yr.)	36,420	49	37,826	51	74,246		419,200		415,104		834,304	

Source: Municipality of Datu Odin Sinsuat CLUP 2019-2027 Planning Period, CPDO



Source: Municipality of Datu Odin Sinsuat CLUP 2019-2027 Planning Period, CPDO

Figure 25.7-9 Datu Odin Sinsuat Education Facilities

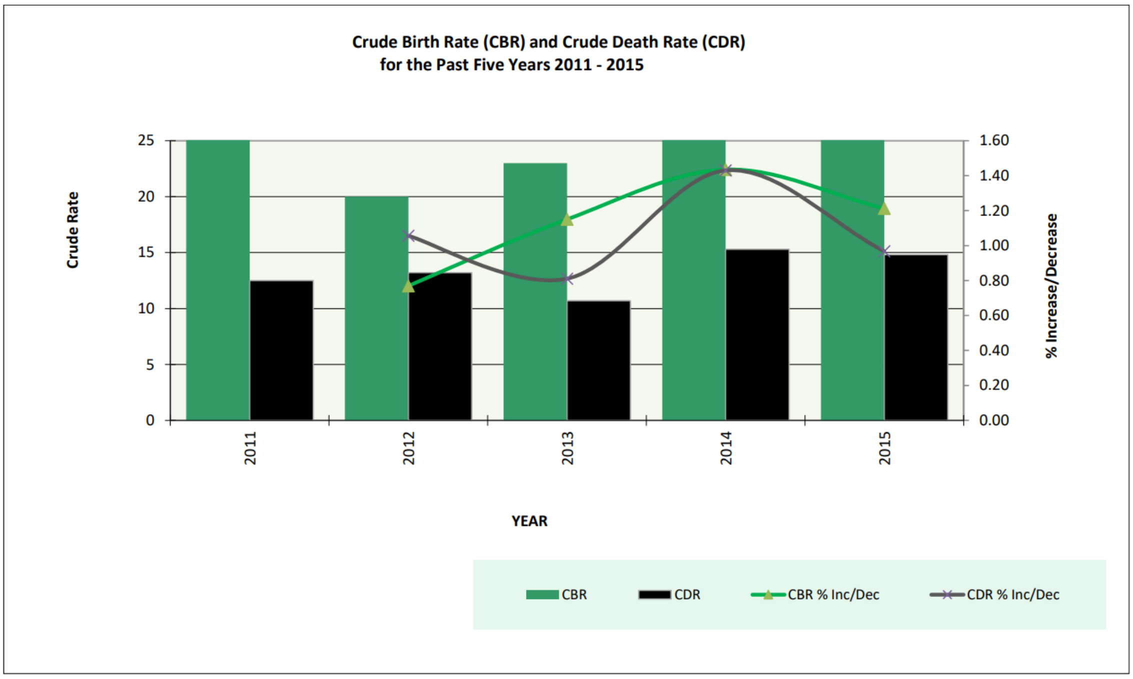
- ***Health Status***

As per record of the Rural Health Unit, Crude Birth Rate (CBR) and Crude Death Rate (CDR) are presented in Table 25.7-18 for the past five (5) years (2011-2015).

Table 25.7-18 Crude Birth and Death Rates

Period	CBR	% Increase/Decrease from previous Year	CDR	% Increase/Decrease from previous Year
2011	20		12.5	
2012	26	0.77	13.2	1.06
2013	23	1.15	10.7	0.81
2014	33	1.43	15.3	1.43
2015	40	1.21	14.8	0.97

Source: Municipality of Datu Odin Sinsuat CLUP 2019-2027 Planning Period, CPDO



Source: Municipality of Datu Odin Sinsuat CLUP 2019-2027 Planning Period, CPDO

Figure 25.7-10 Crude Birth and Death Rates

- ***Transportation System***

The municipality of Datu Odin Sinsuat is one of the areas in Maguindanao fortunate to have an air and land transportation services in its credit. The domestic airport in Awang is where most of the people of Cotabato city and neighboring people in the region take their travel through airlines. The presence of the said domestic airport in this barangay formally created to be an urban center where visitors, investors and other sectors powered to invest in central Mindanao thru the presence of this airport. Various transportation vehicles are regularly traveling in this area. At present, the municipality has its official records approximately one hundred fifty-five thousand nine hundred Eight (155,908) kms total road length. On this figure on road 50.38% municipal road and 15.10% concrete and 49.68% are earth filled.

- ***Protected Services***

The police Station of the Municipality of Datu Odin Sinsuat, is located at Poblacion Dalican and Barangay Awang. At present police station are manned by fifty-six (56) police personnel to include the chief of police, the police personnel ratio 1:1000 (1:921.57), however some of the policemen are designated in the traffic control, investigation of traffic incidents and other personnel police are assigned in sub-station in Barangay Awang. The two (2) units of mobile car/patrol car are utilized in conducting routinary mobile and police visibility.

- ***Sports & Recreation Sector***

The sports facilities were initiated by the Local Government of DOS in coordination with the Provincial Government of Maguindanao. There were several facilities constructed in the different barangays.

Table 25.7-19 Existing Sports and Recreational Facilities by Barangay, Year 2015

Barangay	Area	Sports Facilities	Recreational Facilities	Ownership	Ph ysical Condition Good, Poor, Critical
Pob. Dalican	800	Basketball Court	None	Municipal govt.	Existing
Awang	1000	Basketball Court, Volley Ball, Tennis Court, Billiard Table	None	BLGU	Existing
Subtotal Rural Barangay	300		None		
Dinaig Proper	1000	Basketball Court		BLGU	Existing
Kusiong	300	Basketball Court, Billiard Tables		BLGU	Existing
Labungan	350	Basketball, Volleyball Court, Sipa Court		BLGU	Existing
Tapian	500	Basketball Court		BLGU	Existing
Semba	300	Basketball Court		BLGU	Existing
Baka	300	Basketball Court		BLGU	Existing
Dulangan	300	Basketball court		BLGU	EXISTING
Tamontaka	400	Basketball court		BLGU	EXISTING

- ***Utilities Services Facilities***

<u>Power Supply</u>

The Municipality of Datu Odin Sinsuat, Maguindanao shows that there are both by MAGELCO and by COLIGHT and there are 17,888 households unserved.

<u>Water Services/Usage</u>

Tables below presents the Level I & II Water Supply System by Type and Number of Population Served, Year 2015

Table 25.7-20 Level I Water Supply System by Type and Number of Population Served, Year 2015

Barangay	Shallow Well			Deep Well			Improved Spring		
	Number	HH Pop. Served		Number	HH Pop. Served		Number	HH Pop. Served	
		No.	%		No.	%		No.	%
Ambolodto				1	30	2.110			
Badak				1	28	2.037	1	69	5.021
Bagoenged							1	103	5.981
Baka				5	867	35.002			
Benelon				10	387	30.424			
Bitu				12	282	24.977			
Bugawas									
Kurintem				30	1096	40.015			

Table 25.7-21 Level I Water Supply System by Type and Number of Population Served, Year 2015

Location of Water Sources	Number of Pumps	Number of Communal Faucets	Barangays Served	No. of HH Population Served
Labungan			Labungan	
Linek			Linek	
Baka			Baka	
Bagoenged		1	Bagoenged	
Bugawas			Bugawas	
Makir			Makir	
Poblacion Dalican			Poblacion Dalican	

Communication Sector

All of the communication facilities are located in Poblacion Dalican and Barangay Awang. The postal service, internet providers and cell sites are located at Poblacion Dalican and barangay Awang. However, the source of information and communication is thru radio stations in the nearby Cotabato City and the other source of information in local radio station like Datu Odin Sinsuat Radio Information Association Incorporated (DOSRIA) VHF Radio is one of the sources of information and communication by the residents. There are five (5) types of communication facilities in the municipality. The municipality has existing and presence of one (1) postal services, 3 providers (Globe, Smart and Sun Cellular) of internet services and cellular communication network, one (1) courier (LBC) and also the VHF Radio that provide communication services facilities. All of these are located in Barangays Dalican Poblacion, Awang and some barangays. Private entity owned 19 communication services facilities, while the 2 facilities owned by the government.

Solid Waste Management

The solid waste of the municipality particularly from the collection up to the Dumping areas is being managed by the Local Government Units of Datu Odin Sinsuat. This routinely collection of solid waste is being done in Dalican and in barangay Awang. The collection areas are the public market, food establishments and household along Poblacion streets and at the barangay Awang market and commercial establishments. Waste Collection was done three times a week usually every Wednesday, Friday and Sunday. Two dump truck and one old model tractor are used in collecting waste materials every collection schedule. Drivers and the waste collector are being paid by the Local Government Units with counterpart from Barangay Local Government Unit.

At the moment the Municipality Do not have Sanitary Landfill but eying to have within the 9-year planning period.

Local Economy such as Employment and Livelihood

Revenue Sources

The income of the Local Government Unit of Datu Odin Sinsuat Municipality is derived from real property tax collection; space rentals, building permits, Internal Revenue Allotment, and daily cash tickets from different commercial activities such as Sari-Sari Store, Drug Store, Dry Good Store, Fish Vendor, Carenderia Bakeshop, Computer job, Motorcycle/skylab and Agricultural. Employment

Employment by Type/Classification/Type of Business and Trade

The data below indicates that sari-sari store type/Classification kind of Business & trade has the large number of employment as well as revenue generation while bake shop and motor cycle /skylab has less number of employment as well as revenue generation.

Average Family Income and Expenditures vis-à-vis poverty level

The results of the recently conducted Based-Line Emergency Food Security Assessment (BEFSA) indicate that the average monthly income of household is at PhP 7,393.00 which is 4.5% lower than the national poverty threshold of PhP 7,821.00

The average expenditure for food based on BEFSA is PhP 2,722.00 which is about 49.8% of the monthly national per capita food threshold (PhP 5,458) this indicates an expenditure gap of about PhP 2,736.

2) Poverty and Displacement

The Philippine Statistics Authority (PSA) releases data on poverty every three years, with the aim of helping government agencies and policy makers in their efforts to alleviate poverty.

Poverty threshold is defined by the PSA as the minimum income required to meet the basic food and non-food requirements of an individual. Poverty incidence, on the other hand, refers to the proportion of the population with incomes below the poverty threshold.

Cotabato City recorded an annual per capita poverty threshold of PhP 30,349 in 2018. This means that a family of five needed to earn at least PhP 12,645 monthly to meet their essential needs. While poverty incidence among the entire city population decreased from 49% in 2015 to 42% in 2018, the proportion of poor people remained well above the national average of 17%. The magnitude of poor people in Cotabato City was estimated at 130,100 in 2018.

Table 25.7-22 Number of Reported IPs in the Greater Cotabato Area

Area	Annual Per Capita Poverty Threshold (PhP)				Poverty Incidence among Population (%)			
	2009	2012	2015	2018	2009	2012	2015	2018
Philippines	16,871	18,935	22,747	25,813	26	25	24	17
Region XII	16,405	18,737	21,341	25,023	38	45	38	28
ARMM	16,683	20,517	22,650	27,715	47	56	59	62
Cotabato City	**18,103**	**20,567**	**25,581**	**30,349**	**34**	**44**	**49**	**42**

Source: Philippine Statistics Authority

No unified data and information on displacement in Cotabato City and five (5) adjacent municipalities were available. The following table shows the collected data from different sources. The causes and reasons of the Internally Displaced People (IDPs) were reported to be not only due to armed conflict but also from natural disasters, land disputes between rival clans and escape from persecution in their original homeland. The difference of the causes and reasons also meant the difference in period of being IDPs. It was also observed that IDPs in Mindanao had tendency to immediately and voluntarily return to their original places after the initial recovery of the critical situation.

Table 25.7-23 Number of Reported IDPs in the Greater Cotabato Area (2020)

City/Municipality	Number of reported IDPs (2019-21)	Remarks	Source of Information and Data
Cotabato City	1,000 or more families	Since 1990s.	Cotabato City Social Welfare and Development Office (CSWDO)
Datu Odin Sinsuat	779 families	Sum of the IDPs in 4 different locations	Social Welfare Office of Maguindanao
Sultan Kudarat	None		Social Welfare Office of Maguindanao
Parang	1,232 families	Displaced due to Road Clearing and other government projects. No IDPs due to war conflict	CFSI (an international NGO)
Pigkawayan	3,422 families	Displaced due to Natural Disaster (Flooding - Tyhpoon Quinta) in October 2020.	CFSI (an international NGO)
Sultan Mastura	None		Social Welfare Office of Maguindanao
Total	**6,433 families**		

3) Gender and Children Rights

The Philippines is one of the most developed countries in the field of gender equality. Recognition on the rights of women is widely acknowledged and observed. Generally speaking, gender equality is not really a big concern.

Child labor cases in the Philippines are commonly reported and it may occur in the survey are. When the project is implemented, strict monitoring should be undertaken to avoid occurrences of child labor. Children's rights in the survey area may related to poverty.

Table 25.7-24 Gender Indicators

Indicators	No. of Beneficiaries		
	Male	Female	Total
• No. of Graduates at Women Productivity Skills Center (2007)		133	133
• No. of Women graduates referred for Job Placement (2007)		42	42
• No. of Women entertainers served		173	173
• No. of Women Entertainers undergone counseling		200	200
FAMILIES			
No. of Solo Parents provided IDs:			
CY 2008	2	57	59
CY 2007	26	315	341
CY 2006			237
CY 2005			448
Lack of Parenting Skills			147
• No. of Couples w/ Problem of Relationship given psychosocial therapy/marriage counseling, marriage enrichment seminar	23	26	49
No. of Couples given Marriage Counseling			298
No. of Individuals given Pre-Marriage Seminar	298	298	596
No. of Individuals given PES/ERPAT Training	86	81	167
CRISIS INTERVENTION PROGRAM			
• No. of Walk-in Clients in crisis situation served (2008)	183	228	411
• No. of Disaster Victims given Relief/Support and emergency assistance			101,160
COMMUNITY WELFARE PROGRAM			
• No. of Badjao given support package to counseling, DC Services, health and social hygiene training			84
• No. of Individuals given Business Management Skills/Practical Skills Training			60
POPULATION PROGRAM			
• No. of Individual given pre-marital counseling, Mothers Classes, Reproductive Health and Family Planning	888	2,678	3,566
• Referral to FP Clinic & Contraceptive	29	108	137
• Counseling of Drop Outs (FP Users)	17	161	178
• No. of Couples given Pre-Marriage Counseling			298
• Reproductive Health & Family Planning	220	2,010	2,230
• Population Quiz Show	34	36	70
• No. of School-based Youth from different Secondary Schools and OSY attended AHYDP Seminar	439	570	1,009

Source: Cotabato City CLUP, 2007, CPDO

4) Ethnic Minority and Indigenous People (IPs)

The closest known traditional ancestral domains of the Indigenous People in the study area are those in the Municipalities of Upi, South Upi, and Datu Blah Sinsuat which are inhabited by the Teduray tribe. However due to armed conflict among groups (e.g., AFP vs various armed groups) which affect their communities and further pushed by poverty, some IPs left their homeland to re-settle in some of the towns within the study area. The estimated number of IPs in the study area which was secured through interview with various agencies/organizations are presented in Table 25.7-25.

Table 25.7-25 Number of Reported IPs in the Greater Cotabato Area

City/Municipality	Number of reported IPs (year of data)	Remarks	Source of Information and Data
Cotabato City	4,967 (2020)	Around 90% of them are Teduray tribe.	National Commission for Indigenous People, Region 12
Datu Odin Sinsuat	14,170 (2018)		Ministry of Indigenous Peoples' Affairs
Sultan Kudarat	No known significant concentration of IPs (2018)		Froilyn T. Mendoza, Executive Director of the Teduray Lambangian Women Organization, Inc. (TLWO)
Parang	About 1,500 people/ 300 families (2018)	90% of them are Teduray tribe. Migrated in 1970s at the height of the conflict.	Municipal Planning & Development Coordinator of Parang municipality
Pigkawayan	947 individuals (2020)		National Commission for Indigenous People, Region 12
Sultan Mastura	No known significant concentration of IPs (2018)		Froilyn T. Mendoza, Executive Director of the Teduray Lambangian Women Organization, Inc. (TLWO)

5) Land Acquisition and Resettlement

There have been various experiences of land acquisition and resettlement in and around the project areas including projects under safeguard policies of Asian Development Bank (ADB) and JICA's Environmental and Social Considerations. Procedures of land acquisition and resettlement follows the country system of the Philippines.

There may be identified zones dedicated to accommodate housing needs due to population growth and backlog. Yet housing sites for displaced population due to government-initiated projects continues to obtain lands in agricultural areas. A detailed inventory of lands and landowners should be undertaken to precisely locate suitable sites especially for socialize housing.

In this particular case, the project will not undertake any displacement of people in the sites thus there’s no need for relocation program.

6) Stakeholders Meeting, Public Consultation and Information Campaign

Stakeholder's meeting, public consultations and information campaign shall be continuously carried out to the potentially affected communities in the project area during the FS level to solicit their perception, recommendations and suggestions about the project. Information dissemination about the project's environmental issues and concerns, project components including project status shall be presented for transparency. Stakeholders must be invited and encouraged to participate in community discussions. Flyers about the project shall be distributed. Suitable communication method shall be used.

This study so far undertook two Stakeholders Meetings. Of the two, the 2nd Stakeholders Meeting has relevance to the Water Supply Project. During the said meeting, the three candidate projects for action plan study were part of the presentation. Hence opinions from the stakeholders were received. It was held on 30 March 2021 at Pagana Kutawato Native Restaurant, Cotabato City. It was attended by a total of 76 participants (male 50 and female 26).

Table 25.7-26 Opinions and Answers

No.	Comment, Questions and Suggestion	Answers
1	**Q&A Part I** **Question:** Mr. Pete Marquez (Governor of PCCI for Cotabato City and Maguindanao) – Urban Utility Group to Mr. USUI: It was said that there is no law governing SEA in the Philippines which could be a hindrance to the implementation of the projects under the study. In the absence of such SEA law, would this not affect the plans and their implementation?	**Answer:** JST Tokyo: At the moment there is no SEA Law in the Philippines, but since this Study is funded by JICA we need to follow the requirements set by the JICA. Other donors also require the conduct of SEA. Doing the SEA allows us to identify possible environmental impacts much earlier and comply with donor requirements.
2	**Question:** Rommel Pausal – City Assessor: In the absence of a SEA law in the Philippines, what is the best option to comply with the requirements of JICA and other donors, as well as ensure environmental protection for Greater Cotabato City	**Answer:** JST Tokyo: That is a particularly important question. SEA is like an early-stage instrument to consider matters like policies, plans, and programs. There are good Philippine laws on EIA. Without SEA, it is sometimes very difficult to identify negative impacts that could confront you later at the project stage, more difficult to deal with. Thus, better to do SEA first to look at the entire life of the project and use this SEA idea or findings to conduct EIA. This is how we ensure addressing environmental considerations for the project.
3	**Question:** Nash Maulana – (Writer for the Manila Standard and Mindanao Cross) The Cotabato City port at Timako is near a coral reef, in an open sea, and it is also vulnerable to tsunami. How does the study address these concerns?	**Answer:** JST Tokyo: The City Port is a project of the Philippine Ports Authority and they have conducted the Feasibility Study. At the moment, we have yet to conduct a detailed EIA for the Cotabato Port at Timako, but it will be covered by the SEA. With the SEA, we think of environmental considerations such as the ecosystem, among others, Detailed study of possible environmental impacts on specific projects is done through the EIA
4	**Question:** Roy Fiesta - Environment Group: City Agriculture Office Head. On the proposed land use, the agricultural sector is one of the most	**Answer:** JST Tokyo: Cotabato City Government should promote land policies to protect agricultural lands. This is quite difficult since there is a need to balance the requirement of land to support the

No.	Comment, Questions and Suggestion	Answers
	affected sectors, did the Study consider ways to avoid/lessen conversion of agricultural lands?	development and then the intent to protect agricultural land. **Additional input:** Engr. Rendon: The expansion plans of the city had already been discussed when we are preparing the CLUP. Most developments are to be located inside the resettlement area that will be protected from tsunami and agricultural lands and fisheries are outside that area, thus, fewer numbers of people engaged in agriculture will get affected.
5	**Suggestion/Recommendation:** Pete Marquez – Utility Group: Cotabato City is known to be a city of rivers and creeks; we could include these water resources in the planning for transport and tourism	**Response to Pete Marquez:** Adela Fiesta (CPDO): The utilization of water bodies had already been considered There are specific projects for tourism development, but we are yet still searching for a safer place where it could be placed.
6	**Question:** Edwin Fernandez- Utility Group: On the Institutional framework, it appears that the private sector is not included in the structure, are we not considering (People's Organization) PO's and (Non-Government Organization) NGO's in the planning and implementation of the components of the Master Plan.	**Answer:** JST Tokyo: For thisstudy, the formal consultation with the NGOs and business sector is through the SHMs. We also understand that the City Government is in constant touch with the private sector.
7	**Q&A Part II:** **Suggestion:** Adela Fiesta to JST Tokyo: Traffic congestion is mainly caused by wrong parking, houses along the roads, wrong placement of loading/unloading in some schools; We need to put an emphasis on policies to address these obstructions.	
8	**Suggestion:** Badrudin Ali: On the approval of the implementation for the opening of traffic routes in Cotabato City. I noticed the traffic congestion in Cotabato City, particularly along Sinsuat Avenue. I suggest that the City Government implement the approved traffic routes to lessen vehicles passing through Sinsuat Avenue.	**Answer:** JST Tokyo: Good idea. Noted
9	**Suggestion:** Edwin Fernandez: Could you consider putting a skyway along Sinsuat Avenue?	**Response:** JST Tokyo: It may be too early for such an idea. Skyway/flyovers can be a 2nd phase response after we exhaust options like widening the roads and improving the flow of traffic
10	**Question:** Nash Maulana: Is there a demarcation study to consider the separation of routes for Cotabato Port and Polloc Port? Or how it can potentially connect? Polloc, Cotabato, Zamboanga, Manila.	**Answer:** JST Tokyo: We have not gone to that extent yet. Initially, Cotabato port is for the Cotabato area while Polloc is a regional port – to serve a larger area
11	**Suggestion:** Pete Marquez to LGU: Parking is restrictive, this affects the business sector and buyers now prefer other areas like Midsayap. Parking areas need to be established, as business parking structures	**Response to Pete Marquez:** JST Tokyo: It is a difficult balancing act to cater to the interest of the business sector and the transport sector – the solution could be promoting a parking business. Perhaps private investors can use lands that are not yet utilized by owners for this purpose
12	**Recommendation from Water District:** Asst. GM Villarma: Roads are important to Water District – what about the West Diversion Road, will it also be able to help the Metro Cotabato Water District (MCWD) improve its distribution system?	**Response:** JST Tokyo: Yes, for your information, the route shall cross along the Tamontaka river and it will connect the City to Datu Odin Sinsuat town, through the Southern Philippines Development Authority (SPDA) village and a bridge over the Rio Grande will link the City to Sultan Mastura town

No.	Comment, Questions and Suggestion	Answers
13	**Q&A Part III** **Question:** Engr. Crisanto Saavedra: There is a need to update the data on the plan. Data on solid waste, the daily collection seems to be incomplete – we have these data now. We now have the Materials Recovery Facilities (MRFS) in all barangays – though some need to be completed. We also have a strategy to turn solid waste into fertilizers, this is under negotiation with a proponent. In addition, the presentation slides show a proposal for a sanitary landfill, what is the proposal of the JST, to place it outside or inside Cotabato City considering it is below sea level?	**Answer:** JST Tokyo: Please provide updates. Not yet sure where it is the best area to place the sanitary landfill, information on Disaster Risk could help. We believe the SLF will be in the surrounding towns, but we still need to do some investigation to validate this option/idea.
14	**Question:** Engr. Crisanto Saavedra: On the septic tanks – We can mandate the construction of proper septic tanks when firms or households apply for business permits or construction permits	**Answer:** JST Tokyo: the suggestion is well taken
15	**Suggestion:** Badrudin Ali: on the water system, members of the Integrated Transport Group of Cotabato City Urban settlers in Kalanganan 2 applied for the water connection and it was expensive. Perhaps, MCWD can improve its distribution system in the area to lessen the cost of the water connection to Bubong area residents.	**Response:** JST Tokyo: That is a good suggestion that the MCWD may consider
16	**Q&A Part IV** **Question**: Mr. Ismael Tolentino: What will be the part of the BARMM in implementing all of these programs/projects?	**Answer:** JST Cotabato City. The aspects of the final implementation have not yet been finalized. This is a matter that can be addressed later by the Philippine government or those with authority on the subject.
17	**Question:** Nash Maulana: on the proposal to use Solar panels to augment the supply of electricity, there is a need to consider the possibility of having power surges due to lightning that can strike the system, Control system, service the current technology. Technology has evolved – a recent device has a KW meter. Did the JST already consider this possible problem?	**Answer:** JST Tokyo: Solar panels can be damaged by lightning. It really depends on the areas that have thunder and lightning. If the area does not have that much weather disturbance, then the use of solar panels is desirable. We will consider your input.
18	**Question:** Architect Rebecca Hagad: Did this Study for improving Cotabato City's power sector consider renewable energy; solar, wind, or hydro?	**Answer:** JST Tokyo: The Study is focusing on improving the supply and distribution of power. We can also look at renewable energy, like solar energy being considered by MAGELCO. We could study if there is a potential for tapping renewable energy in Greater Cotabato City.

Source: Stakeholder Consultation, 2021, JICA Study Team

25.7.4 Legal and Institutional Framework of Environmental and Social Considerations

Laws and Regulations related to environmental and social issues in the Philippines are summarized in the Chapter **7** of this report. Based on both legal frameworks in Philippines and the JICA Guidelines for Environmental and Social Considerations, April 2010 (hereinafter, "JICA Environmental Guidelines"), Categorization of MCWD Project is estimated as follows.

(1) Categorization of EIA in line with JICA

Each project is classified by JICA into one of the following Environmental Categories based on the magnitude of its potential impact on the environment or society. In other words, the category indicates the level of Environmental and Social Considerations required.

Table 25.7-27 JICA Environmental Categories

Categories	Description
Category A	The project is likely to have significantly adverse impacts on the environment or society. A project with a wide range of impacts, impacts that are irreversible, complicated, or unprecedented, and impacts that are difficult to assess. A project for a sector that requires special attention (e.g., a sector that involves large-scale infrastructure development), involves activity that requires careful consideration (e.g., large-scale involuntary resettlement), or takes place inside or adjacent to a sensitive area (e.g., protected natural habitat).
Category B	The project may have adverse impacts on the environment or society, but these impacts are less significant than those of Category A projects. These impacts are site-specific; few, if any, of them are irreversible; in most cases, they can be mitigated more readily than Category A projects. Responsibilities of the project proponents include the planning and monitoring of necessary ESC activities. ESC procedures such as Initial Environmental Examination and stakeholder participation may be required, depending on the scale and nature of the adverse impacts.
Category C	The project is likely to have minimal or no adverse impact on the environment or society.
Category FI	JICA provides funds to a Financial Intermediary, which in turn implements sub-projects that may have adverse impacts on the environment or society, but these impacts cannot be identified in detail prior to JICA's approval. If there is a sub-project that can be categorized as Category A, it needs to go through the same procedure as a Category A project including JICA's environmental review and information disclosure prior to its implementation.

Source: The Basics of Environmental and Social Considerations (Introduction to the JICA Guidelines for Environmental and Social Considerations)

(2) Categorization of EIA in line with PEISS

Every proposed project or undertaking which is projected to have significant adverse impact to the quality of the environment is covered by the Philippine EIS system. This includes proposed major expansion, rehabilitation, and/or modification of existing projects as well as resumption of projects that have stopped operations for a prolonged period. (EMB Memorandum Circular No. 005 July 2014 amending Section 2.1 of the Revised Procedural Manual for DAO 2003-30). To determine coverage, proposed projects or undertakings shall be screened according to the following categories in Table 25.7-28, Philippine EIS System Environmental Categories and Table 25.7-29 for Environmentally Critical Area (ECA) Categories.

Table 25.7-28 Philippine EIS System Environmental Categories

Categories	Description
Category A	Projects or undertakings which are classified as environmentally critical projects (ECPs) under Presidential Proclamation No. 2146 (1981), Proclamation No. 803 (1996), and any other projects that may later be declared as such by the President of the Philippines. Proponents of these projects implemented from 1982 onwards are required to secure Environmental Compliance Certificate (ECC).
Category B	Projects or undertakings which are not classified as ECP under Category A, but which are likely deemed to significantly affect the quality of the environment by virtue of being located in Environmentally Critical Area (ECA) as declared under Proclamation 2146 and according to the parameters set forth in the succeeding sections. Proponents of these projects implemented from 1982 onwards are required to secure an ECC.
Category C	Projects or undertakings not falling under Category A or Category B which are intended to directly enhance the quality of the environment or directly address existing environmental problems.
Category D	Projects or undertakings that are deemed unlikely to cause significant adverse impact on the quality of the environment according to the parameters set forth in the Screening Guidelines. These projects are not covered by the Philippines EIS system and are not required to secure an ECC. However, such non-coverage shall not be construed as an exemption from compliance with other environmental laws and government permitting requirements.

Source: EMB Memorandum Circular No. 005 July 2014 Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippines EIS System

Table 25.7-29 List of ECA Categories

No.	ECA Category
1	All areas declared by law as national parks, watershed reserves, wildlife preserves, sanctuaries
2	Areas set aside as aesthetic potential tourist spots
3	Areas which constitute the habitat of any endangered or threatened species of Philippine wildlife (flora and fauna)
4	Areas of unique historic, archaeological, or scientific interests
5	Areas which are traditionally occupied by cultural communities or tribes
6	Areas frequently visited and/or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.)
7	Areas with critical slopes
8	Areas classified as prime agricultural lands
9	Recharge areas of aquifers
10	Water bodies characterized by one or any combination of the following conditions: tapped for domestic purposes; within the controlled and/or protected areas declared by appropriate authorities; which support wildlife and fishery activities
11	Mangrove areas characterized by one or any combination of the following conditions: with primary pristine and dense young growth; adjoining mouth of major river systems; near or adjacent to traditional productive fry or fishing grounds; areas which act as natural buffers against shore erosion, strong winds and storm floods; areas on which people are dependent for their livelihood.
12	Coral reefs characterized by one or any combination of the following conditions: With 50% and above live coralline cover; Spawning and nursery grounds for fish; Act as natural breakwater of coastlines

Source: EMB Memorandum Circular No. 005 July 2014 Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippines EIS System

(3) Project Threshold Coverage and Categorization

According to EMB Memorandum Circular No. 2014-005 otherwise known as Guidelines for Coverage Screening and Standardized Requirements under the Philippine Environmental Impact Statement system (PEISS), the proposed solar project of the MCWD project component falls under the Category D, as categorized under Project No. 3.2.7 of Annex A (Project Thresholds for Coverage Screening and Categorization) of the same revised guidelines. Other components of the project are not included in the indicated coverage of the revised guidelines (replacement of dilapidated pipes and riverbank protection).

Table 25.7-30 Project Threshold for Coverage Screening and Categorization under PEISS

Project/ Description	**Covered (Required to secure ECC)**			**Not covered (may secure CNC)**	**Project size parameters**
	Category A: ECP	**Category B: Non-ECP**		**Category D**	
	EIS	**EIS**	**IEE Checklist**	**PD (Part I only)**	
3.2.7 Renewable energy projects such as ocean, solar, wind, tidal power except waste-to-energy and biogas projects -for installation of solar panel component (2,000kw)	None	$\geq$100 MW	$>$ 5 but $<$ 100 MW	$\leq$ 5 MW	Total power generating capacity
Replacement of dilapidated pipes component	Not indicated in the categorization under EMB MC No. 005 July 2014				
Riverbank. Protection -for the riverbank protection project component	Not indicated in the categorization under EMB MC No. 005 July 2014				

Notes:
ECC – Environmental Compliance Certificate
CNC - Certificate of Non-Coverage
PD – Project Description
IEE - Initial Environmental Examination
EIS – Environmental Impact Statement
ECP - Environmentally Critical Project
ECA- Environmentally Critical Area

Source: EMB Memorandum Circular No. 005 July 2014 Revised Guidelines for Coverage Screening and Standardized Requirements under the Philippines EIS System

Based on the initial screening and categorization above, the "Water Supply Improvement in Greater Cotabato (MCWD Project)", project components fall under Category D. Category D are those projects or undertakings that are deemed unlikely to cause significant adverse impact on the quality of the environment according to the parameters set forth in the Screening Guidelines. These projects are not covered by the Philippines EIS system and <u>are not required to secure an ECC</u>. However, such non-coverage shall not be construed as an exemption from compliance with other environmental laws and government permitting requirements.

The project does not fall in any ECA Category listed. Although the area is within the Dimapatoy watershed, the project components are within A&D dominated with coconut plantation and cropland mixed with coconut plantation based on the land classification and landcover. Thus, the project area does not fall under the strict protection zone of Dimapatoy watershed. However, a reassessment should be undertaken during the FS Study to validate the secondary data. Final screening and categorization of the project components shall be confirmed during the F/S stage. Table 25.7-31 presents the initial project coverage and categorization based on PEISS and JICA.

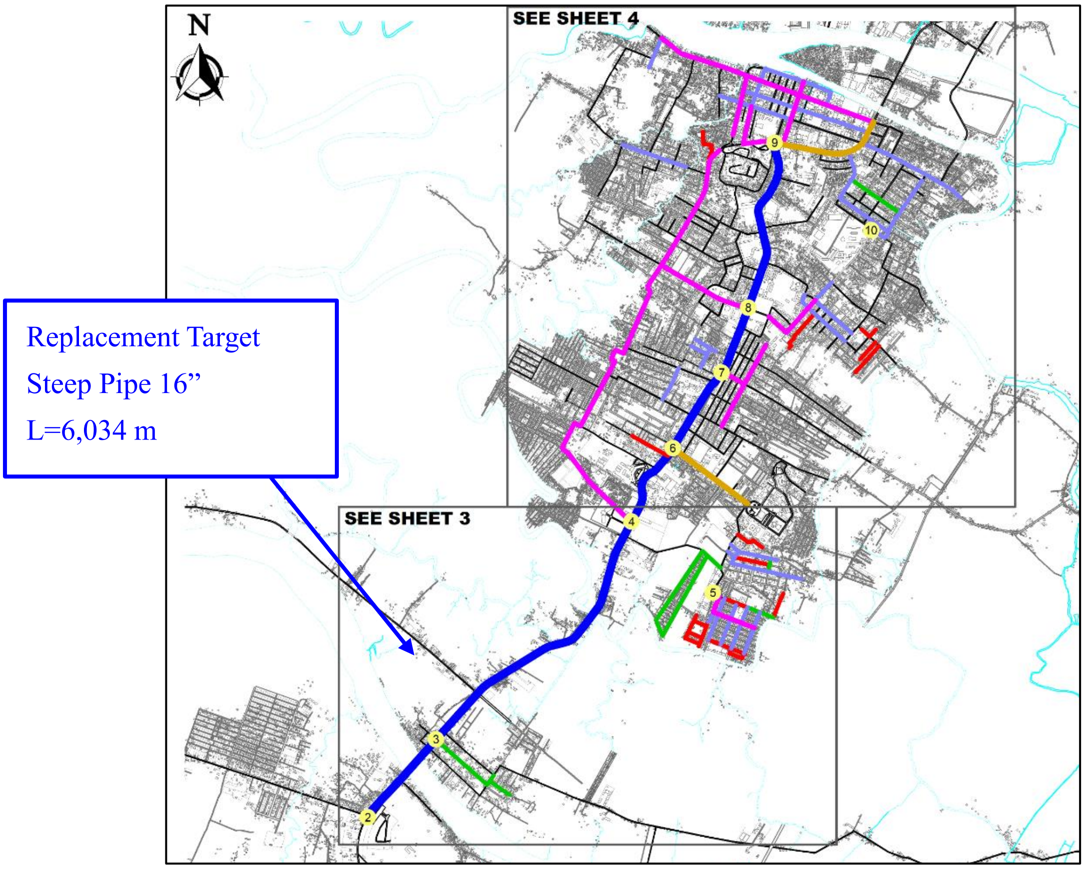
Table 25.7-31 Initial Project Coverage and Categorization based on PEISS and JICA

Project Component	Location	Category		ECA Category
		PEISS	JICA	
Replacement of dilapidated pipes	1. Brgy. Awang, DOS 2. Cotabato City (not specified what Brgy.) 3. Sultan Kudarat (not specified what Brgy.)	D	C	None
Installation of 2,000KW Solar Panel for Electric Power Production with accessories	Brgy. Awang, DOS	D	C	None
Riverbank Protection at Dimapatoy River	Brgy. Awang, DOS	D	C	None

Source: JICA Study Team, 2021

25.7.5 Project Locations

The location of the of the pipe replacement is illustrated in below map which is mostly located in Cotabato City and some sections in Datu Odin Sinsuat Municipality. For the location of both the Solar Panel and River Bank Protection, they are located in the Dimapatoy Watershed (Figure 25.2-2 and Figure 25.5-7)



Source: Metro Cotabato Water District

Figure 25.7-11 Target of Pipe Replacement

25.7.6 Scoping and ToR for Environmental and Social Considerations Surveys

(1) Scoping

Scoping means choosing alternatives for analysis, a range of significant and potentially significant impacts, and study methods. ✓ mark is applied for environmental items which will be affected by the project or cannot be decided without additional surveys. Scoping is executed for different phases of pre-construction/construction and operation in each environmental item. Items without ✓in both two phases are not the target of following survey and evaluation if there are enough reasons that the items will not be affected by the project. Following table shows the result of scoping of MCWD.

Table 25.7-32 Result of Scoping of MCWD

No	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
1	Air Quality	✓		[CS] Construction vehicles including fuel-fed machineries/equipment may cause air pollution temporally during construction of the facilities and related sub-projects. [OS] The solar power component is a clean energy source of power and thus emission-free. No air quality challenge is expected.
2	Water Quality	✓		[CS] Construction activities (such as cutting/filling works with surface erosion), construction vehicles, camp yards may cause water pollution through drainage water and effluents. Thus pose a concern on water quality. [OS] Riverbank protection would able to improve the water quality. On the other hand, with upgraded pipes at the end of the project improves the water quality.
3	Waste	✓		[CS] Construction waste including concrete, asphalt, cut trees and soil may be generated through construction activities. Waste generated in camps and sleeping quarters may also add to the volume of waste (total garbage generation). [OS] Unlikely there will be surges in volume of waste during project operation phase.
4	Soil Contamination	✓		[CS] There is a possibility of soil contaminant by oil leakage from construction vehicles and soil generated by the project. [OS] Unlikely that there will be soil contamination when the project is fully operated.
5	Noise and Vibration	✓	✓	[CS] Construction vehicles may cause noise and vibration temporarily in sections that are near the existing residential areas. [OS] Unlikely there will be increase in noise level and vibration during the project operation phase.
6	Ground Subsidence	✓	✓	[CS] Landfilling may cause ground subsidence in the area of soft soil and other specific conditions. [OS] During the project operation, additional surveys should be conducted to determine possibility of ground subsistence in the project areas.
7	Offensive Odor	✓		[CS] There is a possibility of offensive odor by construction activities only to residential areas that are near the constructed projects. But generally, this may not pose a concern since the project areas are inside the property of the water district, except for the pipe upgrading component which may traverse some residential areas. [OS] Unlikely that there will be offensive odor/smell when the project is fully operated.
8	Bottom Sediment	✓		[CS] There is a minimal possibility of impact on the bottom sediment (land and water bodies) by leaked oil from construction vehicles and flown soil caused by earthwork.

No	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
				[OS] Unlikely that there will be issues on bottom sediment when the project is fully operated.
9	Protected Area	✓	✓	[CS/OS] The project may not cause impact as the project (solar panel and riverbank protection) is outside a protected area or any environmental sensitive areas. The project is located under alienable and disposable land classification abased on NAMRIA Data
10	Ecosystem	✓	✓	[CS/OS] The project may cause impact such as tree-cutting and clearing activities on overall ecosystem of the project sites. Land cover in the project area are crops mixed with coconut plantation. Significant ecosystem to be affected are not foreseen.
11	Hydrology	✓	✓	[CS/OS] There is a possibility of changes to hydrology because the project is situated in watershed (in the case of solar panel and river bank protection) and for pipe improvement component, will cross some of the rivers and creeks.
12	Topography and Geology	✓	✓	[CS] Topography might change by land cutting and filling works. There are possibilities of land slide and soil erosion in the project sites (which are located upstream and rolling terrain). [OS] Operation of the project may cause geographical and topographical changes both directly and indirectly due to pumping of water resource and extraction.
13	Land Acquisition and Resettlement			[PCS] There will be no land acquisition and resettlement in putting up the facilities/structures of MCWD project. The pipe upgrading project component is mostly just passing through residential and agricultural areas. [CS/OS] No resettlement is expected.
14	Poverty			[PCS/CS] There will be no displacement of the vulnerable groups due to sub-projects. [OS] No adverse impact on poor and vulnerable groups when all the sub-projects are fully operated.
15	Ethnic Minority and Indigenous People			[PCS/CS/OS] There is no ethnic minority and/or indigenous people affected by the project since there is no declared CADT in the project area(s).
16	Local Economy such as Employment and Livelihood	✓		[CS] Construction activities may cause temporal inconvenience to communities/nearby households affected by the projects. There may be minimal effect on the employment and livelihood (including farming) of project affected households during construction. [OS] No additional impact is expected during operation stage.
17	Land Use and Usage of Local Resources	✓	✓	[CS] Communities/households nearby the project site may have minimal disturbances by the construction activities. [OS] MCWD may or may not cause some negative impact on land use with the kind of riverways protection infrastructure design and activities related to extraction of water resource. Additional study can be undertaken.
18	Water Usage	✓	✓	[CS] River water may be affected by earthworks. There may be changes in water usage due to construction activities. [OS] During project operation, water usage may change due to the volume of water extracted and channeled, eventually stored.
19	Existing Social Infrastructure and Services	✓		[PCS/CS] There may be minimal disturbances on accessing various social infrastructure services (health and educational centers) due to the construction activities. [OS] No likely impact on people accessing various infrastructure and social services.
20	Social Institutions such as Socially Related Capital and Decision-making Organizations	✓		[CS] There may be adjustments and impacts to local decision-making organizational dynamics due to project constructions as some affected individuals/families may have complaints or issues. [OS] No additional impact is expected.

No	Item	Selection Status		Reasons for Selection
		PCS/ CS	OS	
21	Misdistribution of Benefit and Damage			[CS]/[OS] Misdistribution of benefit and damage caused by the project construction is not expected.
22	Local Conflicts of Interest	✓	✓	[CS]/[OS] There might be conflicts may arise due to various claims on water resource ownership. Detailed assessment can be made in FS phase.
23	Cultural Heritage	✓		Kutawato Cave is the nearest historical/cultural/natural site in the proposed project (approximately 3 km). But this may not really cause serious threat to the heritage site.
24	Landscape	✓		[CS] There is a minor possibility of disturbance of landscape only during the project construction and implementation. [OS] Operation of project may not really cause impact on landscape both directly and indirectly.
25	Gender	✓	✓	[CS] Women and children may not really be affected by the project but more detailed assessment can be done specific to sub-projects. [OS] Improved access to water supply due to the project may cause positive impact on gender and development situation of the community.
26	Children's Right	✓	✓	[CS] There is a possibility of occurrence of child labor. Detailed monitoring can be conducted in the actual project implementation. [OS] Access to clean and potable water supports children's right to live, with possible mortality/morbidity cases among children is addressed.
27	Infectious Diseases such as HIV/AIDS	✓	✓	[CS] Infectious diseases (ex. COVID 19, HIV AIDS) are possible to be spread due to inflows of construction workers in the area. [OS] Infectious diseases (ex. COVID 19 HIV AIDS) are somehow addressed with improved water quality.
28	Labor Environment including Safety	✓	✓	[CS] Due to construction activities, labor environment may be affected. Incidence of unfair labor practices may happen in contracting arrangement and actual work. [OS] During project operation, there might be some impact on labor environment both directly and indirectly.
29	Accident	✓		[CS] Traffic accident related to construction vehicles and accident in construction sites are expected. [OS] No likely impact on incidence of traffic accident when the project is fully operated.
30	Transboundary Impact and Climate Change	✓	✓	[CS] and [OS] Emissions of Greenhouse Effect Gasses may increase due to construction machinery / vehicles and newly generated traffic. [OS] Addressing water supply (availability and quality) to communities supports climate change adaptation initiatives, so in positive ways, the project will have impact to constituents of MCWD

Note) Project stage: PCS: Pre-construction stage, CS: Construction stage, OS: Operation stage

Source: JICA Study Team

(2) ToR for Environmental and Social Considerations Surveys

Based on the scoping results in the previous section, terms of references (ToR) for surveys of necessary environmental items are developed to determine project induced impacts. Possible impact to be caused by project implementation will be evaluated qualitatively based on existing secondary data, interview to concerned parties and examining project design. shows the ToR for environmental and social considerations survey.

Table 25.7-33 ToR for Surveys of Environmental and Social Considerations

No.	Item	Survey Item	Survey Method
1	Air Quality	(1) Relevant standards on air quality monitoring (Domestic, Japanese, WHO's, etc.) (2) Status of air quality vis-a-vis national guideline values	(1) Existing material/baseline (2) Secondary data/information from past projects nearby (3) Qualitative evaluation based on expected traffic volume and construction vehicles (during construction)
2	Water Quality	(1) Relevant standards on water quality monitoring (DENR, Japanese, WHO's, etc.) (2) Status of water quality items	(1) Existing material/baseline (2) Secondary data/information from past projects nearby (3) Qualitative evaluation based on expected construction methods
3	Waste	(1) Waste (solid and wastewater) management process	(1) Secondary data/information from past projects (similar project location, scope or context) (2) Qualitative evaluation based on expected construction methods and facilities
4	Soil Contamination	(1) Protection method against oil leakage	(1) Confirmation on implementation plan of construction vehicles (2) Qualitative evaluation based on expected construction methods
5	Noise and Vibration	(1) Relevant standards on noise and vibration monitoring standards (DENR, Japanese, IFC's, etc.) (2) Status of noise and vibration	(1) Existing material/baseline (2) Secondary data/information from past projects nearby (3) Qualitative evaluation based on expected traffic volume and construction vehicles
6	Ground Subsidence	(1) Soil conditions	(1) Past study around the area (2) Qualitative evaluation based on expected construction methods
7	Offensive Odor	(1) Possible events and practices causing odor	(1) Collection of necessary information on construction method (2) Qualitative evaluation based on expected construction methods
8	Bottom Sediment	(1) Construction method causing sedimentation	(1) Collection of necessary information on construction method (2) Qualitative evaluation based on expected construction methods
9	Protected Areas	(1) Situation of registration (2) Outline of the protected areas	(1) Relevant laws and regulations (2) Past study around the area (3) Qualitative evaluation based on expected construction methods
10	Ecosystem	(1) Baseline situation of general ecosystem (2) IUCN listed species	(1) Past field surveys on occurrences of fauna and flora (2) IUCN Website etc. (3) Qualitative evaluation based on expected construction methods
11	Hydrology	(1) Situation of surface water such as river and lake (2) Impact during construction	(1) Past field surveys (2) Confirmation of construction methods (3) Qualitative evaluation based on expected construction methods
12	Topography and Geology	(1) Construction method causing changes of topography and geology	(1) Collection of necessary information on construction method (2) Qualitative evaluation based on expected construction methods

No.	Item	Survey Item	Survey Method
13	Land Acquisition and Resettlement	(1) Size of impact (area, structure, etc.) (2) Compensation policy	(1) Aerial photos, design, etc. (2) Existing surveys (3) Qualitative evaluation based on expected project effects
14	Poverty	(1) Distribution of poverty groups; degree and extend	(1) Existing surveys and Statistics (2) Qualitative evaluation based on expected project effects
15	Ethnic Minority and Indigenous People	(1) Distribution of ethnic minority and indigenous people	(1) Existing surveys and Statistics (2) Qualitative evaluation based on expected project effects
16	Local Economy such as Employment and Livelihood	(1) Local economic status	(1) Existing surveys and Statistics (2) Qualitative evaluation based on expected project effects
17	Land Use and Usage of Local Resources	(1) Land use status	(1) Existing surveys and existing maps (2) Qualitative evaluation based on expected project effects
18	Water Usage	(1) Water usage status in rivers and other resources (2) Impact during construction	(1) Existing surveys and literature material (2) Confirmation of construction methods (3) Qualitative evaluation based on expected impact on water use
19	Existing Social Infrastructure and Services	(1) Distribution of residential areas, school, hospital, and etc.	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
20	Social Institutions such as Socially Related Capital and Decision-making Organizations	(1) Social institutions and possible impact	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
21	Local Conflicts of Interest	(1) Expected conflicts	(1) Project design and distribution of interest (2) Qualitative evaluation based on expected project effects
22	Landscape	(1) Scenic areas	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected structures and topographical changes
23	Gender	(1) Impact on gender	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
24	Children's Right	(1) General situation/possibility of child labor	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
25	Infectious Diseases such as HIV/AIDS	(1) General situation/possibility of infectious diseases	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
26	Labor Environment including Safety	(1) General situation/possibility of labor environment	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
27	Accident	(1) Expected increases of accident	(1) Existing surveys and literature material (2) Qualitative evaluation based on expected project effects
28	Transboundary Impact and Climate Change	(1) Elements related to cross boundary impacts, cumulative impacts, and climate change	(1) Collect information based on public facilities construction and management (2) Qualitative evaluation based on expected project effects

Source: JICA Study Team, 2021

25.7.7 Environmental Management Plan (EMP)

(1) Preliminary Impact Assessment

The result of potential negative environmental and social impact assessment at action plan study is shown in the following table. In consideration of survey results, the impacts were evaluated qualitatively in each of the three stages separately, namely: pre-construction stage [PCS], construction stage [CS], and operation stage [OS]. The impacts of pollution, natural environment, and social environment were classified as A to D in accordance with the following criteria, assuming no specific measures toward the impacts are taken:

A: Significant Negative Impact	A+: Significant Positive Impact
B: Some Negative Impact	B+: Some Positive Impact

C: Impacts are not clear, need more investigation

D: No impacts or impacts are negligible, no further study required

Table 25.7-34 Result of ESIA at action plan study

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS/ CS	OS	PCS/ CS	OS	
1	Air Quality	✓		B	B+	[CS] In consideration of current residential land use, temporary negative impacts are expected on air quality due to exhaust gas and dust generated from construction activities. The exhaust gas such as NOx, SOx, CO TSP, PM10, PM2.5 will be generated from construction machines, equipment and traffic congestion around the construction yard due to the temporary traffic restriction. And dust will be generated by earth work including foundation excavation for piers, transporting of earth-and-sand, etc. [OS] It is expected to generate some positive impact on air quality since the improved facilities minimize actual monitoring on-site, thus limiting actual vehicular traffic in the area.
2	Water Quality	✓		B	A+	[CS] The project area is located in the mostly residential and agricultural areas (case of pipe replacement). Turbid water may be generated from excavation areas due to surface run-off. Improper stockpiling of construction materials in low -lying areas could affect the water quality of nearby bodies of water bodies. Furthermore, there is a possibility of inadequate treatment and/or mishandling of wastewater, suspended matter, waste oil, and other chemicals, in the all-earthwork area including the main road area and borrowing pit, etc. Additionally, domestic wastewater may be discharged from the labor camp. [OS] Significant positive impact is expected during the project operation phase as the main objective of the project is water supply improvement, both on quality and availability.
3	Waste	✓		B	B+	[CS] Construction waste including waste soil, asphalt mass and cutting trees are expected at the construction site. Additionally, domestic waste (garbage) may be generated from the labor camp, if any. [OS] Some positive impact is expected during the project operation phase as river protection also addresses solid waste management in various ways.
4	Soil Contamination	✓		B	B+	[CS] There is a possibility of soil contaminant by wastewater from tunneling work/piling construction/excavation process, if wastewater is discharged without adequate treatment and/or miss handing. Dumping soil and muck also can cause soil contamination if they have specific chemicals. Furthermore, there is a possibility of soil contamination due to the unexpected leakage/ mishandling of oil and other chemicals, in the all-earthwork area including the main road area and borrowing pit, etc. Dumping soil and muck also can cause soil contamination if they have specific chemicals. [OS] Some positive impact is expected during the project operation phase as concerns such as soil contamination is also addressed.
5	Noise and Vibration	✓	✓	B	B+	[CS] In consideration of current land use temporary negative impacts are expected on ambient noise due to higher noise generated from construction machines and equipment. [OS] Unlikely that there will be significant changes on the levels of ambient noise and vibration during project operation phase. Improvement can be observed by then since no more construction during this phase.

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS/ CS	OS	PCS/ CS	OS	
6	Ground Subsidence	✓	✓	C	C	[CS/OS] The extent of impact is unknown, because there is no detail amount of ground water and geographical test data at this moment. In case of large amount of discharge water and/or worse ground foundation than expectations, there is a possibility of ground subsidence in the mountain area, due to the tunnel construction. To clarify the baseline condition of geographic mechanism including ground water level and geological test shall be conducted along the proposed project sites during the feasibility study.
7	Offensive Odor	✓		C	C	[CS] There are no direct project-related activities that can generate offensive odor due to project construction, however impact of construction basecamp operations may have temporary impact.
8	Bottom Sediment	✓		B	B	[CS] There is a possibility of impact on the river bottom sediment by flown soil caused by earthwork in the river, depending on the construction methodology. In case that crossing river, bottom sediment had already polluted, dumping soils in the riverbed also have possibility of soil contamination when they are dumped other places. During actual operation, over extraction of water resource may generate adverse impact to general environment.
9	Protected Area	✓	✓	B	B	Likely there will be impacts on the environment since the project location for solar panel and riverbank protection is considered within the protected area.
10	Ecosystem	✓	✓	B	B	[CS] Construction activities and existence of road structures leading to the project sites may have some impact on surrounding ecosystem. There is a possibility on decreasing of biodiversity and habitat around the nearby watershed areas. To evaluate the impact, seasonal flora and fauna survey and tree inventory survey shall be conducted during the feasibility survey. In addition, coral reefs along the sea shore might be affected by polluted water (turbid water) and sedimentation from rivers. [OS] Operation of the sub-projects may cause some impact(s) on ecosystem.
11	Hydrology	✓	✓	B	B	[CS/OS] The amount of water uses and source during construction, construction methodology and the design of the facility shall be clarified during the feasibility study. And also, there is a possibility of disturbance of water flow by construction of the facilities in nearby river system and watershed and preventing /changing water flow by concrete structures.
12	Topography and Geology	✓	✓	B	B	[CS] The project area is located in the area of high susceptibility to flooding area defined as the ECA. Topography might change by land development. There is a possibility of topsoil erosion in the construction site during rainy season (May-October).
13	Land Acquisition and Resettlement			D	D	[PCS] It is estimated that only few existing structures are affected due to the implementation of the Project, based on satellite image (Google Earth) interpretation. Since no land acquisition and displacement for this project, socio-economic survey, inventory survey and market value survey may just focus on identification of landowner and compensation for the loss of trees and similar properties.

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS/ CS	OS	PCS/ CS	OS	
14	Poverty			B+	B+	[PCS/CS] The project may bring positive impact on local economy through construction activities and rural development. Some poor groups may be negatively affected by the project if their properties are acquired and/or their livelihood is lost by the project.
15	Ethnic Minority and Indigenous People			D	D	There will be no impact on ethnic minority and/or indigenous people in and around the project site as there's no declared CADT in the area. This can be verified further through the feasibility study.
16	Local Economy such as Employment and Livelihood	✓		B+	B+	[CS] Employment opportunity can be created due to the project construction. On the other hand, overall construction activities and traffic restriction would affect local economy activities including venders and shop owner to some extent temporary inconvenience due to disturbance in smooth operation of commercial/public transportation. Employment and livelihood including fishery of project affected households are also affected by construction activities.
17	Land Use and Usage of Local Resources	✓	✓	B	C	[CS] The project area is located in the residential and agricultural land as in the case of pipe replacement. [OS] Effective use of lands and local resources (water) are expected. Project-induced development may affect local resources adversely if done irresponsibly.
18	Water Usage	✓	✓	B	C	[CS/OS] To clarify the baseline condition of underground water use around the project area, inventory survey for wells shall be conducted during the during the feasibility study. Though water source during construction is not decided at this moment, water use permission in line with regulation shall be approved from relevant agencies prior to the construction to avoid conflict with water users. The amount of water uses and source during construction shall be clear during the feasibility study
19	Existing Social Infrastructure and Services	✓		B-	C	[PCS/CS] There are only few existing utilities (transmission lines, telecom lines, water lines, etc.) in the vicinity of project sites. These infrastructures shall be protected before the construction work.
20	Social Institutions such as Socially Related Capital and	✓		B-	C	[CS] There is a possibility of the temporary physical community division by construction yard during construction. During project operation stage, it is unlikely that the project will have impact on this aspect. Detailed study can be conducted when the project is fully operated.

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS/ CS	OS	PCS/ CS	OS	
	Decision-making Organizations					
21	Local Conflicts of Interest	✓	✓	C	B	[OS] Possible issues on water use conflict is expected once the project is fully operated.
22	Landscape	✓		B	B	[CS] There is a possibility of disturbance of landscape only during construction phase. During project operation phase, there might be impact on overall landscape as the project is all about water resource management which includes processing and storage. If not done properly, it can pose threat to the local environment.
23	Gender	✓	✓	C	B+	[CS]: Temporary inconvenience to residents, commuters, and pedestrians because of construction activities is expected. On the one hand, the Project can provide additional employment opportunities during this phase, which women can take advantage of. However, there might be gaps on working conditions such as wage between men and women when local employment is considered. But overall, by having provision for clean and potable water that is available in every household, gender and development aspect is upheld.
24	Children's Right	✓	✓	B	B+	[CS] There is a possibility of occurrence of child labor during the construction stage. But overall, the project will have a positive impact from the lens of children's right.
25	Infectious Diseases such as HIV/AIDS	✓	✓	B	B+	[CS] Infectious diseases such as HIV/AIDS/COVID 19 are possible to be spread due to inflow of construction workers. Furthermore, alteration to the ground by cutting, soil excavation and land filling may lead to the creation of habitats for mosquitos that possibly transmit dengue fever. During project operation, the project is expected to generate positive results especially in the aspect of COVID19 management as there is enough available water supply for the community.
26	Labor Environment including Safety	✓	✓	B	C	[CS] Accident and harm to health for workers in the construction area for bridge section; however, it will be secured in accordance with the domestic laws and regulations during construction. During project operation, it remains to be seen if project management will observe fair labor policies for the welfare of the workers. This is very much dependent on the utility managers.
27	Accident	✓		B	C	[CS] Traffic accident related to construction vehicles and accident in construction sites are expected. [OS] Th project will not have any impact on the occurrence of traffic accident in the project sites. Detailed study per sub-project can make a better assessment.

No	Item	Assessment at Scoping		Assessment Result based on surveys		Reasons for Assessment
		PCS/CS	OS	PCS/CS	OS	
28	Transboundary Impact and Climate Change	✓	✓	B	B+	[CS] Significant distortion of land forms and degradation of forest/water resource within the watershed area may be expected on this project. [OS] Increase of Greenhouse Effect Gas is anticipated but the level is still unknown. But the provision of solar power for the facility is a demonstration of support to climate change mitigation.

Note: Project stage: PCS: Pre-construction stage, CS: Construction stage, OS: Operation stage

Impact:

A+/-: Significant positive/negative impact is expected.

B+/-: Positive/negative impact is expected to some extent.

D: No impact is expected.

N/A: Impact assessment isn't conducted because the items was not checked ✓ in scoping phase.

Source: JICA Study Team,2021

(2) Mitigation Measures

Items rated as A- and B- in the table of impact assessment are the target of mitigation measures. Mitigation measures should be feasible and practical. Table 25.7-35 shows mitigation measures for ABLH classified into construction and operation phases.

Table 25.7-35 Mitigation Measures

No.	Items (Impacts)	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost (PhP)
Construction Stage					
1	Air Quality	- Water sprinkling to reduce particulate matter - Routine / periodic maintenance and washing of construction machineries and vehicles to minimize air pollutants -Announcement of construction work to surround resident - In the event of complaint from resident, review the additional mitigation measures including the construction schedule or location of heavy vehicles through the communication with local people	Contractor	MCWD	TBD
2	Water Quality	- Installing sedimentation tank to reduce discharged turbid water - Cover exposed earth especially before heavy rains are expected. - Installing septic tanks for origin of polluted water such as camp yard - Appropriate wastewater treatment such as connecting drainage system to existing sewage systems	Contractor	MCWD	TBD
3	Waste	-Prepare detailed waste management program in consideration with LGU's waste management system - Education on waste treatment for workers - Separation of hazardous waste and bring out to appropriate treatment facilities - 3Rs promotion to reduce waste	Contractor	MCWD	TBD
4	Soil Contamination	- Necessary laboratory test to identify contaminated soil and mock for special cares - Find feasible treatment facilities or filling area in earlier stage of the project such as F/S	Contractor	MCWD	TBD
5	Noise and Vibration	- To avoid disturbance of daily life, construction time shall be set within day time, especially residential areas. - Apply low-noise and vibration machineries as much as possible nearby -Provide the temporary noise barrier and/or fence around the construction yard near residential area, if necessary -Announcement of construction work to surround resident - In the event of complaint from resident, review the additional mitigation measures including the construction schedule or location of heavy vehicles through the communication with local people	Contractor	MCWD	TBD
6	Ground Subsidence	- Avoid extraction of ground water for construction - Applying replacement methods for soft soil areas and prevention measures for liquefaction based on further studies and discussion in F/S.	Contractor	MCWD	TBD

No.	Items (Impacts)	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost (PhP)
		- Monitoring to identify early symptoms of subsidence			
7	Offensive Odor	- Education and instruction of rules in camp yards to keep good hygiene	Contractor	MCWD	TBD
8	Bottom Sediment	- Installing sedimentation tank to reduce discharged turbid water	Contractor	MCWD	TBD
9	Ecosystem	- Avoid tree cutting to reduce impact on habitat -Relocation/replant of trees - Consider construction season and time if specific rare species' breeding points / nests / important feeding ground are confirmed in the affected areas. -Conduct awareness campaign to all relevant construction workers about the careful consideration for ecosystem -Adoption of lower noise and vibration construction method and machines - Adoption of adequate pass route, based on the field survey, estimated impact and advices from biological expert, if necessary	Contractor	MCWD	TBD
10	Hydrology	- Avoid large amount of extraction of ground water	Contractor	MCWD	TBD
11	Topography and Geology	- Slope protection is required after cutting slopes especially in the period of rainy season	Contractor	MCWD	TBD
12	Land Acquisition and Resettlement	- Project info-dissemination drive should be conducted during F/S study	Consultant, Contractor, DPWH, LGUs, NHA	MCWD	TBD
13	Poverty	- Appropriate assessment must be prepared consistent with domestic and development partner's policies.	Consultant, Contractor, DPWH, LGUs, NHA	MCWD	TBD
14	Ethnic Minority and Indigenous People	- Appropriate assessment must be prepared consistent with domestic and development partner's policies	Consultant, Contractor, DPWH, LGUs, NHA	MCWD	TBD
15	Local Economy such as Employment and Livelihood	- Appropriate assessment must be prepared consistent with domestic and development partner's policies with assistance for business disturbances.	Consultant, Contractor, DPWH, LGUs, NHA	MCWD	TBD
16	Land Use and Usage of Local Resources	- Appropriate assessment must be prepared consistent with domestic and development partner's policies.	LGUs	LGUs	TBD
17	Water Usage	- Avoid large amount of extraction of ground water	Contractor	MCWD	TBD
18	Existing Social Infrastructure and Services	- Appropriate / agreed compensation for owners of infrastructures to recover, divert, and replace.	DPWH, LGUs	MCWD	TBD
19	Social Institutions such as Socially Related Capital and Decision-making Organizations	- Detour for securing reasonable accessibility to social institutions	Contractor	MCWD	TBD
20	Landscape	- Minimize cutting trees and slopes - Consider earth color for temporal works and fences	Contractor	MCWD	TBD

No.	Items (Impacts)	Proposed Mitigation Measures	Implementing Organization	Responsible Organization	Cost (PhP)
		- Installation of slope seeding / planting to recover construction areas			
21	Gender	- Positive employment of women for light works in construction activities such as cleaning with fair salary and other conditions - Prepare toilet and dressing spaces for women workers - Education on gender equality for workers	Contractor	MCWD	TBD
22	Children's Right	- Restrict child labor (workers under 14 years old) in contract with punishment - Report list of workers with their age information	Contractor	MCWD	TBD
23	Infectious Diseases such as HIV/AIDS	- Education on infectious diseases for workers - Vaccination of workers (COVID-19)	Contractor	MCWD	TBD
24	Labor Environment including Safety	- Education on occupational safety for workers - Safety patrol - Sign boards	Contractor	MCWD	TBD
25	Accident	- Periodic maintenance of machineries and vehicles - Sign boards - Employ enough number of traffic guards	Contractor	MCWD	TBD
26	Transboundary Impact and Climate Change	- Periodic maintenance of machineries and vehicles - Recommendation of idling stop activities	Contractor	MCWD	TBD
Operational Stage					
1	Air Quality	- Strengthening of vehicle inspection	MCWD	MCWD	TBD
2	Noise and Vibration	- Noise barriers if the level significantly exceeds the standard - Restriction of maximum speed	MCWD	MCWD	TBD
3	Ground Subsidence	- Periodic observation of level changes	MCWD	MCWD	TBD
4	Hydrology	- Avoid large amount of extraction of ground water - Periodic observation of water flow / level	MCWD	MCWD	TBD
5	Ethnic Minority and Indigenous People	- If there are indigenous people in and around the project areas, Indigenous People Plan (IPP) must be prepared with cares.	MCWD, LGUs	MCWD	TBD
6	Land Use and Usage of Local Resources	- Controlled rural development under legal framework and masterplans by LGUs	LGUs	LGUs	TBD
7	Water Usage	- Avoid large amount of extraction of ground water - Periodic observation of water flow / level	MCWD, LGUs	MCWD	TBD
8	Local Conflicts of Interest	- Design box culvert or any other crossing structure to secure accessibility	MCWD, LGUs	MCWD	TBD
9	Accident	- Sign boards - Traffic violation crackdown by police - Road safety education at schools and other appropriate facilities	MCWD, LGUs, Police	MCWD	TBD
10	Transboundary Impact and Climate Change	- Strengthening of vehicle inspection	MCWD	MCWD	TBD
				Total Cost	TBD

Source: JICA Study Team, 2021

25.7.8 Monitoring Plan

(1) Proposed EMoP

Table 25.7-36 presents general/typical proposed Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) for mitigating the negative impact. Feasible and specific EMP and EMoP shall be studied during the Feasibility Study.

Table 25.7-36 Monitoring Plan

No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost (PhP)
Construction Stage							
1	Air Quality	PM10, PM2.5, SO2, CO, NO2	Construction sites, major access routes to the construction sites	Once a month	Contractor	MCWD	TBD
2	Water Quality	BOD5, COD, Oil and Grease, pH, Total Coliform, Total Nitrogen, Total Phosphorous, Total suspended solids, Turbidity, Arsenic, Iron, Sulphate	Rivers, drainages, camp yards, wells, springs	Once every three-month	Contractor	MCWD	TBD
3	Waste	Types and amount of waste	Temporal waste storage	Once every three-month	Contractor	MCWD	TBD
4	Soil Contamination	Soil quality test in accordance with the baseline survey and existing land use, Monitoring accident, maintenance record of machineries and vehicles, site observation	Construction sites and camp yards	Once a month	Contractor	MCWD	TBD
5	Noise and Vibration	Sound level and vibration.	Construction sites, major access routes to the construction sites	Once a month	Contractor	MCWD	TBD
6	Ground Subsidence	Visible observation on markers and gauges	Surrounding structures of construction sites	Once a week	Contractor	MCWD	TBD
7	Offensive Odor	Types and amount of waste, other specific cases such as oil leakage	Temporal waste storage	Once every three-month	Contractor	MCWD	TBD
8	Bottom Sediment	Visible observation of rivers and drainage from construction sites	Construction sites and rivers	Once every three-month	Contractor	MCWD	TBD
9	Ecosystem	Field confirmation by experts, number of cutting mangrove trees	Construction sites and surrounding areas	Once a year	Contractor	MCWD	TBD
10	Hydrology	Visible observation, interview, measurement of water volume	River, spring, well, etc.	Once every three-month	Contractor	MCWD	TBD
11	Topography and Geology	Visible observation, reviewing of cut and	Forest, hilly areas	Once every	Contractor	MCWD	TBD

No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost (PhP)
		fill plan, tree cutting plan with certification		three-month			
12	Land Acquisition and Resettlement	Internal / External monitoring report, grievance records	Project Areas	Following RAP	LGUs, NHA, other relevant bodies	MCWD	TBD
13	Poverty	Internal / External monitoring report, grievance records	Project Areas	Following RAP	LGUs, NHA, other relevant bodies	MCWD	TBD
14	Ethnic Minority and Indigenous People	Internal / External monitoring report, grievance records, IPP, if any	Project Areas	Following RAP and IPP	LGUs, NHA, other relevant bodies	MCWD	TBD
15	Local Economy such as Employment and Livelihood	Internal / External monitoring report, grievance records, income restoration program (IRP)	Project Areas	Following RAP, IRP	LGUs, NHA, other relevant bodies	MCWD	TBD
16	Land Use and Usage of Local Resources	Construction plan including lease land, grievance records	Project Areas	Once every three-month	Contractor	MCWD	TBD
17	Water Usage	Water volume, visible observation, interview, grievance records	Water usage areas	Once a month	Contractor	MCWD	TBD
18	Existing Social Infrastructure and Services	Visible observation, interview, grievance records	Project Areas	Once every three-month	Contractor	MCWD	TBD
19	Social Institutions such as Socially Related Capital and Decision-making Organizations	Visible observation, interview, grievance records	Project Areas	Once every three-month	Contractor	MCWD	TBD
20	Landscape	Visible observation, interview, grievance records	Project Areas	Once every three-month	Contractor	MCWD	TBD
21	Gender	Visible observation, interview, grievance records, list of construction worker, record of education, number of facilities for women in construction site and camp yard	Project Areas	Once a month	Contractor	MCWD	TBD
22	Children's Right	Visible observation, interview, grievance records, list of construction worker, record of education	Construction sites	Once a month	Contractor	MCWD	TBD
23	Infectious Diseases such as HIV/AIDS	Visible observation, interview, grievance records, record of education	Construction sites	Once a month	Contractor	MCWD	TBD

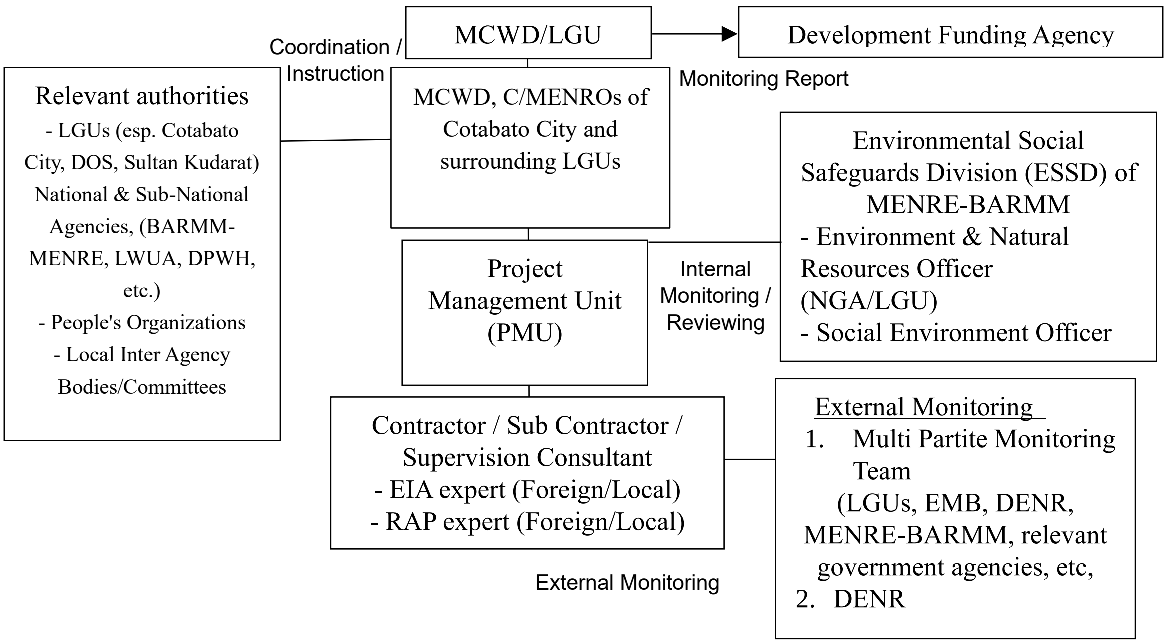
No	Environmental Item	Items	Location	Frequency	Responsible agent	Supervisor	Cost (PhP)
24	Labor Environment including Safety	Visible observation, interview, grievance records, record of education, record of safety patrol, sign boards	Construction sites	Once a month	Contractor	MCWD	TBD
25	Accident	Record of accident, record of education, sign boards	Construction sites and surrounding areas	Once a month, on demand	Contractor	MCWD	TBD
26	Transboundary Impact and Climate Change	Record of maintenance of machinery and vehicles, sign boards	Construction sites	Once a year	Contractor	MCWD	TBD
Operational Stage							
1	Air Quality	PM10, PM2.5, SO_2, CO, NO_2	Residential area, junctions, etc.	Once a year	Regional Office (RO) - DPWH	MCWD	TBD
2	Noise and Vibration	Sound level and vibration.	Junctions and residential areas	Once a year	RO	MCWD	TBD
3	Ground Subsidence	Visible observation on markers and gauges	Surrounding structures of construction sites	Once a year	RO	MCWD	TBD
4	Hydrology	Visible observation, interview, measurement of water volume	River, spring, well, etc.	Once a year	RO	MCWD	TBD
5	Ethnic Minority and Indigenous People	Interview, observation, socio-economic survey, if needed	Project Areas	Once a year	RO	MCWD	TBD
6	Land Use and Usage of Local Resources	Regional development plan, visible observation	Project Areas	Once a year	LGUs	MCWD	TBD
7	Water Usage	Water volume, visible observation, interview, grievance records	Water usage areas	Once a year	RO	MCWD	TBD
8	Local Conflicts of Interest	Interview, observation	Project Areas	Once a year	LGUs	MCWD	TBD
9	Accident	Record of accident, record of education, sign boards	Road leading to construction sites and surrounding areas	Once a year	RO	MCWD	TBD
10	Transboundary Impact and Climate Change	Record of maintenance of machinery and vehicles, sign boards	Roads leading to construction sites and surrounding areas	Once a year	RO	MCWD	TBD

Source: JICA Study Team,2021

25.7.9 Implementation Structure

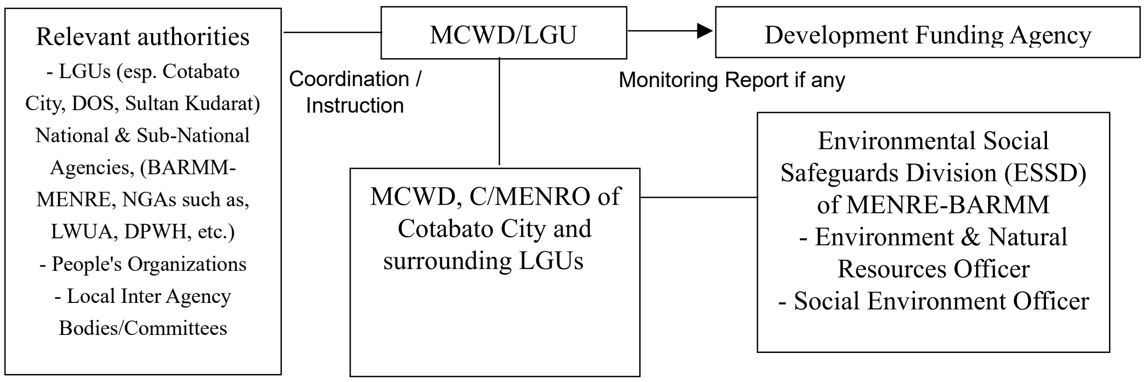
Implementation structure for MCWD Project will be established based on local legal frameworks with reporting/discussion channels to investors/development partners. Based on project implementation structure of other similar water supply development/expansion projects, the proposed implementation structure of environmental and social consideration is illustrated in Figure 25.7-12 and Figure 25.7-13**.** The main implementing entities for the project are the

Metro Cotabato Water District (MCWD) and the City/Municipal Environment and Natural Resources Office (C/MENRO) of Cotabato City and the surrounding LGUs particularly Datu Odin Sinsuat (DOS) and Sultan Kudarat. There are two types of monitoring in the diagram, the internal and external. The internal monitoring of the MCWD and LGUS. The monitoring is intended to provide information useful in promoting consistency and compliance with the Environmental Management Plan (EMP) and compliance with the ECC conditions and continued update of the EMP for sustained responsiveness to project construction, operations and impacts. There are also two layers of external monitoring, the Multipartite Monitoring Team which composed of representatives from the barangay covered by the project, LGUS, DENR, other related GAs, etc. The Multipartite Monitoring Team (MMT) shall be organized to encourage public participation, to promote greater stakeholder vigilance and to provide the appropriate check and balance mechanisms in the monitoring of project implementation. Monitoring by DENR is the other external monitoring. The monitoring is intended to check compliance to the ECC conditions and effectiveness of environmental measures. As deem most effective, this set-up is to be confirmed, revised or updated during the FS stage of the project. Parties involved can organize themselves as to who will take the lead role and others providing supporting roles. This can be better facilitated and decided during the FS stage, as the extent of monitoring shall be based on the project coverage and screening



Source: JICA Study Team

Figure 25.7-12 Implementation Structure of Environmental and Social Considerations During Construction Stage



Source: JICA Study Team

Figure 25.7-13 Implementation Structure of Environmental and Social Considerations During Operation Stage

25.8 Economic Evaluation of the Project

25.8.1 General Methodology

(1) Procedure of Economic Evaluation

Procedure of economic evaluation is explained in Chapter 23. For the water supply project, the quantified project benefits that would be realized from the implementation of the water supply project are water tariffs.

(2) Economic Evaluation Indicators

Economic evaluation indicators are explained in Chapter 23.

(3) Implementation Schedule

The project is proposed to be implemented for the following;

Year	Subject
2023.1 - 2023.6	: Detailed Design
2023.7 - 2023.12	: Tender Assistance
2024.1 - 2025.6	: Construction for Water Supply (18 Months)

Source: JICA Study Team

25.8.2 Economic Cost of the Project

(1) Methodology of Economic Cost Estimation

Methodology of economic cost estimation is explained in Chapter 23.

(2) Setting of Project Cost

1) Construction Cost

Financial cost and converted economic cost are shown in Table 25.8-1 and Table 25.8-2.

Table 25.8-1 Financial Cost

Unit: million PhP

Construction cost	ROW Cost	Consulting Service (D/D)	Consulting Service (C/S)	Total
265.4	0	10.8	16.3	292.5

Source: JICA Study Team

Table 25.8-2 Converted to Economic Cost

Unit: million PhP

Construction cost	ROW Cost	Consulting Service (D/D)	Consulting Service (C/S)	Total
233.9	0	9.7	14.5	258.1

Source: JICA Study Team

2) O&M Cost

Additional O&M costs for routine and periodic are set at 0.01% and 0.005% of construction cost in this action plan study.

25.8.3 Economic Benefit of the Project

(1) Scenario of Economic Benefit

The main economic benefits that were considered in this project are water tariffs for the implementation of the water supply project.

(2) Estimation of Benefit to Water Tariff

Water tariff in 2025 (opening year) and 2035 (past 10 years) was estimated based on latest annual water tariff and growth rate. The methodology of estimation of benefit to water tariff is considered if the water treatment plant will be not upgraded (reduced water supply capacity of Dimapatoy Water Treatment Plant and reduced its tariff).

First, annual water tariff in 2016 and 2018 was reported at 321.4 Mill PhP/year and 391.8 Mill PhP/year, respectively. Based on actual annual water tariff, future water tariff was estimated in this action plan study. annual growth rate from 2016 to 2018 was estimated at 9.0%/year which value is overestimated result compare with population growth rate. Therefore, annual growth rate was applied approx. 2.0% to the future population in Cotabato City (see Section 23.2.4).

Estimation of annual tariff in case of decreasing in annual production is shown in Table 25.8-3. The table shows that water tariff is estimated to be reduced by 12% in case of annual production of Dimapatoy Water Treatment Plant is reduced by 30%.

Table 25.8-3 Loss of Annual Water Tariff Corresponding the Annual Water Production

Name of Water Sources	Type of Water Source	Annual Production (cu. m.) 2018	Annual Production (cu. m.) With 30% loss	Annual Production (cu. m.) With 50% loss	Annual Production (cu. m.) With 100%
Tanuel P.S.	Spring	5,765,981	5,765,981	5,765,981	5,765,981
Dimapatoy P.S.	Surface	5,975,846	4,183,092	2,987,923	0
Rebuken P.S.	Deep well	798,965	798,965	798,965	798,965
Macaguiling 1 P.S.	Deep well	472,126	472,126	472,126	472,126
Macaguiling 2 P.S.	Deep well	187,691	187,691	187,691	187,691
Bulk Water Supply (Mactan Rock-TGV)	Surface	1,506,584	1,506,584	1,506,584	1,506,584
Sub Total		14,707,193	12,914,439	11,719,270	8,731,347
Loss of Annual Tariff			88%	80%	59%

Source: JICA Study Team

(3) Result of Economic Benefit to Water Tariff

As above section, the case of economic benefit to water tariff is set as follows;

Case-0: Loss of Annual Tariff in case of EIRR 10% (Bench Mark)

Case-1: Annual Production with 30% Loss

Case-2: Annual Production with 50% Loss

Case-3: Annual Production with 100% Loss

25.8.4 Result of Economic Evaluation

(1) EIRR

Economic evaluation for the Dimapatoy Water Treatment Plant was estimated as shown in Table 25.8-4. Table shows that EIRR (10.0%) was social discount rate (10%) and B/C (1.00) was more than 1.0 for Case-0, the ratio of loss of water tariff was estimated at **8%** which percentage will be benchmark of loss of water tariff. For the Case-1 to Case-3, EIRR was estimated at 15.3%, 24.8% and 48.0% which are greater than social discount rate (10%). These results indicate that the improvement of Dimapatoy Water Treatment Plant was appropriate from economic view. The cost-benefit stream of Dimapatoy Water Treatment Plant for Case-1 to Case-3 is shown in Table 25.8-5 to Table 25.8-7.

Table 25.8-4 Result of Economic Analysis

Economic Benefit			
Case	**EIRR**	**B/C**	**NPV (Million PhP)**
0	10.0%	Loss of Water Tariff: 8.0%	
1	15.3%	1.50	102.0
2	24.8%	2.49	306.8
3	48.0%	5.11	844.5

Source: Estimated by JICA Study Team

Table 25.8-5 Cost Benefit Stream for Dimapatoy Water Treatment Plant Case-1

West Diversion Road

Undiscounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Benefit	Benefit - Cost
1	2021	0.0	0.0	0.0		0.0	0.0
2	2022	0.0	0.0	0.0		0.0	0.0
3	2023	9.7	0.0	9.7		0.0	-9.7
4	2024	165.7	0.0	165.7		0.0	-165.7
5	2025	82.9	1.2	84.0	19.3	19.3	-64.7
6	2026		2.3	2.3	39.2	39.2	36.9
7	2027		2.3	2.3	39.9	39.9	37.5
8	2028		2.3	2.3	40.5	40.5	38.2
9	2029		2.3	2.3	41.2	41.2	38.9
10	2030		2.3	2.3	41.9	41.9	39.5
11	2031		2.3	2.3	42.6	42.6	40.2
12	2032		2.3	2.3	43.3	43.3	41.0
13	2033		2.3	2.3	44.0	44.0	41.7
14	2034		2.3	2.3	44.7	44.7	42.4
15	2035		2.3	2.3	47.0	47.0	44.7
16	2036		2.3	2.3	47.8	47.8	45.5
17	2037		3.5	3.5	48.6	48.6	45.1
18	2038		2.3	2.3	49.4	49.4	47.1
19	2039		2.3	2.3	50.2	50.2	47.9
20	2040		2.3	2.3	51.1	51.1	48.7
21	2041		2.3	2.3	51.9	51.9	49.6
22	2042		2.3	2.3	52.8	52.8	50.4
23	2043		2.3	2.3	53.6	53.6	51.3
24	2044		2.3	2.3	54.5	54.5	52.2
25	2045		2.3	2.3	55.4	55.4	53.1
26	2046		2.3	2.3	56.4	56.4	54.0
27	2047		3.5	3.5	57.3	57.3	53.8
28	2048		2.3	2.3	58.3	58.3	55.9
29	2049		2.3	2.3	59.2	59.2	56.9
30	2050		2.3	2.3	60.2	60.2	57.9
31	2051		2.3	2.3	61.2	61.2	58.9
32	2052		2.3	2.3	62.2	62.2	59.9
33	2053		2.3	2.3	63.3	63.3	60.9
34	2054		2.3	2.3	64.3	64.3	62.0
35	2055		1.2	1.2	32.7	32.7	31.5
		258.3	72.5	330.8	1,534.2	1,534.2	1,203.4

Discounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Discounted	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Benefit	Benefit - Cost
1	2021	1.00	0.0		0.0		0.0	0.0
2	2022	1.10	0.0		0.0		0.0	0.0
3	2023	1.21	8.0		8.0		0.0	-8.0
4	2024	1.33	124.5		124.5		0.0	-124.5
5	2025	1.46	56.6	0.8	57.4	13.2	13.2	-44.2
6	2026	1.61		1.5	1.5	24.3	24.3	22.9
7	2027	1.77		1.3	1.3	22.5	22.5	21.2
8	2028	1.95		1.2	1.2	20.8	20.8	19.6
9	2029	2.14		1.1	1.1	19.2	19.2	18.1
10	2030	2.36		1.0	1.0	17.8	17.8	16.8
11	2031	2.59		0.9	0.9	16.4	16.4	15.5
12	2032	2.85		0.8	0.8	15.2	15.2	14.4
13	2033	3.14		0.7	0.7	14.0	14.0	13.3
14	2034	3.45		0.7	0.7	13.0	13.0	12.3
15	2035	3.80		0.6	0.6	12.4	12.4	11.8
16	2036	4.18		0.6	0.6	11.4	11.4	10.9
17	2037	4.59		0.8	0.8	10.6	10.6	9.8
18	2038	5.05		0.5	0.5	9.8	9.8	9.3
19	2039	5.56		0.4	0.4	9.0	9.0	8.6
20	2040	6.12		0.4	0.4	8.3	8.3	8.0
21	2041	6.73		0.3	0.3	7.7	7.7	7.4
22	2042	7.40		0.3	0.3	7.1	7.1	6.8
23	2043	8.14		0.3	0.3	6.6	6.6	6.3
24	2044	8.95		0.3	0.3	6.1	6.1	5.8
25	2045	9.85		0.2	0.2	5.6	5.6	5.4
26	2046	10.83		0.2	0.2	5.2	5.2	5.0
27	2047	11.92		0.3	0.3	4.8	4.8	4.5
28	2048	13.11		0.2	0.2	4.4	4.4	4.3
29	2049	14.42		0.2	0.2	4.1	4.1	3.9
30	2050	15.86		0.1	0.1	3.8	3.8	3.6
31	2051	17.45		0.1	0.1	3.5	3.5	3.4
32	2052	19.19		0.1	0.1	3.2	3.2	3.1
33	2053	21.11		0.1	0.1	3.0	3.0	2.9
34	2054	23.23		0.1	0.1	2.8	2.8	2.7
35	2055	25.55		0.0	0.0	1.3	1.3	1.2
			189.1	16.2	205.3	307.2	307.2	102.0

Net Present Value (Million peso)	102.0
B/C Ratio	1.50
EIRR	15.3%

Source: Calculated by JICA Study Team

Table 25.8-6 Cost Benefit Stream for Dimapatoy Water Treatment Plant Case-2

Undiscounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Benefit	Benefit - Cost
1	2021	0.0	0.0	0.0		0.0	0.0
2	2022	0.0	0.0	0.0		0.0	0.0
3	2023	9.7	0.0	9.7		0.0	-9.7
4	2024	165.7	0.0	165.7		0.0	-165.7
5	2025	82.9	1.2	84.0	32.1	32.1	-51.9
6	2026		2.3	2.3	65.4	65.4	63.0
7	2027		2.3	2.3	66.4	66.4	64.1
8	2028		2.3	2.3	67.5	67.5	65.2
9	2029		2.3	2.3	68.7	68.7	66.3
10	2030		2.3	2.3	69.8	69.8	67.5
11	2031		2.3	2.3	71.0	71.0	68.6
12	2032		2.3	2.3	72.2	72.2	69.8
13	2033		2.3	2.3	73.4	73.4	71.0
14	2034		2.3	2.3	74.6	74.6	72.2
15	2035		2.3	2.3	78.4	78.4	76.0
16	2036		2.3	2.3	79.7	79.7	77.3
17	2037		3.5	3.5	81.0	81.0	77.5
18	2038		2.3	2.3	82.3	82.3	80.0
19	2039		2.3	2.3	83.7	83.7	81.4
20	2040		2.3	2.3	85.1	85.1	82.8
21	2041		2.3	2.3	86.5	86.5	84.2
22	2042		2.3	2.3	88.0	88.0	85.6
23	2043		2.3	2.3	89.4	89.4	87.1
24	2044		2.3	2.3	90.9	90.9	88.6
25	2045		2.3	2.3	92.4	92.4	90.1
26	2046		2.3	2.3	94.0	94.0	91.6
27	2047		3.5	3.5	95.5	95.5	92.0
28	2048		2.3	2.3	97.1	97.1	94.8
29	2049		2.3	2.3	98.7	98.7	96.4
30	2050		2.3	2.3	100.4	100.4	98.0
31	2051		2.3	2.3	102.0	102.0	99.7
32	2052		2.3	2.3	103.7	103.7	101.4
33	2053		2.3	2.3	105.5	105.5	103.1
34	2054		2.3	2.3	107.2	107.2	104.9
35	2055		1.2	1.2	54.5	54.5	53.3
		258.3	72.5	330.8	2,556.9	2,556.9	2,226.2

Discounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Discounted	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Benefit	Benefit - Cost
1	2021	1.00	0.0		0.0		0.0	0.0
2	2022	1.10	0.0		0.0		0.0	0.0
3	2023	1.21	8.0		8.0		0.0	-8.0
4	2024	1.33	124.5		124.5		0.0	-124.5
5	2025	1.46	56.6	0.8	57.4	22.0	22.0	-35.4
6	2026	1.61		1.5	1.5	40.6	40.6	39.1
7	2027	1.77		1.3	1.3	37.5	37.5	36.2
8	2028	1.95		1.2	1.2	34.7	34.7	33.5
9	2029	2.14		1.1	1.1	32.0	32.0	30.9
10	2030	2.36		1.0	1.0	29.6	29.6	28.6
11	2031	2.59		0.9	0.9	27.4	27.4	26.5
12	2032	2.85		0.8	0.8	25.3	25.3	24.5
13	2033	3.14		0.7	0.7	23.4	23.4	22.6
14	2034	3.45		0.7	0.7	21.6	21.6	20.9
15	2035	3.80		0.6	0.6	20.6	20.6	20.0
16	2036	4.18		0.6	0.6	19.1	19.1	18.5
17	2037	4.59		0.8	0.8	17.6	17.6	16.9
18	2038	5.05		0.5	0.5	16.3	16.3	15.8
19	2039	5.56		0.4	0.4	15.1	15.1	14.6
20	2040	6.12		0.4	0.4	13.9	13.9	13.5
21	2041	6.73		0.3	0.3	12.9	12.9	12.5
22	2042	7.40		0.3	0.3	11.9	11.9	11.6
23	2043	8.14		0.3	0.3	11.0	11.0	10.7
24	2044	8.95		0.3	0.3	10.2	10.2	9.9
25	2045	9.85		0.2	0.2	9.4	9.4	9.1
26	2046	10.83		0.2	0.2	8.7	8.7	8.5
27	2047	11.92		0.3	0.3	8.0	8.0	7.7
28	2048	13.11		0.2	0.2	7.4	7.4	7.2
29	2049	14.42		0.2	0.2	6.8	6.8	6.7
30	2050	15.86		0.1	0.1	6.3	6.3	6.2
31	2051	17.45		0.1	0.1	5.8	5.8	5.7
32	2052	19.19		0.1	0.1	5.4	5.4	5.3
33	2053	21.11		0.1	0.1	5.0	5.0	4.9
34	2054	23.23		0.1	0.1	4.6	4.6	4.5
35	2055	25.55		0.0	0.0	2.1	2.1	2.1
			189.1	16.2	205.3	512.1	512.1	306.8

Net Present Value (Million peso)	306.8
B/C Ratio	2.49
EIRR	24.8%

Source: Calculated by JICA Study Team

Table 25.8-7 Cost Benefit Stream for Dimapatoy Water Treatment Plant Case-3

Undiscounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Benefit	Benefit - Cost
1	2021	0.0	0.0	0.0		0.0	0.0
2	2022	0.0	0.0	0.0		0.0	0.0
3	2023	9.7	0.0	9.7		0.0	-9.7
4	2024	165.7	0.0	165.7		0.0	-165.7
5	2025	82.9	1.2	84.0	65.9	65.9	-18.1
6	2026		2.3	2.3	134.0	134.0	131.6
7	2027		2.3	2.3	136.2	136.2	133.9
8	2028		2.3	2.3	138.5	138.5	136.1
9	2029		2.3	2.3	140.8	140.8	138.4
10	2030		2.3	2.3	143.1	143.1	140.8
11	2031		2.3	2.3	145.5	145.5	143.2
12	2032		2.3	2.3	147.9	147.9	145.6
13	2033		2.3	2.3	150.4	150.4	148.0
14	2034		2.3	2.3	152.9	152.9	150.5
15	2035		2.3	2.3	160.6	160.6	158.3
16	2036		2.3	2.3	163.3	163.3	161.0
17	2037		3.5	3.5	166.0	166.0	162.5
18	2038		2.3	2.3	168.8	168.8	166.4
19	2039		2.3	2.3	171.6	171.6	169.3
20	2040		2.3	2.3	174.4	174.4	172.1
21	2041		2.3	2.3	177.4	177.4	175.0
22	2042		2.3	2.3	180.3	180.3	178.0
23	2043		2.3	2.3	183.3	183.3	181.0
24	2044		2.3	2.3	186.4	186.4	184.0
25	2045		2.3	2.3	189.5	189.5	187.1
26	2046		2.3	2.3	192.6	192.6	190.3
27	2047		3.5	3.5	195.8	195.8	192.3
28	2048		2.3	2.3	199.1	199.1	196.7
29	2049		2.3	2.3	202.4	202.4	200.0
30	2050		2.3	2.3	205.7	205.7	203.4
31	2051		2.3	2.3	209.2	209.2	206.8
32	2052		2.3	2.3	212.7	212.7	210.3
33	2053		2.3	2.3	216.2	216.2	213.9
34	2054		2.3	2.3	219.8	219.8	217.4
35	2055		1.2	1.2	111.7	111.7	110.6
		258.3	72.5	330.8	5,241.7	5,241.7	4,911.0

Discounted Benefit Cost Stream Revenue

Million Peso

sq	Year	Discounted	Econoomic Cost	O&M	Cost Total	Traffic Benefit	Benefit	Benefit - Cost
1	2021	1.00	0.0		0.0		0.0	0.0
2	2022	1.10	0.0		0.0		0.0	0.0
3	2023	1.21	8.0		8.0		0.0	-8.0
4	2024	1.33	124.5		124.5		0.0	-124.5
5	2025	1.46	56.6	0.8	57.4	45.0	45.0	-12.4
6	2026	1.61		1.5	1.5	83.2	83.2	81.7
7	2027	1.77		1.3	1.3	76.9	76.9	75.6
8	2028	1.95		1.2	1.2	71.1	71.1	69.9
9	2029	2.14		1.1	1.1	65.7	65.7	64.6
10	2030	2.36		1.0	1.0	60.7	60.7	59.7
11	2031	2.59		0.9	0.9	56.1	56.1	55.2
12	2032	2.85		0.8	0.8	51.8	51.8	51.0
13	2033	3.14		0.7	0.7	47.9	47.9	47.2
14	2034	3.45		0.7	0.7	44.3	44.3	43.6
15	2035	3.80		0.6	0.6	42.3	42.3	41.7
16	2036	4.18		0.6	0.6	39.1	39.1	38.5
17	2037	4.59		0.8	0.8	36.1	36.1	35.4
18	2038	5.05		0.5	0.5	33.4	33.4	32.9
19	2039	5.56		0.4	0.4	30.9	30.9	30.4
20	2040	6.12		0.4	0.4	28.5	28.5	28.1
21	2041	6.73		0.3	0.3	26.4	26.4	26.0
22	2042	7.40		0.3	0.3	24.4	24.4	24.0
23	2043	8.14		0.3	0.3	22.5	22.5	22.2
24	2044	8.95		0.3	0.3	20.8	20.8	20.6
25	2045	9.85		0.2	0.2	19.2	19.2	19.0
26	2046	10.83		0.2	0.2	17.8	17.8	17.6
27	2047	11.92		0.3	0.3	16.4	16.4	16.1
28	2048	13.11		0.2	0.2	15.2	15.2	15.0
29	2049	14.42		0.2	0.2	14.0	14.0	13.9
30	2050	15.86		0.1	0.1	13.0	13.0	12.8
31	2051	17.45		0.1	0.1	12.0	12.0	11.9
32	2052	19.19		0.1	0.1	11.1	11.1	11.0
33	2053	21.11		0.1	0.1	10.2	10.2	10.1
34	2054	23.23		0.1	0.1	9.5	9.5	9.4
35	2055	25.55		0.0	0.0	4.4	4.4	4.3
			189.1	16.2	205.3	1,049.7	1,049.7	844.5

Net Present Value (Million peso)	844.5
B/C Ratio	5.11
EIRR	48.0%

Source: Calculated by JICA Study Team

(2) Sensitivity Analysis

The sensitivity analyses were carried out as shown in Table 25.8-8 to Table 25.8-10. This aims to evaluate the relevance of the Dimapatoy Water Treatment Plant under some risks. For example, there may be the case that, the estimated costs would be increased. Other cases would be that the expected benefit in terms of reduction of VOC and TTC may not be attained as expected. In this regard, the following nine (9) cases were evaluated.

As a result, the strictest condition which is Cost 20% Plus and Benefit 20% Less shows that the EIRR value is way higher than the social discount rate (10%).

Table 25.8-8 Result of Sensitivity Analyses for Case-1

Sensitivity Analysis		Benefit		
		0%	**-10%**	**-20%**
Cost	0%	15.3%	13.7%	12.2%
	+10%	13.9%	12.5%	11.0%
	+20%	12.7%	11.4%	10.0%

Table 25.8-9 Result of Sensitivity Analyses for Case-2

Sensitivity Analysis		Benefit		
		0%	**-10%**	**-20%**
Cost	0%	24.8%	22.5%	20.1%
	+10%	22.7%	20.6%	18.4%
	+20%	20.9%	18.9%	16.9%

Table 25.8-10 Result of Sensitivity Analyses for Case-3

Sensitivity Analysis		Benefit		
		0%	**-10%**	**-20%**
Cost	0%			
	+10%			
	+20%			

25.9 Technical Cooperation on Septage Management

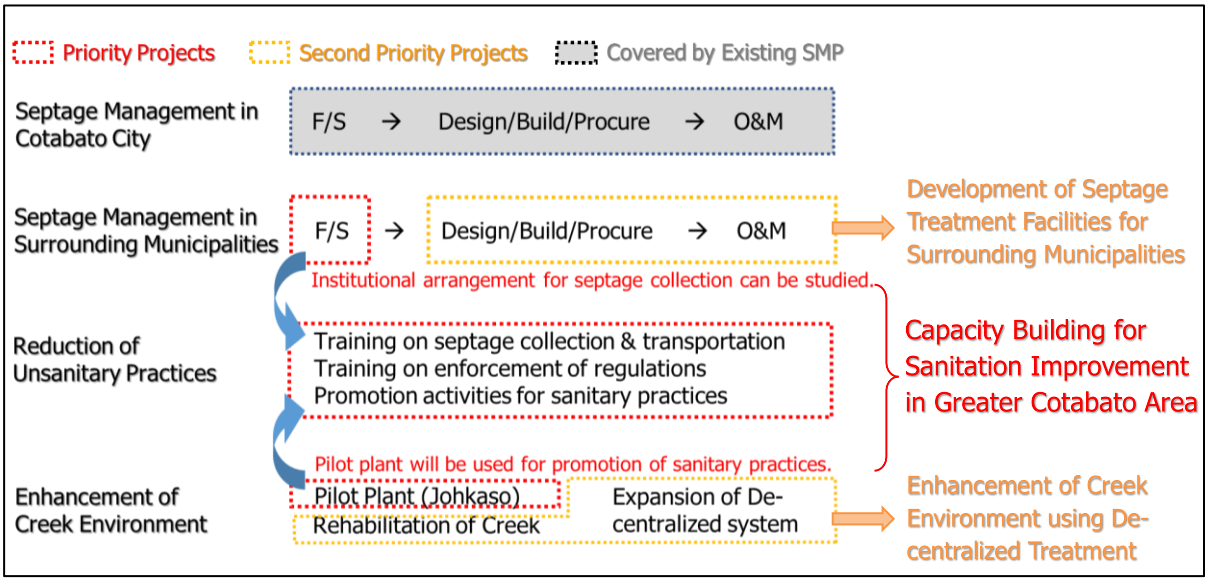
25.9.1 Project Background

In Chapter 15 "Sewerage Development Plan", in addition to the on-going Septage Management Program (SMP) in Cotabato City, one priority projects and two second priority projects are proposed as follows:

- Priority Project
  1) Capacity Building for Sanitation Improvement in Greater Cotabato Area

     In addition to activities for reduction, F/S for septage management in surrounding municipalities and installation of pilot plant (Johkaso) will be combined.
- Second Priority Projects
  1) Development of Septage Treatment Facilities for Surrounding Municipalities
  2) Enhancement of Creek Environment using De-centralized Treatment Plant

Figure 25.9-1 explains the components of the Priority Project and relations between other second priority projects.



Source: JICA Study Team

Figure 25.9-1 Basic Concept of Priority Projects

In this sub-chapter 25.6, the selected priority project "Capacity Building for Sanitation Improvement in Greater Cotabato Area" will be explained.

25.9.2 Outline of the Project

(1) General

1) Purpose

- To develop sustainable septage collection and transportation system for Cotabato city and surrounding municipalities including operation training
- To promote sanitary practices in municipalities including training for enforcement of regulations in line with the National Sewerage and Septage Management Program

2) Implementation Agencies

MCWD and CENRO in Cotabato city and surrounding municipalities

3) Location

Greater Cotabato area (Cotabato city and surrounding municipalities)

4) Implementation Schedule

From 2023 to 2025

(2) Scope of the Works

1) Training to City Officers for Septage Management Practices

In Cotabato City a septage management program has been developed to improve sanitation, however, capacity building of relevant officers to implement septage collection and transportation is still a challenge. As of now, desludging and collection of septage are rarely practiced in those municipalities thus training of city officers is needed to develop their capacity for implementation of septage management system.

2) Feasibility Study on Septage Management Program for Surrounding Municipalities

The septage management program for the five surrounding municipalities are supposed to be combination of desludging/collection and sludge treatment just same as the SMP for Cotabato city. However, since each municipality is distant from others sludge treatment shall be not centralized but done by each municipality, while desludging trucks may be owned and maintained by MCWD and dispatched to the surrounding municipalities upon their needs with fee. Further study shall be done in this project and discussed by relevant stakeholders. Development of financial management shall also be conducted to secure sustainability of SMP.

3) Promotion of Sanitary Practices with Pilot Plant Using Johkaso Technology

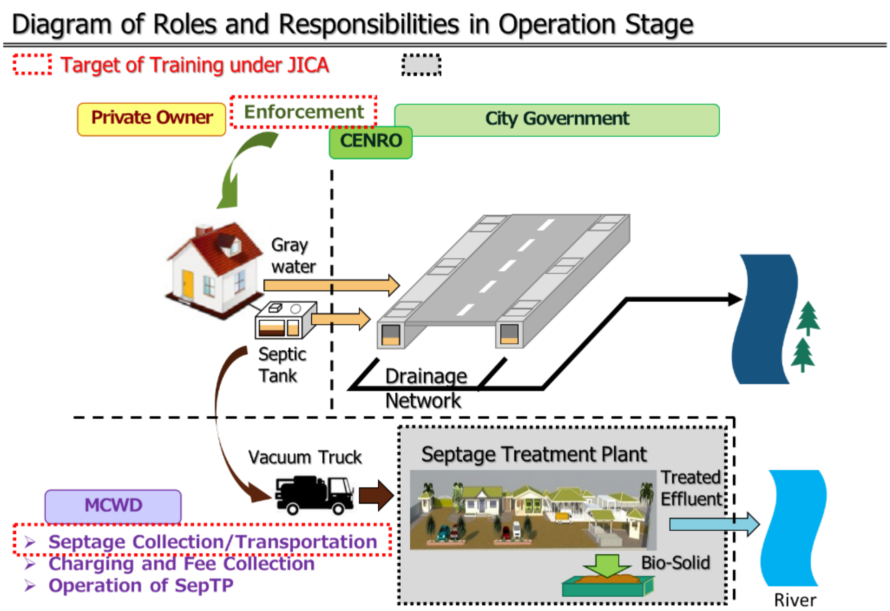
Majority of households use septic tanks. But many households use unsanitary septic tanks (have open bottoms) which do not conform relevant codes and allow discharge of wastewater to public water body. To tackle with this issue, capacity enhancement for reduction of unsanitary practices is needed. Components of this project are as follows.

a) Promotion of affordable options for replacement of sub-standard septic tanks including seminar to local builders
b) Installation of pilot plant for de-centralized treatment system

25.9.3 Training for Septage Management Practices

(1) Basic Concept

Cotabato City already has the Septage Management Program (SMP), which is developed by the City Government of Cotabato and MCWD with technical assistance from Be Secure Program by USAID. However, capacity building of relevant officers to implement septage collection and transportation is still a challenge. As of now, desludging and collection of septage are rarely practiced in those municipalities thus training of city officers is needed to develop their capacity for implementation of septage management system.



Source: JICA Study Team

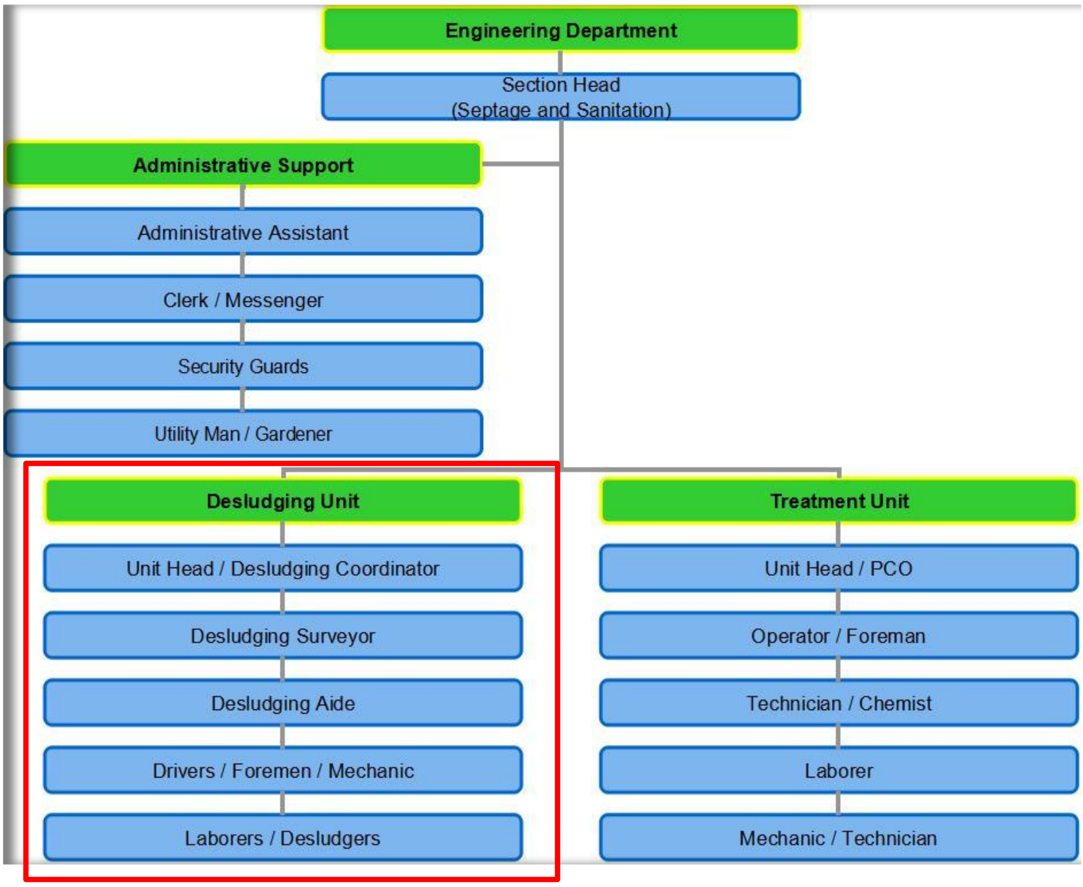
Figure 25.9-2 Basic Concept of Sewerage Development Plan for Cotabato City

(2) Training for Septage Collection and Transportation Plan in the SMP

1) Target Personnel of Septage Collection/Transportation Training

The facilities and equipment under SMP will be operated and managed by the MCWD through a Septage and Sanitation Section to be created under its Engineering Department. A Section Head shall be designated by the MCWD to supervise the operations. He/she will be supported by technical and administrative personnel in the operations of the project. The salary of the section head shall come from the MCWD.

The technical support will have two technical units, i.e., the Desludging Unit and the Treatment Unit. The Desludging Unit will be in-charge of the collection and transport of septage/sludge from septic tanks to treatment plant. This unit is composed of the following: one Unit Head/Desludging Coordinator; one Desludging Surveyor; one Desludging Aide; two Drivers/Foreman/Mechanic; and, two Laborers/Desludgers. Those staffs will be the target of septage collection/transportation training.



Source: Feasibility Study, Cotabato City Septage Management Program, 2019

Figure 25.9-3 Target of Septage Collection / Transportation Training

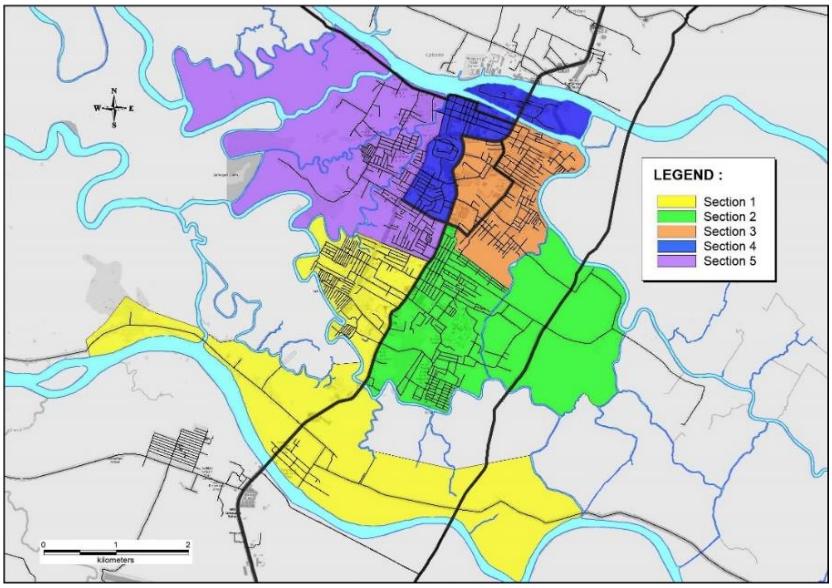
2) Collection and Transportation Plan in the SMP

The city service area is divided into five sections. Each section corresponds to the year of servicing (years 1 to 5). The same schedule will be followed in the next five-year cycle to ensure that all septic tanks are regularly desludged every five years as required by the Department of Health.

Table 25.9-1 Projected Number of Household Clients in Cotabato City

Section	2015	2020	2025	2030	2035
Section 1	3,994	4,630	5,368	6,223	7,214
Section 2	4,390	5,089	5,900	6,839	7,928
Section 3	5,448	6,316	7,322	8,488	9,840
Section 4	4,989	5,784	6,705	7,773	9,011
Section 5	4,355	5,048	5,852	6,784	7,865
Total	**23,176**	**26,867**	**31,147**	**36,107**	**41,858**

Source: Feasibility Study, Cotabato City Septage Management Program, 2019



Source: Feasibility Study, Cotabato City Septage Management Program, 2019

Figure 25.9-4 Sectional Map of Coverage Area

In the first year of operation, the Personal Services expenses is estimated to be about P3.673M. This includes salaries and wages of the staff and other statutory obligations. It is also estimated that there will be salary increase of ten percent (10%) every five years.

3) Necessary Activities

As mentioned above, over all collection/transportation plan and budget allocation were already discussed in the SMP. Also, basic training on equipment operation will be provided in the SMP. However, to conduct operations properly and accordingly to the national guideline (Operations and Manual on the Rules and Regulations Governing Domestic Sludge and Septage), capacity building of technical knowledge for operation staffs is remained as a concern. In this connection, following training shall be provided.

a) Practices for Personal Safety, Traffic Contral, and Sanitary Control

b) Vehicle and Equipment Maintenance

c) Practices on Handling Accidental Spillage

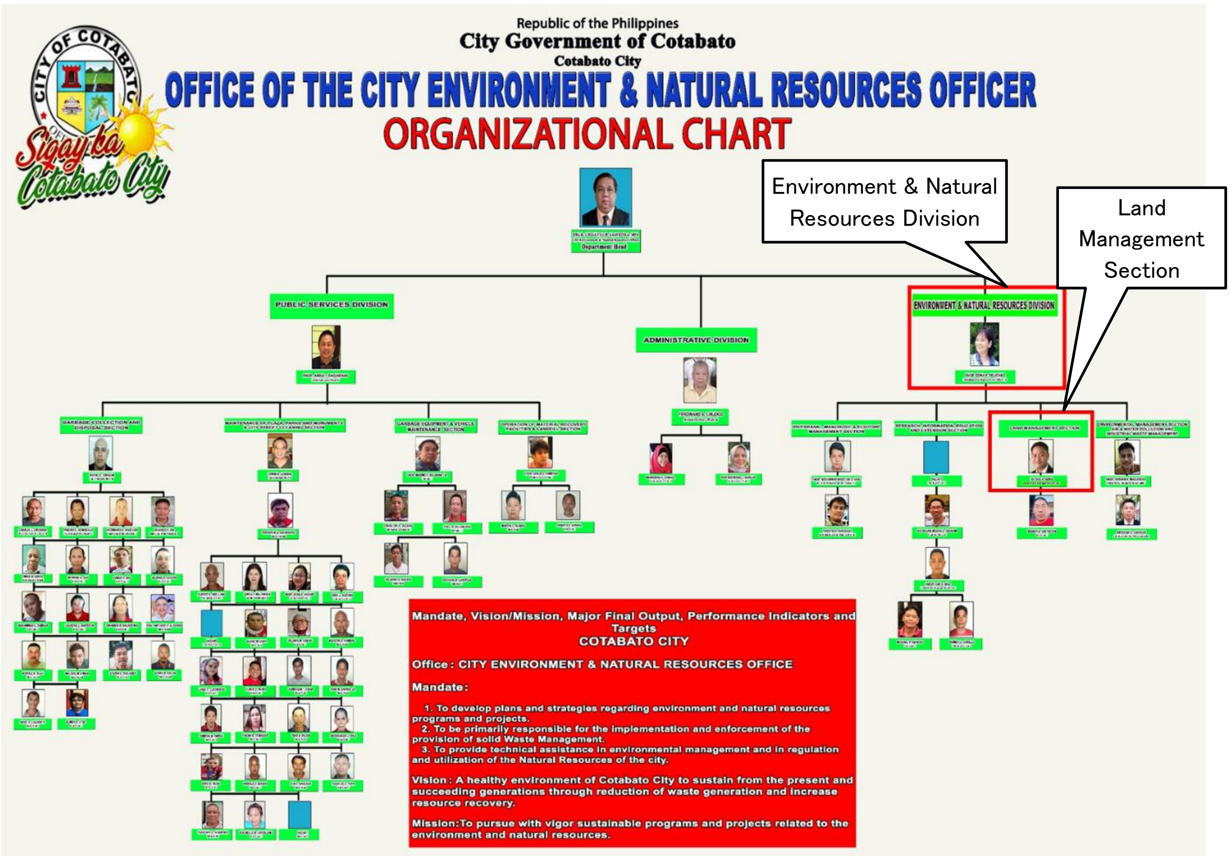
d) Document Control with House Owners/Barangay Captains

(3) Training for Enforcement of Regulations

1) Target Personnel of Septage Collection/Transportation Training

While operation will be under MCWD, The city environment and natural resources office (CENRO) of Cotabato City will take charge of requiring building owners to have their septic tanks desludged regularly, enlist the help of the Barangay Officials to ensure that all septic tanks are desludged and to ensure that all septic tanks are properly designed and built.

Figure 25.9-5 shows the organization chart of Cotabato CENRO. Direct target of the law enforcement training will be Land Management Section under Environment & Natural Resources Division.



Source: Feasibility Study, Cotabato City Septage Management Program, 2019

Figure 25.9-5 Target of Law Enforcement Training Program

2) Necessary Activities

In the national guideline (Operations and Manual on the Rules and Regulations Governing Domestic Sludge and Septage), basic requirement in septic permission is explained and sample forms of application/permission are provided. However, to establish standard procedures for inspection and enforcement, including how to deal with various type of irregular cases, following training shall be provided.

a) Lecture on basic technical knowledge of septic tanks, including theory of treatment, function of each part and meaning of regulations specified in the code

b) Documentation control

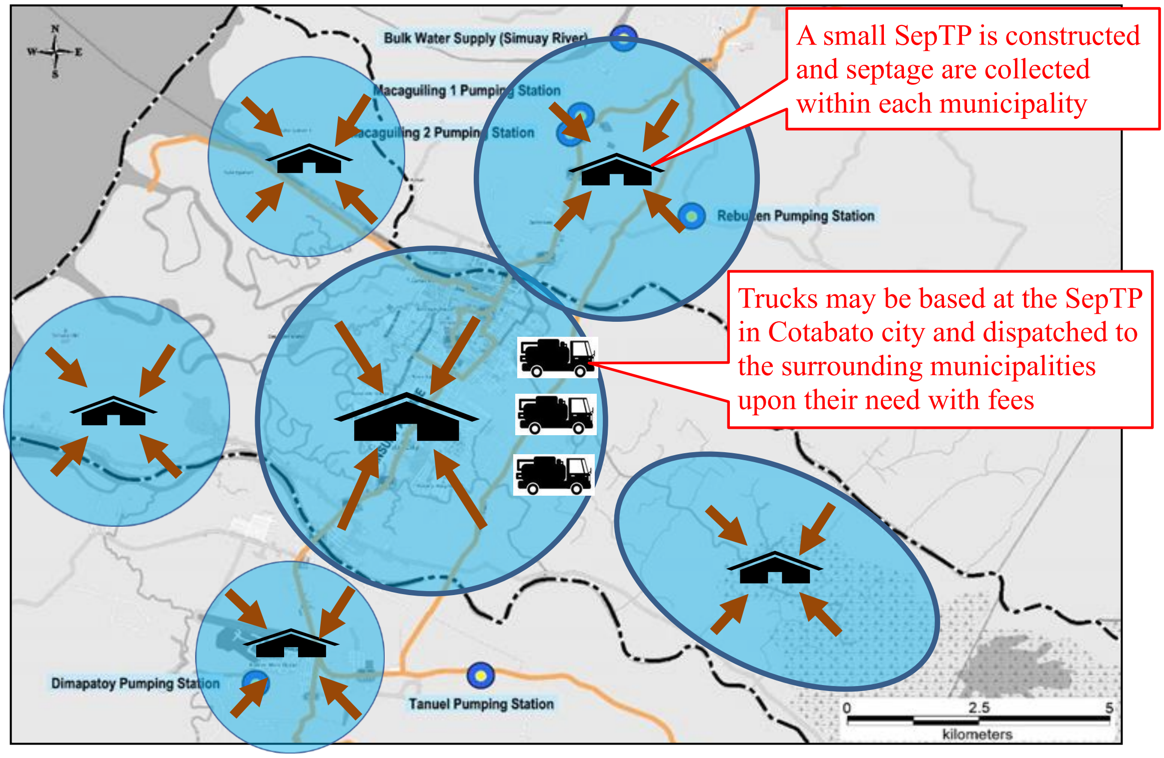
c) Learning good practice samples in other cities or countries including conflict management and dispute resolution

d) Applicable construction technology for improvement of sub-standard tanks

25.9.4 Development of Septage Management Program for Surrounding Municipalities

(1) Basic Concept

Although septage management program has not been established yet for the five surrounding municipalities, the program is supposed to be combination of desludging/collection and sludge treatment just same as the SMP for Cotabato city. However, since each municipality is distant from others sludge treatment shall be not centralized but done by each municipality, while desludging trucks may be based at the septage treatment plant in Cotabato city. Those vehicles owned and maintained by MCWD or Inter-LGUs organization for septage collection and dispatched to the surrounding municipalities upon their needs with fee. Further study shall be done in the future project and discussed by relevant stakeholders.



Source: JICA Study Team

Figure 25.9-6. Concept Image of Septage Management for Surrounding Municipalities

(2) Collection and Transportation

Same as the SMP for Cotabato city, service area is divided into five sections with each municipality. Each section corresponds to the year of servicing (years 1 to 5). The same schedule will be followed in the next five-year cycle to ensure that all septic tanks are regularly desludged every five years. To estimate household number in 2040, population growth of 1.86% is simply applied for growth rate of households. Sanitary rates (households with sanitary toilet / total households) are estimated as 90% in 2040, except Sultan Kudarat which rate is only 26% in the latest statistics.

Table 25.9-2 Projected Number of Household for Surrounding Municipalities

Section	Covered Municipalities	Latest Stat			Projection in 2040		
		Households		Rate	Households		Rate
		Sanitary	Total		Sanitary	Total	
Section 1	Dato Odin Sinsuat	11,182	16,880	66%	21,963	24,403	90%
Section 2	Sultan Kudarat	3,986	15,331	26%	11,082	22,164	50%
Section 3	Sultan Mastura	3,261	3,837	85%	4,992	5,547	90%
Section 4	Parang, Maguindanao	13,736	15,262	90%	19,858	22,064	90%
Section 5	Plgcawayan, North Cotabato	12,514	15,201	82%	19,778	21,976	90%
Total		**44,679**	**66,511**		**77,673**	**96,154**	

Source: JICA Study Team

(3) Necessary Input and Expected Outcome

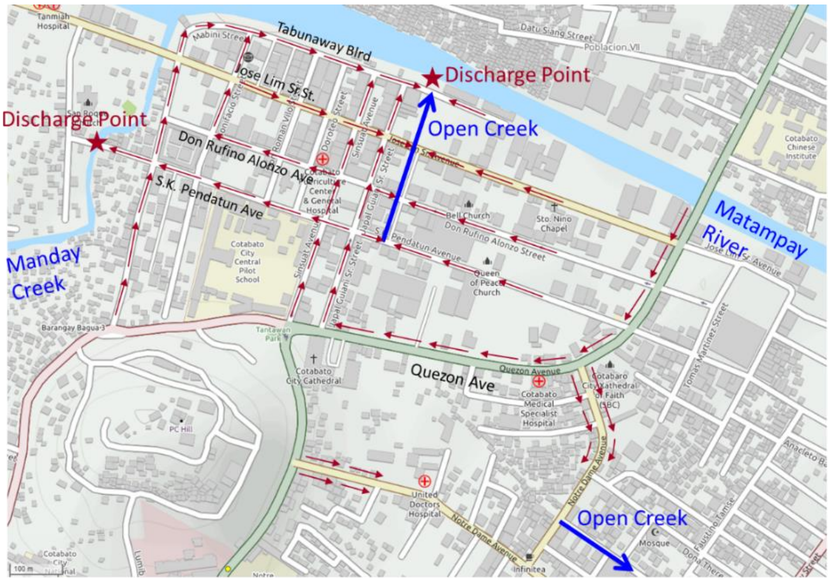
To establish efficient and practical plan for septage management in surrounding municipalities, following activities/studies shall be conducted.

- Determination of Service Area
- Projection of Septage Treatment Demand in Surrounding Municipalities
- Collection and Transportation Plan
- Feasibility Study on Septage Treatment Facilities

25.9.5 Promotion of Sanitary Practices with Pilot Plant Using Johkaso Technology

(1) Background

The effluent wastewater from the septic tanks and non-fecal wastewater of residential houses and commercial establishments within the CBD also flow through to this city drainage system (along the SK Pendatun St., Don Rufino Alonzo Ave., Jose Lim Sr. St., and Rajah Tabunaway Blvd.) and flow into the Manday creek or the “open creek” exiting to Rio Grande River, hence, polluting the river.



Source: JICA Study Team

Figure 25.9-7 Current Condition of City Drainage in Cotabato CBD

To address this issue, de-centralized treatment plant will be installed at major discharge points of city drainages or major source of wastewater such as large-scale commercial facilities. instead of centralized sewerage system which takes cost and time.

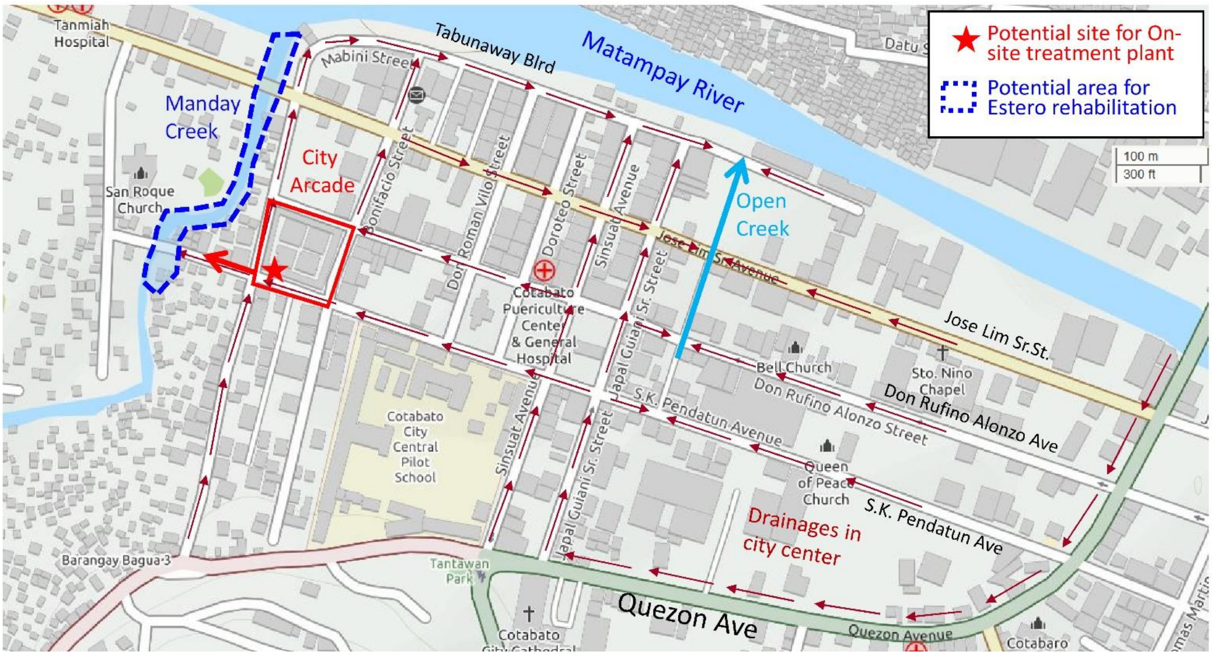
For de-centralized treatment method, Johkaso or other Japanese technologies can be utilized. Johkaso is a multifunctional treatment tank which has functions of sedimentation, anaerobic reaction, aeration, storage and disinfection in one tank.

Source: FujiClean CO.,LTD

Figure 25.9-8 Example of Installation of Johkaso in the Philippines

(2) Outline of Pilot Plant

In the proposed project, a pilot plant will be installed as a show-case of de-centralized treatment technology. The City Arcade is recommended for the pilot plant site, since it is one of the major organic pollutant source in Cotabato City CBD, located near discharge point and managed under the city government. Figure 25.9-10 shows a site map with surrounding drainage system and photos of City Arcade.



Source: JICA Study Team

Figure 25.9-9　Vicinity Map of Potential Site for the Pilot Plant

Source: JICA Study Team

Figure 25.9-10　Photos of Potential Site for the Pilot Plant

(3) Expected Spec and Cost of the Pilot Plant

Capacity of Johkaso is indicated by number of users, such as 5 people type, 10 people type, 50 people type etc. In case of industrial or commercial facilities, required capacity is still indicated by the number of users of ordinary house-hold usage which have equivalent pollutant load from the facility. The Building Standard Law in Japan offers a calculation matrix for estimation of required capacity for various type of building facility. As shown in the table below, for public market, the capacity can be estimated simply by the floor are of the market.

Table 25.9-3 Standards for Jhokaso Capacity by Type of Facility

Standards for Calculation of Required Capacity of Jhokaso by Facility Type（JIS A3302-2000）

No.	Type of Facility				Required Jhokaso Capacity (Indicated by Number of people)		(For Reference) Expected Volume of Wastewater BOD by Facility Type		(For Reference) Hours in use
					Formula	Explanation of Units	Volume (per base unit)	BOD (mg/L)	
1	Public Hall, Event Hall etc.				details omitted				
2	Residences				details omitted				
3	Hotel				details omitted				
4	Medical Facility				details omitted				
5	Store/Restaurant				details omitted				
6	Amusement Facility				details omitted				
7	Highway Service Area				details omitted				
8	Schools				details omitted				
9	Offices				details omitted				
10	Industrial Facility				details omitted				
11	Others	a	Public Market		n = 0.02A	n: Required Capacity (Number of people) A: Floor Area (m2)	4.2(L/m^2・day)	200	10
		b	Public Bath		n = 0.17A		33(L/m^2・day)	50	12
		c	Piblic Toilet		n = 16C	n: Required Capacity (Number of people) C: Number of Bowl (n)	2,400(L/n・day)	260	-
		d	Transportaion Hub	P ＜ 100,000	n = 0.008P	n: Required Capacity (Number of people) P: Passengers (n/day)	-	-	Depends
				100,000 ≦ P ＜ 200,000	n = 0.010P				
				200,000 ≦ P	n = 0.013P				

Source: JICA Study Team

Floor area of City Arcade is estimated approximately 2,500 sq.m from aerial map, thus the required capacity and expected volume of wastewater discharged from the market are estimated as shown below.

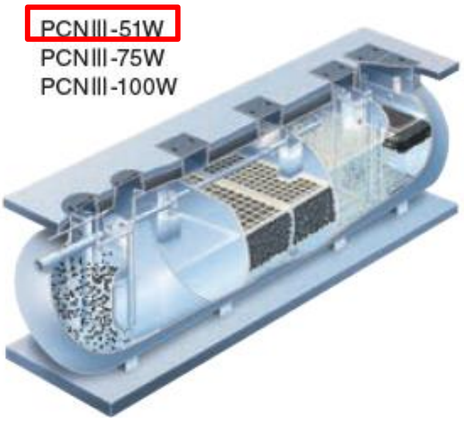
Table 25.9-4 Required Capacity of Jhokaso for the Pilot Plant

Floor Area (m2)	Expected Volume of Wastewater (m3/d)	BOD (mg/L)	Required Capacity of Jhokaso
2,500	**10.5**	**200**	**50 peeple type**

Source: JICA Study Team

In terms of volume of wastewater, according to the city environmental management office, daily water consumption of City Arcade is 11 to 13 (m3/day). Thus calculated wastewater volume from the matrix by floor area is close to the actual wastewater volume there.

However, in terms of wastewater quality, there may be significant difference in the wastewater from public market in Japan and in the Philippines, especially wastewater from meat processing which is not seen often in the market in Japan. Therefore, water quality survey shall be done on site and detail capacity shall be determined based on result of the survey.



Sample Sizes of 50 people type Jhokaso	
Length	5,960(mm)
Width	2,012(mm)
Height	2,270(mm)
Weight	2,100(kg)

*Note : Those sizes cover Jhokaso equipment only. Necessary space for installation shall be studied including civil works with sufficient margin to adjacent structures.

Source: FujiClean CO.,LTD

Figure 25.9-11 Sample of Jhokaso Product for the Pilot Plant

Table 25.9-5 shows rough cost estimation for installation of the proposed pilot plant under premise of using standard Johkaso for 50 people.

Table 25.9-5 Cost Estimation of Jhokaso Pilot Plant

1 PHP=2.2 JPY

Direct Cost	Total (PHP)	F/C (JPY)	Remarks
Jhokaso	2,182,000	4,800,000	
Civil Works	1,309,200		60% of Jhokaso Price
Pre-Treatment Equipment	***		To be studied based on water quality survey
Sub Total	3,491,200		
Indirect Cost			
20% of Direct Cost (Tentatively)	698,240		
	-		
Grand Total	*4,189,440*		

Source: JICA Study Team

however, further studies listed in the next clause shall be done to obtain details and finalize the cost estimation.

(4) Necessary Activities or Studies in the proposed project

For promotion of sanitary practices with pilot plant using Johkaso technology, following activities or studies shall be conducted.

1) Wastewater Quality Survey

Wastewater quality survey shall be done to determine design pollution load. Based on the survey result, installation of pre-treatment equipment such as grease trap shall be considered.

2) Selection of Installation Point and Detail Design

Site survey shall be done to find sufficient space for installation (parking lots by the market area, probably) and locate discharge pipe to city drainage for detail design of pipe connection and other civil works.

3) Installation of Johkaso and Civil/Pipimg Works

Johkaso will be transported from oversea factory of the manufacture, while piping works and civil works will be provided by the local construction company.

4) Training on Operation of Johkaso

O&M training for Johkaso by Japanese experts shall be provided.

5) Feedback of Operation Data Study Training on Operation of Johkaso

Operation records (volume and quality of influent, effluent and sludge, electricity consumption, etc.) shall be collected and analyzed to examine applicability to other facilities in the area.

6) Study on Potential Needs of De-Centralized System in Greater Cotabato Area

For future expansion of de-centralized sanitation system, potential location or facilities where Johkaso can be applied will be studied.

25.9.6 Cost Estimation of the Project

Combining necessary activities for “Capacity Building for Sanitation Improvement in Greater Cotabato Area”, schedule for the proposed project is as shown in Table 25.9-6.

Table 25.9-6 Expected Manning Schedule of the Proposed Project

Project / Activities			Activity Schedule 2023				2024				2025				Input Experts	M/M
Capacity Building for Sanitation Improvement in Greater Cotabato Area																
Preparation of Inception Report			■												Septage Management Expert1	0.5
1. Training for septage management	1-1	Analysis on operation conditions and establishment of training program	■	■											Septage Management Expert1 Septage Management Expert2 O&M Expert	0.5 1.0 1.0
	1-1	Training on septage collection / transportationcity for workers			■	■									Septage Management Expert2 O&M Expert	2.0 2.0
	1-1	Training on enforcement of regulations to city officers			■	■									Septage Management Expert2 Facility Plan & Design	2.0 1.0
	1-1	Follow-up and Feedback / Compiling manual for operation procedures					■	■							Septage Management Expert1 Septage Management Expert2 Facility Plan & Design	1.0 2.0 1.0
2. Septage Management Program for Surrounding	1-2a	Detail data collection related to septage management in surrounding municipalities	■	■											Septage Management Expert1 Financial Planning Social & Environmental	1.0 0.5 0.5
	1-2b	Development of Septage Management Program for Five Surrounding Municipalities			■	■									Septage Management Expert1 Septage Management Expert2 Financial Planning Social & Environmental	2.0 2.0 1.0 1.0
	1-2c	Pre-Feasibility study of septage treatment facilities for surrounding municipalities						■	■						Septage Management Expert1 Facility Plan & Design Construction Plan/Cost Estimation	1.0 2.0 2.0
3. Promotion of Sanitary Practices with Pilot Plant Using Johkaso	1-3a	Study and Design for Johlaso Pilot Plant Instalation	■	■											Water Quality Analysit Facility Plan & Design Construction Plan/Cost Estimation	1.0 1.0 1.0
	1-3b	Installation of Johlaso Pilot Plant					■								Construction Plan/Cost Estimation	0.5
	1-3b	Operation Training and Data Collection						■							O&M Expert Water Quality Analysit	1.0 0.5
	1-3c	Study on potential needs and promotion activities including seminers to local owners/builders							■	■					Septage Management Expert1 Septage Management Expert2 Facility Plan & Design	0.5 1.0 1.0
Final Report											■				Septage Management Expert1	0.5

Source: JICA Study Team

25.10 Conclusion and Recommendation

25.10.1 Conclusion

Improvement of water supply system and sanitation system is essential to offer better quality of lives for citizens in Greater Cotabato Area.

25.10.2 Recommendations

(1) Project Implementing Office

The project implementing office is recommended to be the MCWD and Cotabato City. BARMM should act as a co-implementing office to organize discussions about extension of water supply/sanitary system to the five surrounding municipalities.

(2) Necessity of Technical Cooperation Program

To realize future construction projects in these sectors, implementation of technical cooperation programs is recommended to support establishment of water supply master plan, which will push practical and efficient water source development and pipe network expansion as well as knowledge transfer on operation issues in septage management sector.

CHAPTER 26
RECOMMENDATIONS

26.1 Realization of the Urban Infrastructure Development in Greater Cotabato City(UID)

The survey which integrates development of the Greater Cotabato Area (GCA) among key sectors has been prepared. The next step is how to realize the implementation of the UID. Proposed programs (e.g. Capacity Building on various sectors, Traffic Awareness and Safety Campaign, etc.), projects, regularization of surveys shall be included in the BARMM Regional Development Plan and concerned LGUs Comprehensive Development Plans. Similarly, large-scale projects like proposed national roads (identified as primary and secondary roads in the road network masterplan in Chapter 11), flood control projects, new airport, completion of Timako Port, among others require funding support from the national government. The Republic Act No. 11054 (Bangsamoro Basic Law) provides a guideline for possible collaboration of the BARMM Government and the national government in undertaking large-scale projects. Article XIII, Section 37 of the R.A. No. 11054 states that:

"The National Government shall fund and implement the construction and maintenance of national roads, bridges, water supply and services, and flood control and irrigation systems and for the maintenance of existing airports, seaports, and wharves in the Bangsamoro Autonomous Region..."“The Bangsamoro Government shall submit proposals to the appropriate national government agency for the inclusion of the cost of such maintenance in the latter's budget that shall be submitted to the Congress of the Philippines for inclusion in the General Appropriations Act."

To highlight the importance of the proposed large-scale projects on the development of the GCA, these projects shall be included in the local development plans and preferably illustrate how they harmonized with the locally funded projects as part of the proposed large-scale projects. Requested assistance from the national government may include undertaking of full feasibility study of the priority large-scale projects, detailed engineering design, environmental impact study, right-of-way acquisition, resettlement action plan, and construction, among others. The BARMM Government may use the forum provided in the RA No. 11054 (Intergovernmental Relations Body and the Intergovernmental Infrastructure Development Board) to advance the realization of these projects.

26.2 Coordination with the National Government particularly DPWH and DOTr for Planning and Implementation of Large-scale projects

As mentioned above, there exists a forum provided by the R.A. No. 1105 to discuss large-scale projects which the BARMM Government may request the National Government for funding. The BARMM Government shall actively promote and discuss in this forum the large-scale projects identified in this survey. Some of these include:

- West Diversion Road – proposed as a bypass national road and a tsunami barrier. Action plan study is conducted under this survey.
- Mindanao River Southside Road – proposed as national road and action plan study is conducted under this survey.
- Ambal-Simuay and Rio Grande Mindanao River Flood Control Projects – DPWH is in discussion with an international development partner and monitoring of its progress is needed.
- Project for Flood Control and Drainage Improvement in Cotabato City – Feasibility Study is needed in collaboration with DPWH
- Development of New Cotabato Airport – feasibility study is needed in collaboration with the DOTr and MOTC-BARMM

However, the foregoing priority projects should be considered first for inclusion under the BARMM Regional Development Plan and Investment Program approved by the BARMM Economic and Development Council (BEDC).

26.3 Strong Efforts to Advance the Institutional Arrangement among the LGUs in the GCA

The survey proposed an institutional arrangement among the Local Government Units (LGUs) to facilitate integrated approach in pursuing the identified projects in the survey. As explained in Chapter 20, there are many identified projects in the survey where successful implementation requires collaboration of the various LGUs. The roadmap calls for establishment of Development Coordinating Council in 2022 as initial step and over time, the alliance may expand to engage into development cooperative corporation which can implement specific sector services, when it becomes capable. Further, probably by year 2040 or even earlier, the alliance may already qualify to establish a Metropolitan Development Authority which can implement integrated inter-municipal projects and services.

The first step in this direction is the creation of an interim Technical Working Group (TWG) composed of technical personnel from the BPDA, MILG-BARMM, Maguindanao Provincial Government, City Government of Cotabato, and other member-LGUs to do the necessary groundwork, such as, consultations with respective LGU officials, preparation of draft Operations Manual of the alliance, conduct necessary research and interviews on stakeholders of similar inter-LGU alliances, field and observation trips in areas with similar inter-LGU alliances, preparation of the draft MOA, and other necessary activities. The roadmap should be pursued with urgency by the concerned agencies and LGUs.

26.4 Capacity Enhancement of Key Agencies

The study proposed various capacity enhancement programs across different sectors to enhance performance of the concerned offices in executing their regular functions and positioned them better to support realization of the identified projects. Some of the trainings were identified by the MPW-BARMM, some by various offices of the City Government of Cotabato and some by the JICA Study Team. Concerned agencies/offices shall exert efforts to realize the needed training through (i) preparing necessary budget in their expenditure program and/or (ii) request support from international development partners.

Table 26.4-1 Proposed Capacity Enhancement Programs

Proposed Trainings	Target Agencies/Offices
1. Technical Writing Training on various topics to enhance skills in preparation of project concepts, feasibility studies, local development plans, etc.	BARMM related agencies *MPW-BARMM, MOTC-BARMM, BPDA* Cotabato City LGU related agencies *CPDO, CENRO, CDRRMO, CEO* Municipal LGU related agencies *Municipal Planning & Development Office* Private Sector *MCWD*
2. Entire infrastructure project cycle • Project concept and identification • Feasibility Study • Social and Environmental Consideration for Infrastructure Projects • Detailed Engineering Design • RAP preparation • Procurement • Project Management (project implementation and/or monitoring of project implementation)	BARMM related agencies *MPW-BARMM, MOTC-BARMM* Cotabato City LGU related agencies *CPDO, CENRO, CDRRMO, CEO* Municipal LGU related agencies *Municipal Planning & Development Office*
3. Capacity Enhancement on Solid Waste Management	CENRO and environmental sector of the surrounding municipalities
4. Capacity Building for Sanitation Improvement in Greater Cotabato Area	CENRO and environmental sector of the surrounding municipalities
5. Capacity Enhancement on Tsunami Early Warning System (TEWS)	DPWH, MPW-BARMM, LGUs
6. Capacity Enhancement of Traffic Police and relevant agencies/offices on Traffic Management, Traffic Safety, Safety Campaign	Traffic Police (PNP), TMU-Cotabato City, traffic related sector of the surrounding municipalities

Note: MPW=Ministry of Public Works, MOTC=Ministry of Transportation and Communications, CEO=City Engineering Office, CDRRMO=City Disaster Risk Reduction Management Office, CENRO=City Environment and Natural Resources Office, CPDO=City Planning and Development Office, MCWD=Metro Cotabato Water District

26.5 Monitoring of Project Implementation, Periodic Review and Regular Updating of the Masterplan

Monitoring of the implementation of the programs and projects identified in the survey is necessary to ensure that proposed actions toward their realization are executed. Currently, there is no single government agency which has a function wide enough to cover monitoring of all the projects, both implemented by national government agencies and local government units. Similarly, some projects transcend borders of a single or two LGUs. Early establishment of the Metro/Greater Cotabato Development Council can serve as vehicle to monitor the implementation of the different programs and projects in close coordination with the national government agencies and LGUs concerned.

Equally important is the periodic review (e.g. annually or every 2 years) of the Masterplan and its regular updating (e.g. every 5 years) to reflect the actual changes in the GCA. For example, the survey was prepared with various assumptions, such as socioeconomic development framework which affect the calculation of land requirements for residential use and other uses. Therefore, the following, needs to be regularly updated:

- Future socioeconomic framework
- Progress of major development plans (e.g. Integrated Public Terminal in Bubong, Cotabato City; New BARMM Administrative Center in Sarmiento, Parang, etc.)

26.6 Addressing the Difficulty of ROW Acquisition

Recent experiences from other road projects (e.g. JICA's Detailed Engineering Design Study for Matanog – Barira - Almada - Libungan Road and Tapian - Lebak Road under the Road Network Development Project in Conflict-affected Areas in Mindanao and ADB's Feasibility Study (FS), Detailed Engineering Design (DED) and Construction Supervision (CS) for Reconstruction and Development Plan For a Greater Marawi– Stage 2) assisted by international development partners revealed that land ownership issue in Bangsamoro is complex and complicated. In most cases, majority land claimants affected by the project lacked sufficient documents to prove ownership. This considerably delay both the acquisition of the land and the start of the project because the concerned agency could not legally acquire the land for ROW without sufficient authentic documents.

For the above reason, the BARMM through its MAFAR (Ministry of Agriculture, Fisheries and Agrarian Reform) and MENRE (Ministry of Environment, Natural Resources and Energy) may further strengthen their programs aim to improve land tenurial system in the area. The GCA may include among their prioritized areas for land titling the proposed ROW of road projects to support speedy implementation of the identified projects in the study.

26.7 Implementation of the three (3) Action Plans under this survey

Three (3) high priority projects were subjected for Action Plans under this survey. These are the (i) West Diversion Road, (ii) Mindanao River Southside Road, and (iii) Water Supply Improvement in Greater Cotabato Area. The three projects were found to be economically viable, hence efforts should be made to push these projects to undergo the full feasibility study.

For the two road projects, preliminary design was carried out based on secondary data. Hence, it is recommended to carry out the following surveys during the full feasibility study:

- Topographic survey
- Geotechnical survey

Final alignment will be decided based on various factors (e.g. alignment with less affected structures is better) including the results of the two surveys.

26.8 Consideration for tsunami and flood

(1) Tsunami

Considering the tsunami inundation area indicated by the tsunami hazard map for Maguindanao Province, simulation model may not represent well enough the effect of tsunami running up along rivers. Therefore, more detailed tsunami simulation study should be conducted. The study is also useful to evaluate tsunami force on the West Diversion Road (WDR) and the effect of mitigating inland damage.

In the initial stage of the WDR project, barrage or sluice gate to prevent tsunami run up through the rivers or the culvers of WDR are not planned. Accordingly, WDR will contribute to mitigate tsunami damage by decreasing the tsunami energy and the inside inundation depth and delaying the inside arrival time, however, it cannot completely prevent tsunami intrusion. Therefore, evacuation facility such as tsunami tower should be also constructed.

(2) Flood

Since the WDR is going to lie vertical to the Mindanao River, the embankment road may worsen the upstream drainage in flooding. If flood control projects such as the Ambal-Simuay and Rio Grande de Mindanao project are completed to have enough flow capacity to prevent frequent flooding from the Mindanao River, it will not be a big issue. However, before the completion, the countermeasures against floods should be studied.

26.9 Conduct of Feasibility Studies for other High Priority Projects

As shown in the table below, of the nine (9) priority projects identified for various sectors, only three (3) were subjected for action plan study. The other projects, although equally important but they were not covered for action plan study due to limited time and resources. For projects where the lead is the national government, the BARMM government may appeal for support from the national government to undertake the feasibility study or other type of study necessary to pursue the realization of the project. For projects under the local government units, collaborative efforts may be pursued among the BARMM government and the six LGUs to share the cost of the study. Both solid waste management project and disaster risk reduction management project have high potential for collaboration since these problems are common among the LGUs. Similarly, support from development partners (e.g. JICA, ADB, WB) may be sought by the concerned LGUs.

Table 26.9-1 High Priority Projects per Sector

Sector	Project/Program	Score	Rank	Action plan study undertaken in this survey?	In-charge
***Road/ Disaster Risk Reduction**	West Diversion Road (Tsunami barrier)	**96**	**1**	Yes	DPWH/ MPW-BARMM
***Road**	Mindanao River Southside Road Development Project	**96**	**1**	Yes	DPWH/ MPW-BARMM
***Airport**	Improvement of Existing Cotabato Airport	83	7	No	DOTr/ MOTC-BARMM
***Port**	Updating of Timako Port FS and Construction of the Port	78	9	No	PPA/MOTC-BARMM
Water Supply	Water Supply Capacity Expansion of Metro Cotabato Water District (MCWD)	**95**	**3**	Yes	MCWD
Sewage	Capacity Building for Sanitation Improvement in Greater Cotabato Area	94	4	No	LGU Cotabato City
Solid Waste	Construction of New Sanitary Landfill (SLF)	94	4	No	LGUs
Power supply	Capacity Enhancement in the Event of Power Outage	79	8	No	MAGELCO/ CLPC
***Disaster Risk Reduction**	Project for Building Tsunami Disaster Resilient Community	91	6	No	DPWH/ MPW-BARMM/ LGUs

Note 1: *National Government is the lead agency; Note 2: In view of sufficient plan of the DOTr concerning the existing Cotabato Airport (Awang), the FS may instead be conducted for a new airport

26.10 Immediate Rehabilitation of Roads in Poor Condition and Non-functional Roadside Drainage

Immediate rehabilitation of roads in “bad” and “very bad” condition identified in the road condition survey is necessary to address the limited capacity of the road network. Equally important is the immediate rehabilitation of the identified non-functional roadside drainage which is significant contributor to the recurrent flooding in Cotabato City. Implementation of these two projects may be done immediately since feasibility study is no longer required.

26.11 Regularization of Traffic Count Survey, Travel Speed Survey, Road Condition Survey and Drainage Condition Survey

The road network of Cotabato City is rather limited, hence its capacity is also limited. To attain better flow of traffic, there is a need to identify the bottlenecks in the network. This survey undertook various surveys resulting to the identification of these bottlenecks and corresponding measures are proposed (under “Asset Preservation” and “Traffic Management Sub-plan” of Chapter 11). Of the various surveys conducted under this survey, three (3) important surveys have to be sustained to guide the formulation of future traffic rules and regulations, identify priority roads and sections of drainage system for repair, among others. In this direction, the following surveys might be pursued:

Traffic Survey

A collaboration between the City Government of Cotabato (CGC) with the Engineering Department of the leading universities in Cotabato City (Notre Dame University and Cotabato State University) might be fruitful. The traffic data is useful for academic papers (conference papers and students’ thesis) and useful to the CGC for policy intervention. Both institutions will benefit from the said collaboration.

Travel Speed Survey

This is also a possible area for collaboration between the CGC and the leading universities for the same purposes mentioned above. Or the CGC through its City Engineering Office may execute it on its own.

Road Condition Survey and Drainage Condition Survey

For the road condition survey, JICA has donated two (2) DRIMS (Dynamic Response Intelligent Monitoring System) equipment to the MPW-BARMM. Collaboration between the City Engineering Office of the City Government of Cotabato and the MPW-BARMM will make the road condition survey easier. DRIMS equipment is mounted on a car making the survey fast and less labor-intensive.