I. Initial Environmental Examination (IEE)

Table of Contents

Page

List of Tables

Table

List of Tabs.

Tab.

List of Figs.

Fig.

I. INITIAL ENVIRONMENTAL EXAMINATION (IEE)

1 INTRODUCTION

1.1 Project Background

1.1.1 Background of the Study

The Japan International Cooperation Agency (JICA) had provided technical assistance to the Government of the Philippines (GOP) through the preparation of the "Study on the Nationwide Flood Risk Assessment and the Flood Mitigation Plan for the Selected Areas in the Republic of the Philippines" (the Study).

The Study includes the development of flood mitigation plans using non-structural and structural interventions that are identified for each of the model river basins in the Study.

An Initial Environmental Examination (IEE) was undertaken for each model river basin in order to establish the environmental and social feasibility of the proposed flood mitigation projects. The IEE process includes the conduct of onsite environmental and social scoping, assessment of potential environmental and human related impacts, and preparation of mitigation and environmental management plans (EMP).

It was specified in the JICA Environmental and Social Safeguards Guidelines that the Study/Master Plan falls under Category B which requires the preparation of an IEE report.

1.1.2 Background of Selection of Model River Basin

Fifty-six (56) river basins have been selected as a result of the Second Screening. These 56 river basins have been classified into several groups by flood damage type. In principal, the grouping was made on the basis of flood damage type. However, most of the river basins suffer from not only one flood damage type, but also a combination of plural flood damage type such as debris flow and flash flood in the upstream, bank erosion and overflow in the middle and downstream, and inland flooding in the downstream. Therefore, the above 56 river basins were finally classified into six (6) groups. The model river basins were selected from each of the six (6) groups considering the following principle:

- Two (2) model river basins are selected from each region (Luzon, Visayas and Mindanao);
- In principle high priority is given to a higher-ranking river basin; and
- Also, high priority is given to a river basin with enough data and information.

As a result, the following river basins are selected as the model river basins:

Table I-1-1 Model River Basins

Group	Name of River Basin	Region
F+O+B, F+B Type	Ilog-Hilabangan	VI, VII (Visayas)
O+B Type	Dungcaan	VIII (Visayas)
F+O, O, F Type	Meycauayan	III, NCR (Luzon)
F+O+B+I, F+I Type	Kinanliman	IV-A (Luzon)
F+O+I, F+I+B, F+I Type	Tuganay	XI (Mindanao)
F+O+B+I+L Type	Dinanggasan	X (Mindanao)

1.2 Requirements for the Initial Environmental Examination

1.2.1 Policy Categorization and Requirement

Section 1.7 of the JICA Guidelines for Environmental and Social Considerations (2004) has clearly defines that all technical cooperation projects shall perform an environmental impact assessment (EIA) study consistent with the environmental and social safeguards policy for Japan Official Development Assistance (ODA) projects.

Based on the purpose and scale of the master plan (preparatory stage), the minimum requirement for environmental and social considerations is to conduct an IEE, although certain projects, depending on the type and magnitude of flood control measures, may require an expanded IEE that is typical in Feasibility Studies.

1.2.2 JICA Procedures on Environmental and Social Considerations

Projects that are proposed for technical cooperation have to undergo a review and confirmation process by the Japan's Ministry of Foreign Affairs (MOFA). Details of project preparation shall depend on the type and sector of the proposed project or undertaking. For the master plan, the following steps shall be observed.

- JICA conducts the preparatory study for the cooperation project. JICA dispatches the necessary expert(s) for environmental and social considerations to conduct field survey for Category A and B cooperation projects and also, if necessary, for a Category C cooperation project;
- JICA examines measures for environmental and social considerations described in the request. In addition, JICA conducts information gathering, field survey and consultations with the recipient government. On the basis of collected information and consultations, JICA categorizes project through the second screening and reviews the categorization when necessary;
- JICA conducts provisional scoping according to categorization and prepares draft of the Terms of Reference (TOR) for environmental and social considerations study. For the Category A study, JICA conducts field survey, obtains information and opinions from local stakeholders, and incorporates results into the draft of the TOR;

- JICA consults with the recipient government about environmental and social considerations and concludes mutual undertakings, partnership and coordination; and
- JICA prepares the draft of the Scope of Work (S/W) after consultation with the recipient government about the organizational structure of environmental and social considerations. JICA obtains basic agreement from the recipient government to incorporate results of environmental and social considerations study into the decision-making process of the project.

Issues raised by stakeholders (resident perception, LGU officials, DPWH, local disaster coordinating councils, etc.) and the JICA Study Team during the scoping process have been fully understood and the results are included in this IEE report.

Public disclosure of the environmental and social information in the IEE of the cooperation project shall meet the requirements of Section 2.1 of the JICA guidelines.

1.2.3 Existing Country System on Environmental Impact Assessment

The preparation of the IEE report is conducted consistent with the Philippine Environmental Policy of attaining and maintaining a rational and orderly balance between socio-economic growth and environmental protection through the sustainable use, development, management, renewal and conservation of the country's natural resources, including the protection and enhancement of the quality of the environment.

It is mandated by law that all projects that introduce change in the existing environment or cause negative environmental impacts shall undergo the screening process prescribed in Presidential Decree (PD) 1586, the Philippine Environmental Impact Statement System.

The Philippine EIS objective or framework is to screen early the project undertakings by defining the scope and scale of environmental assessment needed. The implementing rules and regulation (IRR) of PD 1586 was first issued through the Department of Environment and Natural Resources Administrative Order (DENR-DAO) 96-37. In 2003, this administrative order was revised and enhanced with the issuance of DAO 2003-30 which provides a comprehensive procedural manual for environmental impact assessment.

Section 4, Article II of the Implementing Rules and Regulations (IRR) of DAO 2003-30 presents the categories of projects/undertakings under the Philippine Environmental Impact Statement (EIS) System. Definitions of these project categories are as stated below:

- Category A – Environmentally critical projects (ECPs) with significant potential to cause negative environmental impacts;
- Category B – Projects that are not categorized as ECPs, but which may cause negative environmental impacts because they are located in environmentally critical areas (ECAs);
- Category C and Category D – Projects unlikely to cause adverse environmental impacts.

1.2.4 Minimum Content of the IEE Report

The minimum contents of the IEE study that is prescribed under the JICA Environmental and Social Considerations and DENR DAO 2003-30 are as follows.

- Brief description of the proposed projects and alternatives;
- Existing conditions of the model river basins covering social environment, natural environment and pollution;
- Environmental elements identified in the scoping which might be subject to moderate adverse impacts on the model river basins for each project alternative;
- Preliminary assessment of the impacts of each alternative case on the environmental elements mentioned above; and
- Description of the possible mitigation measures for the impacts.

As to resettlement, there is no comprehensive policy in the Philippines that govern involuntary resettlement. For foreign-assisted projects with a component involving Right-of-Way acquisition and resettlement, the DPWH follows the Land Acquisition, Resettlement, Rehabilitation Policy and Indigenous People (LARIP). For locally-funded projects, DPWH follows Republic Act 8974 or "An Act to Facilitate the Acquisition of Right-of-Way, Site or Location for National Infrastructure Projects and for Other Purposes."

1.3 IEE Approach and Methodology

The primary purpose of the IEE is to investigate and describe impacts of the proposed flood mitigation project to the existing environmental elements.

Specifically, the study aims to predict the potential impacts of the project activities and recommend mitigation and abatement measures for impacts (in the pre-construction, construction and operational stages of development) that are considered potentially adverse to the surrounding environment.

In general, this IEE intends to:

- Examine and describe the existing status of the various ecological, physical and human related components surrounding the project area;
- Predict the potential significant impacts of the project on the surrounding environment during the pre-construction, construction, operations and maintenance stages and recommend appropriate mitigation and abatement measures; and
- Identify residual impacts of the project and recommend appropriate short-term and long-term management plans.

1.3.1 Data Sources of the IEE

The following documents were used as reference in the preparation of the IEE report:

- Result of technical field survey/investigations
- Result of key informant survey, onsite scoping, scoping with implementing agency (DPWH-ESSO), and water quality and sediment analysis
- Interim Report prepared by the Study Team
- Socio-economic and operational profile of the LGUs located within the model river basins and identified as impact area of the immediate action plan for the flood mitigation project
- Comprehensive Land Use Plans of the LGUs located within the model river basins and identified as impact area for the immediate action plan
- DENR DAO 2003-20 otherwise known as the Implementing Rules and Regulation of PD 1586 (Philippine Environmental Impact Statement System)
- DAO 35 (Revised Effluent Regulation of 1990)
- DAO 34 (Revised Water Usage and Classification/Water Quality Criteria)
- RA 6969 (Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990)
- Clean Air Act
- Clean Water Act

For the purpose of identifying the institutional responsibilities, the IEE took note of the following information:

- Review of existing agencies and organizations involved in flood mitigation operations.
- Flow of management information during flood occurrences.
- Legislation concerning flood mitigation and reports of national government agencies on the historical records of flood occurrences including damages and extent of impact.

1.3.2 Scoping/Baseline Data Gathering

Scoping of issues to be addressed in the IEE was conducted early in the assessment process to collect the appropriate baseline information so that collected and the IEE report/study can focused on the relevant issues needed in the master plan.

The objectives of undertaking the scoping activities were:

- To provide an early link among the implementing agency, the recipient and affected community and the IEE preparer;
- To ensure that the IEE will address only relevant issues and concerns;
- To present the scope of environmental studies, issues and alternatives that requires thorough examination and consideration in the master plan; and
- To ensure complete coverage of potential environmental and social issues that is required under the JICA Environmental and Social Considerations.

Aside from the natural environmental conditions and pollution issues, other significant concerns relating to the project include:

- Assessment of direct and indirect project benefits, including:
- Health and sanitation conditions
- Flood occurrences and damages
- Resettlement and Land Acquisition
  - Identifying land to be acquired and the affected persons;
  - Their economic status and impact of loss of land;
  - Institutional arrangements for processing resettlement;

The summary of the environmental elements that were evaluated for the flood mitigation project is presented in Tab.I-1-1. The process of sourcing the environmental elements is briefly discussed below.

(1) Physical Environment

1) Meteorology

Basic meteorological characteristics such as climate, rainfall, temperature, relative humidity and prevailing surface winds were obtained from the Philippine Atmospheric, Geophysical and Astronomic Services Administration (PAGASA).

2) Topography, Geology, Geomorphology and Pedology

Information on these above physical features were obtained from various published sources as well as from the national government agency tasked to document such information. Among the government agencies visited were the Philippine Institute of Volcanology and Seismology (PHILVOCS), the Department of Agriculture (DA), the Bureau of Soils and Water Resources (BSWM), the National Mapping Resources and Information Agency (NAMRIA), the Mines and Geosciences Bureau (MGB), and the Local Government Units (LGUs) located within the model river basins.

The assessment of the physical components was envisioned to:

- Describe the existing geologic, topographic, and soil conditions in the basin;
- Identify possible geologic hazards and assess the threats they pose to the project; and
- Recommend measures to minimize the impacts of the project on geologic and soil conditions and to recommend means to minimize the geologic hazards, if any.

3) Hydrology and Water Quality Survey

A review on the Interim Report of the Study was made and compared with the information obtained from the Department of Environment and Natural Resources (DENR), NAMRIA, Philippine Atmospheric Geophysical and Astronomical Services Administration (PAGASA) and other agencies with shared responsibility in hydrology and water quality.

Validation of the secondary data was made by the actual field visits at the identified project sites. Water quality sampling and analysis of freshwater were also performed to evaluate the extent of pollution.

4) Riverbed Sediment Quality Survey

The determination of the riverbed quality was achieved through the assessment of heavy metal concentration in the sediments. Essentially the objective of this procedure was to have an idea of the level of heavy metal contamination on the potential dredged materials that may require special disposal schemes.

5) Air Quality Survey

The ambient air quality at the project sites was obtained from secondary sources since the nature and extent of the flood mitigation projects are not perceived to cause damage or deterioration in the air quality around each model river basin.

(2) Biological Environment

1) Vegetation, Mangrove and Protected Areas

The identification of the type of vegetation at the primary impact zone was done during the field investigation by observing patches of vegetation growth. Secondary data published from the LGUs socio-economic profile and CLUP were used as references especially in identifying the affected areas within the city/municipality.

Vast source of data were also obtained from the website of the Protected Areas and Wildlife Bureau (PAWB) of the DENR, particularly, the records of protected areas.

2) Fish, Aquatic Habitats and Wildlife

Fish, aquatic habitats and wildlife existence were documented with reference to the LGU records and interviews of the local people along the subject river. Additional information was sourced from the DENR-PAWB.

(3) Socio-Economic Environment

1) Land and Resource Use

Data were sourced from the existing land use plan and socio-economic profile of the LGU(s) where most of the project development plans (immediate action plan) are located. This was then validated onsite to determine the applicability of data reflected in the land use plan.

2) Socio-Economic and Human Related Aspects

Socio-economic parameters include concerns on whether there will be adverse impact on the existing businesses, especially agri-businesses; on the sources of income and livelihood of families and individuals; on the schooling of school-aged children and youth; and, on the physical displacement/resettlement of families, especially those within the proximity of disaster-prone areas and/or where the structural measures may be erected.

Some of the parameters included population dynamics, health conditions, and waste management among others. Key informant interview (survey) was also conducted.

The field visits/investigation survey yielded numerous data on the local conditions. However, only the related and essential information to the implementation of the flood mitigation project were picked up as discussed in this IEE report.

1.3.3 Prediction of Potential Environmental Impact

The environmental examination of the proposed projects includes impact identification, prediction and assessment. Impact identification is important in identifying the project components that may alter or affect the environment.

Prediction of the potential impact was studied intently and is made comprehensive which covering the alternatives and providing key information for effective decision-making.

The Study Team decided to simplify the predicted impacts and enumerate the nature and extent of such environmental impacts in a matrix format.

1.3.4 Identification of Mitigating Measures and Preparation of EMP

The goal of preparing the EMP is to recommend doable environmental management and environmental protection measures whose purpose is to:

- Mitigate negative environmental impacts;
- Provide in-kind compensation for lost environmental resources; and
- Enhance the quality of environmental resources.

The mitigation measures in the EMP may include the following approach/solutions:

- The technical work program of mitigating adverse impacts, including details of required tasks and reports, and necessary staff, skills, supplies and equipment;
- A detailed accounting of the estimated costs of implementing the plan; and,
- The planned operation or implementation scheme including a staffing chart and proposed schedules of participation by the project management, and activities and inputs from various government agencies.

In addition to the EMP, an Environmental Monitoring Plan (EMoP) was prepared in order to maintain quality control and ensure that detailed environmental protection measures are adopted.

2 PROJECT DESCRIPTION

The characteristics of the alternative projects are described in the Chapter 5 of the Main Report. After the IEE survey was conducted some ideas on the structural measures for the model river basins were proposed and added from the technical point of view. These additional alternatives were concluded as not weighty plans through the stage of technical consideration so that IEE survey for these project alternatives was not additionally conducted.

The comparative chart between the latest alternatives and previous alternatives is shown below;

Table I-2-1 Comparative Chart between the Latest and Previous Alternatives

	Alternatives		Previous Alternatives (described in this report)	Final Report
Ilog-Hilabangan	A	River channel improvement of the Ilog-Hilabangan River	Alternative 1 (IL-1)	Case-1
	B	Diversion Channel using Old Ilog River, and river channel improvement in the upstream	Alternative 2 (IL-2)	Case-2
	C	Combination of river channel improvement and diversion channel	Alternative 1+2 (DU-1+ DU-2)	Case-3
Dungcaan	A	River channel improvement including river mouth mangrove into river area	Alternative 2 (DU-2)	Case-1
	B	River channel improvement excluding river mouth mangrove from river area	Alternative 2 (DU-2)	Case-2
	C	Combination of the river channel improvement and the dam and reservoir (Case A is adopted for the river channel improvement)	Alternative 1 (DU-1)	---
Meycauayan	A	Combination of river channel improvement and drainage facilities	Alternative 1 (ME-1)	Case-2
	B	Case A plus river channel improvement (dredging) in the downstream until the river mouth	Alternative 1 (ME-1)	Case-1
Kinanliman	A	Combination of river improvement and sabo dam	Alternative 1 (KI-1)	Case-1
Tuganay	T-A	River channel improvement	Alternative 1 (TU-1)	T-1 + I-1
Anibongan (Tributary)	T-B A-A	River channel improvement + Retarding Basins Without gate between Tuganay River	Alternative 2 (TU-2)	T-2 + I-2 A-1
	A-B	Combination of river channel improvement, gate and retarding basin	---	A-2
	A-C	Combination of river channel improvement, gate and diversion channel	---	A-3
	A-D	Combination of river channel improvement, gate and pump	---	A-4
Dinanggasan	A	Joint river basin of Dinanggasan River and the Compol River	Alternative 1 (DI-1)	Case-1
	B	Separate river basins of Dinanggasan River and the Compol River	Alternative 2 (DI-2)	Case-2

The hatched alternatives indicate the recommended alternatives from the technical, economical, social and environmental points of view.

3 ENVIRONMENTAL SETTING

3.1 Ilog-Hilabangan River Basin

The Ilog-Hilabangan River Basin is generally rural in nature except for the Poblacion district of Kabankalan City and the Municipality of Ilog. Both LGUs have vast tracks of land devoted to agricultural activity which are mostly sugarcane plantation. Aside from a few sugarcane farms, crops and banana plantations are also found adjacent to Ilog River.

Field survey results showed (refer to Fig.I-3-1) that the recommended river improvement works along the main channel of Ilog River will have to consider the following existing environmental conditions.

- Sugarcane plantations along the left and right bank of Ilog River
- Quarrying operations at the silted portion and confluence of Hilabangan River and Ilog River
- Irregular patches of mangroves and nipa palms approaching Panay Gulf
- Banana plantation and fishpond at the left bank towards the river mouth
- Approximately 30 residential households situated along Ilog River

On the other hand, the existing environmental conditions along Old Ilog River exhibit the features shown in Fig.I-3-1.

3.1.1 Natural Conditions

(1) Watershed Management

Current flood control structures and projects in the river basin include revetment works, dredging at the mouth of Ilog River and reforestation of 902 hectares of watershed protected area (CENRO, DENR). Despite of this river basin improvement works, flood occurred in this river basin last September 29, 2007 which inundated 11 barangays and displaced about 1,000 residents in the Municipality of Ilog (Municipal Disaster Coordinating Council).

(2) Erosion Potential

Based on the field investigation, river banks have high erosion potential and are continuously deteriorating. It is also evident from the visual quality of water and the widespread siltation along the river system. This can be attributed to the poor vegetative cover in the mountainous portions of Kabankalan City.

(3) Surface Water and Groundwater Use

Sources of domestic water are springs, wells, boreholes, rivers and creeks. Groundwater and spring water that come from the Ilog-Hilabangan River Basin are mainly used for drinking, while the remaining sources are used for irrigation.

(4) Quality of River Bottom Sediment

Heavy metal concentration in six (6) sediment samples was compared with the United States Environmental Protection Agency (USEPA) permissible toxicity level for biosolids in the absence of any Philippine soil standards. The USEPA established maximum contaminant levels (MCL) as thresholds for protecting public health and the environment.

Analysis of the sediment samples showed concentration levels of heavy metals within the allowable MCL. Thus, the river sediments may be disposed on land without producing adverse effects on human and ecological health (refer to Tab.I-3-1 and Fig.I-3-7).

(5) Vegetation

Various types of vegetation such as mangroves, nipa palms, grasses, sugar canes and shrubs are found in the Study Area.

The riparian vegetation is composed primarily of nipa palms and other mangrove species, which are sporadically distributed along the river banks (including Old Ilog River which has a marshland or a natural wetland).

(6) Fish and Wildlife

Thirty-eight (38) species of fish from mangrove swamps have been recorded, 36 of which are edible. The invertebrate fauna includes 17 species of gastropods, 20 species of pelecypods, 22 species of crustaceans, one species of chiton and one species of brachiopod. The estuaries are also important for a wide variety of resident and migratory waterfowl.

(7) Endangered and Threatened Species

In this river basin, there are no sanctuary of the 80 species of birds, 33 species of mammals, 18 species of reptiles and 15 species of amphibians that are designated by DENR as species for conservation in the Philippines (CITES). The results of field survey did not also reveal flora species which can be classified into threatened or endangered species. (Refer to Tab.I-3-7)

(8) Protected Area

The 2004 Statistics of Philippine Protected Areas and Wildlife Resources (DENR, PAWB) have identified two protected areas within the Ilog-Hilabangan River Basin. One of them is the Ilog-Hilabangan Watershed Forest Reserve (WFR) that is shared by the Municipality of

Himamaylan and the City of Kabankalan in Negros Occidental. The other protected area is the Kabankalan WFR whose area of coverage is solely within the political boundary of Kabankalan City, Negros Occidental. (Refer to Tab.I-3-8)

3.1.2 Social Conditions

(1) Land Use along Ilog River

The stretch of land along Ilog River from the confluence of Hilabangan River to Panay Gulf is mostly agricultural. These lands are a mixture of private and publicly owned or hacienderos (large farm lot owners). Although there are existing Philippine regulations requiring the buffer zones along main river channels, these were not seen in this river basin because agricultural crops are planted until the edge of the river banks.

(2) Urban Land Use

1) City of Kabankalan

The total urban area is 3,115.0 hectares (31.2 km^2), just 4.5% of the total land area. More than one-fifth of the urban area is used for agriculture and more than a third is used for residential area. Land use for commercial, institutional and parks makes up more than 7% of the land.

2) Municipality of Ilog

The total urban area is approximately 6,621 hectares (66.2 km^2), which represents nearly more than one-fifth of the entire land area of the municipality. Even in the urban area, land use is predominantly agriculture, which accounts for nearly 91.8%.

(3) Number and Size of Households

The total number of households is 27,851 and the total household population of Kabankalan City is 149,605. The average household size is estimated to be 5.37 persons per household. It is noteworthy that the average household size in the urban area (5.31) is lower than that in the rural area (5.39), suggesting greater awareness on population management and responsible reproductive health.

In the Municipality of Ilog, the total number of households is 9,141 and the total household population is 46,469. The average household size is estimated to be 5.08 persons per household representing a dramatic decline from the 1995 level of 5.23. It is noteworthy that the average household size in the urban area (5.03) is lower than that in the rural area (5.10).

(4) Local Economy

The main economic activity in this river basin is agriculture and aquaculture, and sugarcane is the primary agricultural product. Agricultural investment varies from agricultural production to livestock and fish production.

Other sources of income are tourism, commerce and trade, sugarcane industry, mining of mineral deposits (e.g., lime, phosphate, coal and metallic minerals) and rice mills (refer to Tab.I-3-9 and Tab.I-3-10).

(5) Public Utilities

This river basin has access to the following essential public infrastructure/utilities:

- Power supply provided by Negros Occidental Electric Cooperative (NOCECO)
- Roads and Bridges (2 bridges in Ilog and 2 bridges in Kabankalan will be directly affected by the river widening activities)
- Telecommunication

3.1.3 Public Hazardous Elements

(1) Solid Waste Management

Garbage or waste materials at the city proper of Kabankalan are gathered from each household through the city's garbage compactors and dump trucks. The city has implemented a "No Segregation, No Collection" policy which has greatly reduced residual waste to a minimum.

In Ilog, poor solid waste management and disposal system exist since it does not have any dumpsite or equipment. Based on key Informant Interview, it was confirmed that the major methods of waste disposal are the traditional burning, burying and dumping into the river.

(2) Water Quality

The result of the water quality analysis for the six (6) water samples (refer to Tab.I-3-12 and Fig.I-3-7) showed that Biological Oxygen Demand (BOD) exceeds the permissible limits for Class C standards of the Department of Environment and Natural Resources Administrative Order (DAO) No. 34. The upper and lower reaches of Ilog River exhibit high turbidity levels compared to Hilabangan River. This is an affirmation of the high sedimentation and the disturbance of shallow sections.

Ilog-Hilabangan River is tapped for drinking water supply because the samples failed the permissible limits for coliforms in Class A, B and C.

(3) Air Quality and Noise

Secondary data information for the Ilog-Hilabangan River Basin was gathered from the Environmental Impact Statement of the Balacotoc-Magballo Multipurpose Irrigation Project at Kabankalan, Negros Occidental.

The observed TSP level ranged from 14 to 136 μg/Ncm. This value was below the DENR 1-hr standards of 300μg/Ncm. The measured SO_2 level for the four stations ranged from 10.44 to 20.42 μg/Ncm which are within the allowable DENR 1-hr limit of 340 μg/Ncm. On the other hand, the NO_2 ranged from nil or negligible level to 5.60 μg/Ncm way below the 1-hr standard of DENR at 260 μg/Ncm.

For noise, the measured level was from below 40 to 54 dB (A) for the four (4) sampling stations. The observed noise is typical for rural areas where noise level is in ambient conditions. The area can be considered as residential/agricultural where night and day time period limits are 45 and 55 dB(A), respectively.

3.2 Dungcaan River Basin

The present conditions in the Dungcaan River Basin feature a typical fast growing pattern in economic development where human settlements are densely located near the coastal area.

Significant onsite environmental and social conditions (refer to Fig.I-3-2) were observed during the field investigation conducted along the stretch of the Dungcaan River riparian area. Among the sets of significant observation are the following:

- Severe bank erosion along Dungcaan River especially at the vicinity of the proposed Spur Dike;
- Natural wetland near the river mouth where mangrove and fishponds exist;
- A community living near the mangrove area that is at risk of getting displaced once the proposed dike is constructed; and
- A community living near the proposed site of the Multipurpose Reservoir.

3.2.1 Natural Conditions

(1) Erosion Potential

Severe bank erosion is prevalent along the upper and lower stretches of Dungcaan River channel. This scenario of bank erosion is evident in the area of the proposed Spur Dike.

The City Government of Baybay has also documented in their Comprehensive Land Use Plan (CLUP) that there are around 6,400 hectares of land in the city that are classified with no apparent erosion, 1,728 hectares slightly eroded, 3,776 hectares moderately-severely eroded and

15,330 hectares as very severely eroded. The steepness of the slopes of the surrounding mountain ranges may be the factor to have catalyzed the areas where there is a higher percentage of erosion.

(2) Surface Water and Groundwater Use

The existing surface and groundwater resources are used by the Local Government Unit (LGU) of Baybay for various beneficial use systems (CLUP, Baybay City). It has also been reported that the groundwater and spring water are used for domestic water supply including drinking.

(3) Quality of River Bottom Sediment

Four (4) sediment samples were obtained along Dungcaan River and brought to the laboratory for heavy metals analysis. Heavy metal concentration in the sediment samples was compared with the United States Environmental Protection Agency (USEPA) permissible toxicity level for biosolids in the absence of any Philippine standards. (Refer to Tab. I-3-2 and Fig.I-3-8)
The USEPA established maximum contaminant levels (MCL) as thresholds for protecting public health and the environment. Analysis of the sediment samples in the four (4) sampling stations showed concentration levels of heavy metals were within the allowable MCL. Thus, the river sediments may be disposed on land without producing adverse effects on human and ecological health.

(4) Vegetation

Various types of vegetation were found in the riparian area along Dungcaan River. These include mangroves, ferns, grasses, banana, coconut trees, nipa palms and shrubs.
The riparian vegetation is composed primarily of nipa palm and other mangrove species. Such species are significant due to their ecological importance to aquatic organisms particularly for fishes. As expected, mangrove vegetation becomes thicker as it reaches the mouth of the river from Dungcaan Bridge. According to the CLUP of Baybay City, the total area covered by mangroves in the city is 4.13 hectares. Mangrove trees are valued for their considerable loss in number due to habitat destruction and logging.

(5) Fish and Wildlife

According to fisher folks in the area, common freshwater fishes found in most rivers are bangus (Chanos chanos), tilapia (Oreochromis sp.), dalag (Channa sp.), catfish (Hito sp.), bia (Redigobius sp.) and lapu-lapu (Epinephelus polystigma). Crustacean includes freshwater crabs. These types of fish found in the freshwater are the species being propagated in fishponds.

In the case of Philippine wildlife, the DENR published a national red list of species which are considered threatened. From this record, no specific wildlife fauna was identified to have existed/lived in this river basin.

(6) Endangered and Threatened Species

In this river basin, there are no sanctuary of the 80 species of birds, 33 species of mammals, 18 species of reptiles and 15 species of amphibians that are designated by DENR as species for conservation in the Philippines (CITES). The results of field survey did not also reveal flora species which can be classified into threatened or endangered species. (Refer to Tab. I-3-7)

(7) Protected Area

The City of Baybay, Leyte is sharing with Abuyog, Leyte the Kuapnit Balinsasayao National Park. This park has an area of 364 hectares that has been declared as a protected area through Presidential Proclamation No. 142 dated April 16, 1937 (Refer to Tab. I-3-8).

3.2.2 Social Conditions

(1) General Land Use

Nearly half of the land area of the City of Baybay is utilized for agriculture while more than two-fifths are considered as forest areas. A large patch of land is occupied by the Leyte State University, also known as Visayas State College of Agriculture (VISCA).
In terms of land use, the city's land area is subdivided into the following:

- Built-up Areas
- Agricultural Areas
- Forest Areas
- Fishponds/Swamps/Mangroves
- Grassland Areas
- Open Water Spaces
- Institutional Areas
- Road Network and Transportation Utilities
- Agri-Industrial Areas
- Other Land Uses (dumpsite, burial/cemetery, etc.)

(2) Number and Size of Households

The total number of households in Baybay City is 19,517 and the total household population is 95,330 (CLUP). The average household size is estimated to be 4.9 persons per household. It is noteworthy that the average household size in the rural area is lower than that in the urban area

(3) Public Utilities

Water is supplied to all the barangays by the Baybay Water District, although there are parts in the barangays that are served by the Level II system. Level I water system remains available in various rural barangays.

Electricity is provided for the whole city by the Leyte Electric Cooperative (LEYECO) IV with the capacity of 3.75 MVA with the service area covering 12,679 households. A lot of non-served areas are found in the rural areas.

3.2.3 Public Hazardous Elements

(1) Solid Waste Management

Garbage or waste materials at the city proper are gathered from each household through the city's garbage truck. These are in turn dumped in their dumping site located at Barangay Gubang. Non-served communities, which are mostly in the rural areas, are practicing burial/entombment and burning in managing their domestic solid waste.

(2) Water Quality

Water quality samples were obtained in four (4) different locations along Dungcaan River. The selection of the sampling stations was based on the following criteria:

- Accessibility;
- Safety/risk; and
- Sufficiency in volumetric flow rate (for good mixing and representativeness).

Except for the Biological Oxygen Demand (BOD), the test results (shown in Tab.I-3-13 and Fig.I-3-8) in the four water samples showed that Dungcaan River (stretch of the river where the samples were obtained) falls within the DENR Class A standards (refer to Tab.I-3-11). Applicable water usage for Class A fresh water is for Public Water Supply Class II.

In 2004, the DENR had identified the water quality at the downstream of Dungcaan River (close to Baybay Bridge) as Class C. Water quality parameters under Class C exhibit concentration levels that can be used for fishery and recreational activities like boating.

(3) Air Quality and Noise

Air quality condition in this river basin is expected to exhibit air quality parameters, e.g., TSP, SO_2, NO_2 below the threshold limits set by the Philippine Clean Air Act of 1999 because of its rural condition. Even in the urban center of Baybay City, air quality is not expected to surpass the National Ambient Air Quality Standards (NAAQS) Guideline Values due to the good dispersion in the area and the limited sources of contamination, i.e., mobile, stationary and area.

It can be inferred that the air quality condition in Baybay City is better than that of the regional center which is Tacloban City. In 2004, the DENR had published results of nationwide air quality monitoring that showed annual mean total suspended particulates (TSP) concentration in the regional center of Tacloban City equals to 100 μg/Nm^3, which is slightly higher than the 90 μg/Nm^3 NAAQS.

3.3 Meycauayan River Basin

The environmental state of the Meycauayan River Basin can be considered to feature an urbanized environment with most areas as highly urbanized because of its close proximity to Metro Manila. The Municipality of Marilao has an urban set-up, while most parts of Valenzuela City, the Municipality of Obando and Meycauayan City are highly urbanized. The field survey showed (refer to Fig.I-3-3) that the proposed river improvement works along Meycauayan River and Marilao River will have to consider the following existing environmental conditions:

- Strip of palm and banana, and patches of coconut vegetation along the banks of Meycauayan River and Marilao River;
- Fishponds that are adjacent to the project area; and
- Approximately 90 residential households situated immediately along the project area.

3.3.1 Natural Conditions

(1) Watershed Management

There is no established watershed management in the area covered by Meycauayan, Marilao and Obando. The black/grey color in the river water of Meycauayan River as well as the brown color in the water of Marilao River, with widespread garbage deposition indicates that industrial, commercial and residential activities have massively polluted the river water.

The following action plans may be necessary to determine the rehabilitation strategy for the watershed:

- Characterization of watershed;
- Identification of baseline riverbed sediments; and
- Monitoring of critical areas.

(2) Erosion Potential

The stretches of the Meycauayan and Marilao riverbanks have existing dikes with a combination of concrete and earth linings. Some portions of these dikes have a high potential for soil erosion, while in other areas erosion is significantly minimized.

(3) Surface Water and Groundwater Use

Water is supplied to all the barangays by the local Water District (Level III – individual household connection) although records indicate that only about two-fifths of the total households in the service area are actually served (Meycauayan SEP, 2006). Although this river basin is characterized to have urban conditions, there are certain households that are still using the Level I (hand pump) water supply system.

Commercial establishments and industries operating in the area draw their water needs from deep groundwater wells. This contributes to the land subsidence and the lowering of groundwater table and the high level of salt water intrusion, as reported by the National Water Resources Board (NWRB).

(4) Quality of River Bottom Sediment

Heavy metal concentration in six (6) sediment samples was compared with the United States Environmental Protection Agency (USEPA) permissible toxicity level for biosolids in the absence of any Philippine soil standards. The USEPA established maximum contaminant levels (MCL) as thresholds for protecting public health and the environment (Refer to Tab.I-3-3 and Fig.I-3-9).

Analysis of the sediment samples showed concentration levels of heavy metals were within the allowable MCL. Thus, the river sediments may be disposed on land without producing adverse effects on human and ecological health.

(5) Vegetation

Various types of vegetation such as mangroves (VOM area), coconut, banana, and mostly graminae species are found in this river basin. The riparian vegetation is composed primarily of nipa palm and other mangrove species in the VOM area, while banana plants and coconut trees are observed along the Marilao and Meycauayan River channels. However, very few can be observed since most of the riverbank stretches in this river basin were installed with dikes.

(6) Fish and Wildlife

Field interviews among the community residents along the river system did not yield positive identification of the presence of any wildlife species. This could be attributed to the highly urbanized and developed conditions of the surrounding environment.

Several fishponds were observed along Meycauayan River and Marilao River during the ocular inspection, and these were mostly used for raising tilapia, milkfish and prawn. Some of these fishponds were said to be non-operational except for one fishpond in Barangay Calbaryo, which is adjacent to Meycauayan River (located in the upstream left bank).

(7) Endangered/Threatened Species

According to the list published by PAWB, no particular species was identified to be endangered within this river basin.

(8) Protected Areas

The Meycauayan River Basin does not locate in the nearest protected area which is the Angat Watershed located northeast of the City of Meycauayan (refer to Tab.I-3-8).

3.3.2 Social Conditions

(1) Land Use along Meycauayan River

The stretch of land along Meycauayan River from the point of confluence with Marilao River up to the North Luzon Expressway (NLEX) is approximately 4.8 kilometers. Along this stretch, around 1 kilometer length of the riverbank is a densely populated area. Another patch of nearly 0.44 kilometers is a vegetation area of palm and mangrove, while another stretch of the river, near the NLEX running to about 0.3 kilometers, is a sparsely populated site.

(2) Land Use along Marilao River

The stretch of land along Marilao River from the point of confluence with Meycauayan River up to the NLEX is approximately 4.7 kilometers. Along this stretch, nearly 3.0 kilometers are used as residential, with minimal areas occupied by palm/mangrove and with an industrial facility near the NLEX.

(3) Population Dynamics

The total number of households in the City of Meycauayan is 34,882, while the total number of household population is 162,281. The average household size is estimated to be 4.65 persons per household. Further, the population density of the city is 50.79 persons per hectare. In the Municipality of Marilao, the total number of households is 22,363, and the total household population is 100,925. The average household size is estimated to be 4.51 persons per household. It is noteworthy that actual field observation indicates the existence of informal settlers in Meycauayan although official records can not be solicited.

(4) Local Economy

The main economic activity in this river basin is jewelry and leather-craft although a substantial portion of land is allotted for agri-based activity such as fishponds. There is however a noticeable decline in agricultural and fishpond income as well as in other agri-based investments.

This is due to the effect of high urbanization even in the local service sector (Refer to Tab.I-3-9 and Tab.I-3-10).

(5) Public Utilities

This river basin has access to the following essential public infrastructure/utilities:

- Power supply provided by Manila Electric Company (MERALCO)
- Roads and Bridges (at least 3 bridges in Meycauayan and 3 bridges in Marilao will be directly affected once the height of the existing dike is raised)
- Telecommunication

3.3.3 Public Hazardous Elements

(1) Solid Waste Management

Solid waste deposits and the amount of solid wastes collected at the riverbanks are mostly taken by river flow at the confluence of the two river channels (i.e., Marilao River and Meycauayan River) near Barabgay Wawang Pulo and Barabgay Ubihan.
This may be the effect of open and indiscriminate dumping of domestic refuse by residents and business establishments adjacent to the river systems of this river basin.

(2) Water Quality

The water quality in the above river systems exhibits a degraded environment. Levels of dissolved oxygen (DO) in all the sampling stations (refer to Tab.I-3-14 and Fig.I-3-9) except for Obando (Station No. 6) are below 1.0 which is prohibitive to any biological growth. The extent of contamination is also reflected in the BOD levels which all failed the DAO 34 standards for all classes of surface water. The TSS concentrations are also above the standards in the three (3) surface water classifications. Furthermore, the microbial contamination from fecal and other coliform organisms exceeds DAO-34 standards for Class A, B and C (refer to Tab.I-3-11).

(3) Air Quality and Noise

The TSP level in the record of the DENR exceeded four times the TSP standard of 230 µg/Ncm. Lead concentration in the atmosphere is four times above the allowable DENR standard value of 1.5 µg/Ncm for the period Jan-Mar 2006.
For SO_2 and NO_2 pollutants, measurement at Saluysoy Station showed the SO_2 level exceeding by five times the DENR standard of 0.7 ppm, and only once has the NO_2 level have been exceeded the standard of 0.8 ppm in the period January to March 2006.
As for noise level near or along national roads, the typical level of a traffic generated noise is about 65 to 90 dB (A) with an average level of 70 dB (A). For the noise level in uninhabited

location far from domestic and traffic sources, typically noise is about 40 to 50 dB (A). The project area is located in industrial areas with some residential houses. The area can be Class B of DENR standards with allowable noise limit of 55 to 65 dB (A) for night and day time periods, respectively.

3.4 Kinanliman River Basin

The environmental condition in the Kinanliman River Basin is generally rural, and resembles a classical pattern in development where human settlements are densely located in the coastal zone/area.

Among the significant environmental onsite conditions (refer to Fig.I-3-4) along Kinanliman River are:

- Existing community waterworks project upstream and downstream of the proposed Sabo Dam
- Natural vegetation, e.g., coconut trees, banana, locally grown trees and weeds
- Severe erosion and exposed earth in the upstream stretch of Kinanliman River at the vicinity of the Sabo Dam
- Necessary excavation to be excavated/dredged to facilitate the flow at around the spur dike

3.4.1 Natural Conditions

(1) Erosion Potential

Based on the field investigation, upstream river banks have high erosion potential and are continuously deteriorating. This case is worsened by the steep slopes of the surrounding mountain ranges, which are the origin of the Kinanliman River's headwaters. The weathered soil and aggregate sediments indicate the movement of debris and its eventual deposit in the downstream portion of the river.

(2) Surface Water and Groundwater Use

There are two main water supply providers in the municipality; namely, the Municipal Waterworks System and the Puerto Real Water Linkage and Sewerage System. Water is sourced from natural springs, rivers and shallow/deep wells.

(3) Quality of River Bottom Sediment

Heavy metal concentration in three (3) sediment samples was compared with the United States Environmental Protection Agency (USEPA) permissible toxicity level for biosolids in the absence of any Philippine soil standards. The USEPA established maximum contaminant levels

(MCL) as thresholds for protecting public health and the environment (refer to Tab.I-3-4 and Fig.I-3-10).

Analysis of the sediment samples showed concentration levels of heavy metals were within the allowable MCL. Thus, the river sediments may be disposed on land without producing adverse effects on human and ecological health.

(4) Vegetation

Various types of vegetation can be found at the vicinity of this river basin. However, the significant vegetation is those that exist in the riparian section along Kinanliman River such as grasses, spots of land with banana, fast growing local trees (said to be purposely planted to prevent damage to the existing dike) and shrubs.

Other riparian vegetation is mangrove which is locating along the coastline of Barangay Cawayan, approximately 2 kilometers north of the Kinanliman River's mouth.

(5) Fish and Wildlife

Fish sanctuary in this river basin covers the stretch of the beach front from Barangay Kiloloran to Barangay Capalong. Fishponds in the area consist of 272 hectares of brackish water and 10 hectares of fresh water. These fishponds are situated in Cawayan, Real, Quezon (Refer to Tab.I-3-7).

(6) Endangered and Threatened Species

According to the red list of Philippine wildlife, endangered species such as Philippine macaque, wild rat, and Philippine deer and other faunal species are known to exist in the mountainous area of the Kinanliman River Basin. These include bird species such as Rufous Hornbill (Buceros hydrocorax), Rufous concae, Forest Kingfisher, Spotted Wood King Fisher and Luzon Little Crow. Monkey, bat, migratory birds, wild chicken, wild pig, kalao, snakes, butterfly and dragonfly also exist.

(7) Protected Area

The protected Area Systems (NIPAS) proclaimed the Quezon Protected Landscape on June 2, 2003 under Presidential Proclamation No. 394. Another declared protected site is the Land Grant issued to the University of the Philippines via proclamation No. 129-D (refer to Tab.I-3-8).

3.4.2 Social Conditions

(1) General Land Use

Consequent to the geologic and topographic features of the Municipality of Real, only 16% of the total land area is relatively flat and suitable for urban expansion. Further, the municipal territory of Real is covered by several overlapping of presidential proclamations that reserve huge tracts of land for specific purposes. Nearly half of the land area of Real falls under these proclamations, to wit:

1) BURIQUELA National Park

This area, covering nearly 23,592 hectares, was declared as a national park, wildlife sanctuary and game refuge under Presidential Proclamation No. 1636 on 18 April 1977.

2) UP Land Grant

This land area, covering 6,436 hectares, was granted by the National Government as endowment to the University of the Philippines under Proclamation 129-D. Some portions of this reservation overlap with the BURIQUELA National Park.

3) DAR Reservation Lot 1

This reservation covers a total of 2,646 hectares within portions of Barangays Maunlad, Masikip and Pandan. This is meant for distribution to qualified agrarian reform beneficiaries.

4) Proclamation 196

This proclamation curved out about 9,550 hectares from the BURIQUELA National Park for the Comprehensive Agrarian Reform Law. Nearly 8,450 hectares had already been earmarked for distribution as agricultural plots.

5) Other Agricultural Resettlements

There are two (2) smaller agricultural settlement areas: 1,734 hectares in Barangay Llavac; and the Camagong-Anilad (Proclamation 262) covering 700 hectares in Barangay Malapad. These reservations are within the BURUQUELA National Park reservation.

(2) Land Use along Kinanliman River

Current use of land varies along the entire stretch of Kinanliman River. The upstream area is generally mountainous and forested, while downstream river segments are built-up and agricultural areas. A majority of the strip of land along the river channel remains idle with locally growing species of grass, shrubs and trees.

(3) Number and Size of Households

The total number of households is 5,849, and the total household population is 30,627. The average household size is estimated 5.24 persons per household. It is noteworthy that the average household size in the rural area is lower than that in the urban area.

Given the number and size of households in the whole municipality, there has been no informal settler within the vicinity of the proposed structural measures in Kinanliman River.

(4) Local Economy

The main economic activities in this river basin are agriculture livestock production, fish production, commerce and trade, quarrying and cottage industry, and tourism (Refer to Tab.I-3-9 and Tab.I-3-10).

(5) Public Utilities

This river basin has access to the following essential public infrastructure/utilities:

- Power supply provided by Quezon Electric Cooperative Inc. II (QUEZELCO II)
- Roads and Kinanliman Bridge (will be directly affected by the river widening activities)
- Telecommunications from local telephone companies and cellular phone service providers

3.4.3 Public Hazardous Elements

(1) Solid Waste Management

To date, Kinanliman River is not yet contaminated with solid waste. This could be attributed to the regular collection of solid wastes and the presence of solid waste disposal facilities. In areas that are un-served by the disposal facilities, the common practice is disposal via pit entombment and backyard burning.
Solid waste materials, i.e., wrappers, plastic, silt, etc. are observed at certain sections of Kinanliman River near the urban settlement.

(2) Water Quality

The result of the water quality test (refer to Tab.I-3-15 and Fig.I-3-10) showed conformity with the permissible limits of DENR AO-34, Class A standards except for the presence of total coliform (refer to Tab.I-3-11). The high levels of coliform organism indicate the presence of human or animal excretal which is known sources of microbial contamination.

(3) Air Quality and Noise

There was no available information within the Kinanliman River Basin for air and noise parameters. The project area is a typical rural setting with no industrial plant that could be pollutant source/generator. Domestic and agriculture related activities, such as household cooking and agricultural waste burning, are the temporal sources of air pollutants. Local transportation is also a possible source of air pollution and noise within the area but in a minimum level. Intermittent high noise level to about 90 dB (A) maybe observed while vehicles

are passing along the roadways but eventually the condition goes back to the normal level thereafter.

3.5 Tuganay River Basin

The environmental condition in the Tuganay River Basin is generally rural and follows a setup common in most municipalities in the Province of Davao del Norte. Vast tracks of land are vegetated particularly with banana plants (Refer to Fig.I-3-5).

The onsite environmental conditions in this river basin are presented below for each river system where flood mitigation activities are proposed as follows.

Table I-3-1 Onsite Environmental Conditions (Tuganay River Basin)

River Name	Environmental Condition
Tuganay and Anibongan River	• Agricultural land adjacent to the proposed retarding basins. • Eroded embankment and estuarine area with natural vegetation of banana, rice field, few coconut trees, local trees and weeds. • Man-made channel connected to Tuganay River. • Residential households adjacent to the river channel including a community settlement located in Barangay Anibongan.
Ising River	• Community settlement in Purok 18 of Barangay Ising. • Few strips of mangroves and other natural vegetation, e.g., banana, coconut trees, weeds and local trees. • Foot bridge and a Church (Mormons) located downstream of the proposed retarding basin
Downstream section of Tuganay River and Ising River	• Natural vegetation is mangroves located in several patches along the riverbanks of the two river channels. Other mangrove sites are mostly found at the coastline and river mouth. The natural vegetation found in the area is locally grown trees, coconut trees, banana and weeds. • The mangroves located along Ising River have a potential of disturbance once the channelization works are designed to shift the majority of current river flow to the new channel line. • Settlers (approximately 20 households) or potential sites of PAF/PAP (displace entities) along the alignment of the proposed improvement in Tuganay River. • There are also residential houses (estimate is 10) located along the stretch of Ising River at Barangay Taba and Barangay La Paz.

3.5.1 Natural Conditions

(1) Erosion Potential

In the Municipality of Carmen, erosions that caused siltations at the riverbanks are observed in some areas along the main streams, Ising River, Tuganay River, etc.

(2) Surface Water and Groundwater Use

The Local Government Units (LGUs) located within the river basin have tapped the existing surface and groundwater resources for various beneficial use systems. It has been reported that

the groundwater and spring water can be used for drinking, and the water from the rivers and creeks can be used for irrigation and other purposes.

(3) Quality of River Bottom Sediment

Heavy metal concentration in the sediment samples was compared with the United States Environmental Protection Agency (USEPA) permissible toxicity level for biosolids in the absence of any Philippine soil standards. The USEPA established maximum contaminant levels (MCL) as thresholds for protecting public health and the environment (refer to Tab.I-3-5 and Fig.I-3-11).

Analysis of the five (5) sediment samples showed heavy metal concentrations within the allowable MCL. Thus, the river sediments may be disposed on land without producing adverse effects on human and ecological health.

(4) Vegetation

The most common vegetation found in the estuarine zone of Tuganay River is banana (major crops), rice, coconut, abaca, weeds and other tropical fruits.

The mangrove areas along the stretches of Ising River and Tuganay River are undocumented. Some LGUs located within this river basin have mangroves located near the coastlines (mouth of Tuganay River and sea). However, the presence of mangroves in such areas did not indicate the existence of mangrove reserves by the DENR-PAWB. The area of mangroves located near the coastline is 1.5 hectares. Its function is for the kaingeros/charcoal production.

(5) Fish and Wildlife

Unlike in a full Environmental Impact Assessment, the scope and information obtained through Initial Environmental Examination is only limited to visual presentation of the observations gathered in the field. Such activity would only describe the presence or absence of fish and wildlife.

The field survey was performed along Tuganay River, Ising River, Anibongan River and others with the objective of finding out the number and type of fish cultivation, existence of fish community and any form of wildlife (flora and fauna) (refer to Tab.I-3-7).

Results of the field survey and records of secondary baseline information show that there is minimal possibility of disturbing the wildlife habitat in Barangay San Isidro Wildlife Sanctuary (DENR, NIPAS).

It was mentioned in the CLUP of the municipality that fishponds occupy a total of 222.40 hectares and were developed in Barangays Taba, Lapaz, Tuganay, Ising, San Isidro and Anibongan. However, most of these fishponds are non-operational, and the others will not be displaced or directly affected by the proposed measures.

(6) Endangered and Threatened Species

In this river basin, there are no sanctuary of the 80 species of birds, 33 species of mammals, 18 species of reptiles and 15 species of amphibians that are designated by DENR as species for conservation in the Philippines (CITES). The results of field survey did not also reveal flora species which can be classified into threatened or endangered species.

3.5.2 Social Conditions

(1) General Land Use

The dominant land use in the area can be categorized into 1) built-up areas, 2) agro-industrial area, 3) forestland, 4) agricultural and 5) other uses such as quarry and tourist areas.

(2) Local Economy

A majority of the residents of the Municipality of Carman rely on the following sources of income:

- Agriculture
- Commerce and Trade
- Small Scale Agro-based Industry
- Quarrying
- Tourism

(3) Environmental Health and Sanitation

The Carmen Water District (CWD) provides the Poblacion area as well as portions of Barangay Tuganay with Level III water system. As much as 246 households and 45 commercial establishments are being served. Two (2) other barangays with level III water system are Barangays Minda and Magsaysay, each having one (1) pump with a capacity of 11 liters/second. There were no reported Level II water systems in the area; hence, the rest of the population have the Level I water systems.

97 % of households within the municipality use water-sealed sewer or septic tank sanitation facilities.

3.5.3 Public Hazardous Elements

(1) Solid Waste Management

Garbage or waste materials at the municipality are gathered from each household through the Municipality's garbage trucks. Nearly one fifth of the households dispose their waste materials

in this manner. However, a majority of the population practice composting of their solid wastes management. Nearly one-fourth practice burning and simply dumps their solid wastes into open pits.

(2) Water Quality

Characteristics of the water quality parameters taken along Tuganay River were compared with the Department of Environment and Natural Resources (DENR) Administrative Order 34 – Water Quality Standard Criteria for Water Body Classification (refer to Tab.I-3-11). The objective of comparing the concentration level with standard values is to establish the potential impact of project activities on the water body.

The water quality (refer to Tab.I-3-16 and Fig.I-3-11) of Tuganay River in the four (4) sampling stations indicates high microbial contamination (as indicated in the high level of fecal and total coliforms), which may be attributed to human and animal excretal.

Such scenario may also be linked to the runoff from the surrounding banana plantations as shown in the levels of BOD of the water samples, which have exceeded the permissible limits for Class C standards. The concentration of DO in all water samples was also slightly below the allowable standards for Class A, B and C surface waters.

(3) Air Quality and Noise

Air quality status in this river basin was compared (in the absence of primary data) with the DENR records of air quality at the nearest monitoring station/center. Essentially, the closest DENR monitoring station is found in Davao City, which has better economic activities and more number of air contaminant generators.

Such approach makes a useful pre-identification of the air quality conditions in the Municipality of Carmen and Braulio E. Dujali once the air quality conditions in Davao City fall within the national standards.

The Total Suspended Particulates (TSP) data measured within Metro Davao (National Ambient Air Status Report, 2004) were sourced at the sampling stations located at Barangay Bankerohan and along Quirino Avenue towards Bankerohan Bridge.

Roadside TSP in major roads of Davao City implied the occurrence of monthly variation due to meteorological factors and the volume of vehicles plying these areas. The TSP concentrations, that are beyond the 230 $\mu g/Nm^3$ short-term standard (National Ambient Air Quality Guideline value), may be attributed to the contamination from mobile sources and others. Based on these TSP values the extent of TSP level perceived to prevail in this river basin is expected to be substantially below the national standard.

3.6 Dinanggasan River Basin

The environmental condition in the Dinanggasan River Basin is generally rural and follows a setup common in most municipalities in the Island of Camiguin, where people settle near the coastal zone (Refer to Fig.I-3-6).

The onsite environmental conditions in this river basin are as presented below for each river, where the flood control activities are proposed.

Table I-3-2 Onsite Environmental Conditions (Dinanggasan River Basin)

River Name	Environmental Condition
Dinanggasan River	• Existing community irrigation project downstream of the proposed Sabo Dam. • Natural vegetation, e.g., bamboo, banana, locally grown trees and weeds. • Severe erosion and exposed earth in the upstream stretch of Dinanggasan at the vicinity of the proposed Sand Pocket and Sabo Dam • Necessity of excavation to facilitate the flow at the section in the downstream
Tag-Ibo River	• Existing water pipeline crossing Tag-Ibo River. • Natural vegetation, e.g., banana, coconut trees, rice, wheat, weeds and local trees. • Sporadic/isolated areas with cases of erosion and sedimentation.
Compol River	• Natural vegetation, e.g., weeds, locally grown trees, coconut trees and ferns. • Whole stretch of Compol River is dried up and filled with sediments/aggregates. • Approximately 18 residential houses distributed along the stretch of Compol River.

3.6.1 Natural Conditions

(1) Erosion Potential

The steep slopes at the foot of Mt. Hibok-Hibok and other exposed areas along the stretch of Dinanggasan River are prone to erosion, although the status of erosion along the river banks of Dinanggasan, Compol and Tag-Ibo is at a controlled state with the riparian area filled with vegetation.

Basically, the manner of utilizing the land is one of the major reasons for the cause of erosion. Given the physiological and topographical features, the vulnerability of bank erosion is higher.

(2) Surface Water and Groundwater Use

River flow originates from the slopes of Hibok-Hibok volcano before draining towards Macajalar Bay of Mindanao Sea. The closest river of Dinanggasan is Compol River in the east. There are the several rivers/creeks that supply water to the households and irrigation needs. Water supply for plants and animal use is obtained from stream channels and natural basins by construction of dam as shown in the Barangay Mainit Communal Irrigation System.

(3) Quality of River Bottom Sediment

Heavy metal concentration in the sediment samples was compared with the United States Environmental Protection Agency (USEPA) permissible toxicity level for biosolids in the absence of any Philippine soil standards. The USEPA established maximum contaminant levels (MCL) as thresholds for protecting public health and the environment (Refer to Tab.I-3-6 and Fig.I-3-12).

Analysis of the five (5) sediment samples showed heavy metal concentration was within the allowable MCL. Thus, the river sediments may be disposed on land without producing adverse effects on human and ecological health.

(4) Vegetation

Field survey was conducted along Compol River, Dinanggasan River and Tag-Ibo River so as to identify the vegetation in these river basins that can be directly affected by the proposed river channel improvement works.

The identified vegetation is namely: untreated banana plants, coconut trees, ornamental plants, imperata grasses, fruit bearing trees and ferns.

(5) Fish and Wildlife

Unlike a full Environmental Impact Assessment, the scope and information obtained through Initial Environmental Examination are only limited to visual presentation of the observations gathered in the field. Such activity would only describe the presence or absence of fish and wildlife.

The field survey was performed along Dinanggasan River, Compol River and Tag-Ibo River with the objective of finding out the number and type of fish cultivation, existence of fish community, and any form of wildlife (flora and fauna).

The field survey did not yield fish communities and wildlife resources along the said rivers. There are no river activities related to fish cultures or propagation given the Municipality's abundance of marine fish catch. Fish production in Catarman has a total area of 245,200 hectares of coastal and municipal fisheries. The municipality produces 636 tons of fish annually from the both full time and part time operators.

(6) Endangered and Threatened Species

There are no threatened or endangered species found within the vicinity of Dinanggasan, Tag-Ibo and Compol Rivers specifically near the proposed flood control project.

As for the Municipality, the endangered marine species, which can be found in the coastal areas and marine waters, are the giant clams, sea turtles, tabon birds and whales.

3.6.2 Social Conditions

(1) General Land Use

The major dominant land use in the Municipality can be categorized into 1) built-up areas, 2) agro-industrial area, 3) forestland, 4) grassland and 5) other uses such as quarry and tourist areas.

(2) Local Economy

A majority of the residents of the Municipality of Catarman including those living along Dinanggasan River, Compol River and Tag-Ibo River rely on the following sources of income:

- Agriculture
- Commerce and Trade
- Wood Industry
- Mining and Quarrying
- Tourism

(3) Health and Sanitation

All barangays in municipality are served by the local water works systems. However, most are inadequately served in spite of the facilities. The two biggest water works systems are the Poblacion Water Works System and the SAIL-Katughupan to Bonbon Water Works System.
Barangay Poblacion has problem on drainage canals because the municipal streets leading to the public market are clogged up and overflowed during heavy rains.
Type 3 Toilet Facility or water sealed toilet is predominant among the types of toilet facilities in the municipality. It accounts to 1,790 households. It is interesting to note that 322 households do not have any toilet facilities at all.

3.6.3 Public Hazardous Elements

(1) Solid Waste Management

There is no indication of illegally disposed solid waste materials in the river channel of Dinanggasan, Tag-Ibo and Compol Rivers. The river channels in this area are mostly placed with volcanic debris, e.g., boulders and aggregates that originates Mt. Hibok-Hibok.
The common practices of solid waste management of the residential communities in these river basins involve backyard burial and burning of domestic refuse. Such practices remain to be the most convenient means of solid waste management among the residential communities.

In the residential communities that are close to the existing dike (left embankment of Dinanggasan River towards the Macalajar Bay), the height of the dike makes things impractical and difficult for disposal of domestic refuse.

(2) Water Quality

The characteristics of the water quality parameters were compared with the Department of Environment and Natural Resources (DENR) Administrative Order 34 – Water Quality Standard Criteria for Water Body Classification (refer to Tab.I-3-11). The objective of comparing the concentration level with standard values is to establish the potential impact of project activities with the beneficial use of Dinanggasan River.

The water quality in the five sampling stations indicates microbial contamination (as indicated in the high level of fecal and total coliforms) which may be attributed to human and animal excretal. The level of BOD shown for Station No. 5 (refer to Tab.I-3-17 and Fig.I-3-12) exceeds the permissible limits for Class C standards. The level of BOD in station 4 may be a result of discharge coming from the residential area of Barangay Sto. Niño where the water sampling was made.

(3) Air Quality and Noise

The assessment of the air quality status in the river basins was made by way of comparing (in the absence of primary data) the DENR records of air quality in the nearby or similar area with the observed air quality conditions in the river basins.

In 2003, the maximum 24-hr average particulate matter concentration level in Cagayan de Oro was recorded at 75 $\mu g/Nm^3$ and the annual mean was 39 $\mu g/Nm^3$, which were below the NAAQS of 90 $\mu g/Nm^3$.

Visual inspection of the surrounding environment indicated a better air quality condition in the river basins because of its rural condition relative to the urban climate in Cagayan de Oro City.

4 FUTURE ENVIRONMENTAL SCENARIO WITHOUT THE PROJECT

This chapter outlines the overall of future environmental scenario without the flood control measures.

4.1 Worsening of Flood Conditions

Present flooding in the inundated areas will worsen, as follows:

- Especially if the increase in population will contribute to the uncontrolled disposal of domestic solid waste in waterways, absence of non-structural flood control programs such as dredging and watershed management, and the continued bank erosion.
- Under this scenario, the flow capacity of the existing river channel will be below the level of accepting peak flow/discharge. Such conditions could pose significant threat from worsening flooding incidence which could be felt in the rural and urban barangays that are currently flood-free.

4.2 Increase in Human and Health Flood Risks

Flooding damages cover not only monetary costs but also impacts on human lives. Records of flood incidence (by the Local and National Disaster Coordinating Councils) have already showed considerable damage to human lives. This is expected to increase under the without the project scenario.

4.3 Deterioration and Degradation of Environmental Conditions

The continuous bank erosion and the effect of high intensity rainfall from stronger typhoons will induce degradation of the river channel downstream. The negative repercussions of storm water - debris and sediments results to damages in agricultural land by exposing the soil layer along stream/river banks. Hence, damage to aquatic flora and fauna and the ecosystem in the estuarine area is eminent.

4.4 Piecemeal Approach to Environmental Management

The people in the LGUs within the inundated areas would lose the opportunity of informal education on integrated environmental management, the flood control project is deferred. Aside from achieving the project objectives, the flood control programs can introduce more information pertaining to solid waste management, sanitation improvement and watershed protection. The cost of deferring the

implementation of the project is a waste of the planning efforts already initiated by the stakeholders i.e., DPWH, LGU, etc.

4.5 Deteriorating Economic

The frequency of flooding and the threat of material loss and damages will mean declining value of investments and thus do not present an attractive climate for business. Many agricultural production areas situated along river banks will likely suffer economic setback with the loss in agricultural land and recurrent flood inundation. They are just a few examples and so many other phenomena are expected under the situation.

5 IMPACT ASSESSMENT AND MITIGATING MEASURES

This section of the IEE report presents the potential environmental and social impacts associated with the implementation of the various activities of the proposed flood control project. Each identified impacts particularly those which are negative in nature are presented together with its corresponding mitigating measures. This approach provides the information on the possible resolutions of the negative impacts. Thus, complications and misconceptions will be prevented in the whole impact assessment process.

To further detail the process of impact assessment, this section presents the timing of impacts that will likely arise during the pre-construction, construction and operational phase of the project development. Overall, this section of the IEE report provides the key recommendations in the decision-making process and in the proper selection of project alternatives.

5.1 Methodology in Impact Identification and Assessment

5.1.1 Impact Assessment Scenarios

The identification of the physico-chemical, ecological and human interest related potential environmental impacts were based on two distinct scenarios, as follows:

- "without-the-project scenario" and
- "with-the-project scenario"

The evaluation of the without-the-project scenario employs a simple qualitative approach, where the current conditions are viewed as continuing in nature. The discussions on the environmental and human related interest impacts under the "without the project scenario" are described in Chapter 4.

Under the "with-the-project scenario", all the environmental impacts and their corresponding mitigating measures, those are under each project alternative, are summarized in Tab.I-5-1 to Tab.I-5-11. Using the information presented in these tables, a decisional impact matrix (refer to Tab.I-5-12 to Tab.I-5-17) was developed by linking the actions under each project alternative to the impacts in the natural, socio-economic and public hazards environmental elements.

5.1.2 Impact Rating

A rating system is herein introduced that can establish the linkage between the direct and indirect impacts (which is difficult to be achieved in EIA checklist and matrix method). The system includes the identification of the potential impacts which are then given with specific impact description based on the following assessment criteria:

- According to its beneficial outcome (negative or positive);
- According to its area extent (localized or widespread);

- Nature of reversibility (reversible or irreversible);
- Magnitude (severe/moderate/low);
- Timing (during pre-construction/construction/operation);
- Likelihood/probability of occurrence (low/medium/high); and
- Duration (short term, long term, medium term).

(1) According to Beneficial Outcome

The most eminent impacts are those that are directly linked to the proposed alternatives, and can be connected (in space and time) to the action. Typical examples of direct impacts are:

- Loss of wetlands caused by flood control;
- Destruction of natural habitats caused by forest clearance;
- Relocation of displaced households/project affected persons caused by reservoir impoundment or dam construction;
- Increased air particulate emissions caused by operation of a cement plant, etc.

Indirect or secondary impacts are usually less apparent, they occur at a later time or distant from the impact source. Examples of these types of impact are:

- The spread of malaria/dengue fever as a result of drainage schemes that increase standing water and thereby create new breeding grounds; and
- Anxiety, stress and community disruption associated with increased traffic volumes and noise caused by bridge or road construction.

As a matter of simplifying the linkage between indirect and direct impact, any actions or activities of the project may be considered to have negative impacts, if it:

- Alters or has detrimental effects on natural systems (processes and conditions);
- Affects any area/item that the government seeks to protect; and
- Violates or exceeds government standards and/or known best practices.

On the other hand, impacts of activities may be classified as positive, if they:

- Ecologically and environmentally enhance existing conditions and processes;
- Reinforce the use of best practices; and
- Support government programs and efforts for environmental protection.

(2) Extent/Location

The spatial extent or zone of influence by the impacts can be predicted for site-specific conditions, e.g., widespread or localized.

(3) Magnitude

The primary importance in an environmental assessment is the estimation of the magnitude of the impact. The magnitude in terms of relative severity, such as severe, moderate or low is shown in the IEE study.

(4) Timing

The IEE considers the environmental impacts arising from all the stages of the project development cycle (i.e., during construction, operation and decommissioning). Thus, one can notice that some impacts will occur immediately, while others may be delayed.

(5) Duration

Duration is rated, such as the noise arising from the operation of equipment during construction may immediately be classified as short-term. Other impacts may be long-term, for example, the inundation of land for the construction of a reservoir/dam.
For simplicity, the duration of an impact is herein described using short term (less than 1 year), medium term (10 years) and long term (more than 10 years) impact indicators.

5.2 Environmental Impacts of the Flood Control Project

5.2.1 Pre-Construction Phase

Three (3) major activities, which are known sources of environmental and social impacts under the pre-construction phase, are (i) land acquisition, project mobilization activities (e.g., site clearing, mobilization of survey instruments, hiring of workers, dredging, etc.), (ii) disturbance to local infrastructure (e.g., bridge, utilities, etc.) and (iii) transport (mobility), and resettlement of project affected persons. The direct and indirect impacts of such activities for the respective river basins are outlined in the succeeding discussions.

(1) Ilog-Hilabangan River Basin

1) Geologic Consideration (Structural Integrity and Stability)

Particular attention shall be made on the characteristics of the geologic materials in the Ilog-Hilabangan River Basin, type of prevalent geologic structures, and the potential for occurrence of geologic hazards.
It is equally important for the proposed dike and revetments, which are susceptible to scouring due to high surface water velocity during storm events, to analyze the slope failure. Such analysis includes the design slope of the channel for safety and structural stability.

The level of groundwater is necessary as it greatly influences slope stability. Aside from the engineering properties of soils and rocks, ground motions have to be considered in the design of the proposed earth dike.

2) Disturbance from Site Clearing/Land and Right-of-Way Acquisition

During topographic survey and other technical investigations, temporary disturbance to soil, water and vegetation are unavoidable. Notably, the river improvement works along the Ilog River for alternative case-1 will affect nearly eight (8) sugar plantations, nine (9) nipa palms/mangrove sites, three (3) banana plantations, two (2) fishponds and power transmission lines. In the alternative case-2, nearly thirteen (13) sugar plantations, thirteen (13) nipa palms/mangrove sites, five (5) banana plantations, three (3) fishponds, power plant with transmission lines, and a prawn farm near the mouth of the river.

3) Disturbance of Wildlife

During site clearing, resettlement of disturbed wildlife habitat and feeding grounds will be incited due to strip vegetation. However, only insects and small animals may be displaced at this project development stage.

4) Resettlement of Communities

Based on the initial investigation of this river basin, given the possible flood mitigation measures that will be implemented, there is great likelihood of a substantial resettlement of families, especially those residing near river banks and areas where river improvement measures will be erected.

There are approximately 38 families, whose houses are located in either the right or left bank of the river that will be displaced if the proposed river improvement works will be along Old Ilog River (case-2). On the other hand, the planned river structures along Ilog River (case-1) will require resettlement of about 30 PAFs.

The probability of more communities/PAFs for resettlement is high, and this can cause an irreversible disturbance to the living condition of those entities. Since involuntary resettlement results to direct and severe impact, immediate attention shall be appropriately addressed by the LGUs and DPWH to reduce the indirect negative effect of loss of livelihood, education and access to public facilities/utilities.

5) Public Acceptance of the Project

Though the project is environmentally enhancing in nature which mitigates flood damages, public disclosure and pro-active information campaign shall be part of the project implementation arrangement.

(2) Dungcaan River Basin

1) Geologic Consideration (Structural Integrity and Stability)

Site geology for this type of project shall be given important consideration. The integrity of the proposed structures is primarily affected by the characteristics of the geologic materials in the Dungcaan River Basin, type of prevalent geologic structures, and the potential for occurrence of geologic hazards.

The proposed dikes and revetments are susceptible to scouring and slope failure. The level of groundwater is necessary as it greatly influences slope stability. The designed slope angle of the channel shall be established once the aforementioned parameters are obtained.

Aside from the engineering properties of soils and rocks, ground motions have to be considered in the design of the proposed multi-purpose dam structure.

2) Disturbance from Site Clearing

During topographic survey and other technical investigations, temporary disturbance to soil, water and vegetation are unavoidable.

3) Disturbance of Wildlife

During site clearing, resettlement of disturbed wildlife habitat and feeding grounds will be incited due to strip vegetation. However, only insects and small animals may be displaced at this project development stage.

4) Air Emission from the Mobilization of Equipment

The mobilization of heavy equipment during the pre-construction stage may generate dust and other suspended particulates in the vicinity. Increase in vehicle emissions such as CO_2, CO, NO_x and other suspended particulates are expected and can be a nuisance to the nearby residents. Noise level in the area may also increase due to the operation of construction equipment. The magnitude of noise disturbance is expected to be minimal.

5) Resettlement of Communities

Based on the initial investigation of the area, given the possible flood mitigation measures that will be implemented, there is great likelihood of a substantial resettlement of families especially those residing near river banks and areas where river improvement measures will be erected.

Notably, Sitio Brandy Island, Barangay Candadam is at ground-zero with its 114 families, and a population composed of 269 males and 240 females. Another set of about 20 families in the other sitio of Barangay Candadam faces the same risk of resettlement. Also at risk are families residing at Sitio Paradise Island, Barangay Sto. Rosario with no less than 20 families potentially resettled. The proposed dam at Barangay Ciabo will require resettlement of approximately 15 residential households.

The impact of community getting resettled will be significant and attention shall be appropriately addressed by the LGUs and DPWH.

6) Public Acceptance of the Project

Though the project is environmentally enhancing in nature which mitigates flood damages, the public shall be informed of the project implementation arrangement.

(3) Meycauayan River Basin

1) Disturbance from Site Clearing/Land and Right-of-Way Acquisition

During topographic survey and other technical investigations, temporary disturbance to soil, water and vegetation are unavoidable.

2) Disturbance of Wildlife

There are no identified wildlife reserves or wildlife species within the Meycauayan River Basin. Thus there is no expected impact to wildlife with the undertaking of pre-construction related activities, e.g., technical survey, water and sediment sampling, etc.

3) Resettlement of Communities

The proposed river and drainage improvement measures/structures for the Meycauayan River Basin are likely to cause resettlement of settlers, especially those residing near river banks and the areas close to the construction activities.

Numerous households/establishments are found along the stretch of the Marilao and Meycauayan River Channels. These structures are closely aggregated, even some settlers install their dwellings under the bridge along Marilao River.

An estimate of more than 90 PAPs will be resettled. The negative impact on the affected household may not only bring direct resettlement but also lead to the disturbance in the living condition and loss of livelihood, as well as closure/relocation of business establishments. This issue on involuntary resettlement must be given the keen attention so that appropriate measures are provided by the LGUs and DPWH.

4) Public Acceptance of the Project and Land Use Conflict

Though the project is environmentally enhancing in nature which mitigates flood damages, public disclosure and pro-active information campaign shall be part of the project implementation arrangement.

Such approach is equally important in handling the issue on potential conflict in land use. This conflict could arise in the event the LGUs will not allow the conversion of the land/fishpond into other special use. Consequently, a considerable number of people that are currently living in the area will be resettled physically and economically.

(4) Kinanliman River Basin

1) Geologic Consideration (Structural Integrity and Stability)

Particular attention shall be made on the characteristics of the geologic materials in the area, type of prevalent geologic structures, and the potential for occurrence of geologic hazards in the design of the dike, sabo dam and the reconstruction of Kinanliman Bridge.

Slope failure analysis is equally important for the proposed dike and revetments, which are susceptible to scouring.

The level of groundwater is necessary as it greatly influences slope stability. Aside from the engineering properties of soils and rocks, ground motions have to be considered in the design of the proposed dike and others.

2) Disturbance from Site Clearing/Land and Right-of-Way Acquisition

During topographic survey and other technical investigations temporary disturbance to soil, water and vegetation are unavoidable. Notably, the river improvement works along Kinanliman River will require the permanent removal of bamboo, banana, locally grown trees and weeds. There is also needed for land to be acquired throughout the river stretch where river improvement is needed.

3) Disturbance of Wildlife

During site clearing, resettlement of disturbed wildlife habitat and feeding grounds will be incited due to strip vegetation. However, only insects and small animals may be displaced at this project development stage.

4) Resettlement of Communities

The proposed flood control facilities will not result in any resettlement of local community settlers.

5) Public Acceptance of the Project

Though the project is environmentally enhancing in nature which mitigates flood damages, public disclosure and pro-active information campaign shall be part of the project implementation arrangement.

(5) Tuganay River Basin

Three (3) major activities which are known sources of environmental and social impacts under the pre-construction phase are (i) land acquisition, (ii) project mobilization activities (e.g., site clearing, mobilization of survey instruments, hiring of workers, etc.) and (iii) resettlement of project affected persons (in the implementation of both Alternatives, T-A and T-B). The direct and indirect impacts of such activities are outlined in the succeeding discussions.

1) Geologic Consideration (Structural Integrity and Stability)

Although there is no present geologic hazard/threat, the design of the river structures shall be given important consideration to prevent failure. Particular attention shall be made on the characteristics of the geologic materials.

2) Disturbance from Site Clearing/Land and Right-of-Way Acquisition

During topographic survey and other technical investigations, temporary disturbance to soil, water and vegetation are unavoidable.

3) Disturbance of Wildlife

The wildlife listed in Tab.I-3-7 does not live within the area close to the proposed flood control structures. Hence, the flood control project will not result in the disturbance of wildlife that is reported to have existed in the entire Province of Davao del Norte.

4) Resettlement of Communities

The proposed flood mitigation measures/structures for alternative T-A have a high potential to cause resettlement of families especially those residing near river banks and areas where river improvement measures will be erected. Not less than 15 residential households will be affected by the construction of the dike located in Barangay Anibongan. Not less than 34 residential households or PAFs will be resettled in the implementation of Alternative T-B. These negative social impacts will require community resettlement of project affected residential households.

The negative impact on the affected households may not only bring direct resettlement but also lead to the disturbance in the living condition and loss of livelihood. This issue on involuntary resettlement must be given the keen attention so that appropriate measures are provided by the LGUs and DPWH.

5) Public Acceptance of the Project

Although the project is environmentally enhancing in nature which flood damages, public disclosure and pro-active information campaign shall be part of the project implementation arrangement in order to achieve general public acceptance.

(6) Dinanggasan River Basin

1) Geologic Consideration (Structural Integrity and Stability)

There is an eminent geologic hazard/threat flood control facilities due to the proximity of Mt. Hibok-Hibok with the. As such, the design of the project structure shall be given important structural consideration. Particular attention shall be made on the characteristics of the geologic materials in the area, type of prevalent geologic structures, and the potential for recurrence of geologic hazards.

2) Disturbance from Site Clearing/Land and Right-of-Way Acquisition

During topographic survey and other technical investigations, temporary disturbance to soil, water and vegetation are unavoidable.

3) Disturbance of Wildlife

Wildlife breeding grounds at the slopes of Mt. Hibok-Hibok will not be disturbed as a result of survey works and field investigation for the identification of the site for the Sabo dam and sand pocket. There are no expected impacts to wildlife with the undertaking of pre-construction related activities, e.g., technical survey, water and sediment sampling, etc.

4) Resettlement of Communities

The proposed flood mitigation measures/structures for alternative A is not likely to cause resettlement of families, especially those residing near river banks and areas where river improvement measures will be erected. However, the construction of the proposed embankment along Compol River (Alternative B) will introduce negative impact as it will require resettlement of more than 18 residential household.

These households are not closely aggregated but are distributed along the stretch of Compol River where the embankment is proposed.

The negative impact on the affected households may not only bring direct resettlement but also lead to the disturbance in the living condition and loss of livelihood. This issue on involuntary resettlement must be given the keen attention so that appropriate measures are provided by the LGUs and DPWH.

5) Public Acceptance of the Project

Although the project is environmentally enhancing in nature which mitigates flood damages, public disclosure and pro-active information campaign shall be part of the project implementation arrangement.

5.2.2 Construction Phase

(1) Ilog-Hilabangan River Basin

During construction phase, the major construction activities that will likely exert positive and negative impacts to the environment are the civil works. Most of the construction phase impacts are short-term and can be mitigated.

1) Ecological Impacts

The civil works and earthmoving activities will entail the removal of ornamental plants, other locally available invasive (grows anywhere) trees, including natural vegetation (patches of grasses, weeds and bamboo, plantation of sugarcane, root crops, etc.).

Negative impacts may also arise in the removal of mangrove strips near the river mouth and other sites along Ilog River.

There are no endangered species of wildlife (mammals) specifically living or can be found in the area.

a) Loss of Vegetation and Increase in Soil Erosion

The removal of fruit bearing trees, ornamental plants and natural vegetation (patches of grasses, banana, ferns, etc.) along Ilog River (where civil works and earthmoving activities are programmed) and Old Ilog River is unavoidable. The removal of mangrove will only cover the areas within the Right-of-Way required to erect the dike.

Beneficial outcome upon completion of the proposed facilities includes unimpeded flood water flow to the sea and others.

Nonetheless, the proposed activities for each alternative will result to negative, medium-term or intermediate, moderate but reversible environmental impacts. The activities may also present indirect negative impacts like increase in soil erosion in the affected site.

b) Disturbance to Fish and Wildlife

Results of the field investigation and records of secondary baseline information showed no disturbance to wildlife.

There is one (i) fishpond adjacent to Ilog River located approximately 1.65 kilometers from Panay Gulf. This could be potentially at risk due to accidental release of construction debris and substance, e.g., cement mix, oils spills, etc. Under such circumstances, there will be negative impact on the survival of the fish but the probability of occurring is low, and the magnitude of the impact would range from low to moderate. Immediate implementation of mitigating measures can reverse the impact of any accidental spills. Hence, the impact duration will take effect only in the short-term.

c) Endangered and Threatened Species

Based on the DENR PAWB list of endangered flora and fauna, the proposed project will have no impact, since endangered or threatened species do not lived or thrived in the impact areas. Likewise, field interviews did not reveal the presence of endangered and threatened species.

There is no declaration on the status of Mangrove plantations and/or forest formation along Ilog River. Such formation is threatened by the implementation of the proposed alternative A and B, since Right-of-Way has to be established for the construction of the dike and sluice gates. Thus, removal or cutting of mangrove is inevitable. The magnitude of environmental impact may be severe and long-term in the absence of mitigating measures. Addressing this environmental concern would require re-vegetation of mangrove areas close to coastline/at the mouth of the river.

d) Protected Areas

The flood control infrastructures will complement and enhance the protected areas of the Ilog-Hilabangan River Basin. With the proposed project scenario, beneficial outcome and enhancement of the local and regional environmental conditions outweigh the critical impact that can be mitigated.

2) Physico-Chemical Impacts

a) Soil Resettlement and Increase in Turbidity in Ilog River from Quarrying/Dredging Operations

Quarries, dredge materials and borrow pits may be used as materials in the construction of the earth dike and other component structures.

However, such activity would result in environmental disturbance created during aggregate extraction and processing. This may then result in the change in geomorphology and land use.

The removal of agricultural land along Ilog River for the river improvement may also increase soil deposition or sedimentation.

There may be competition in the quarry of river materials near the confluence of Hilabangan and Ilog Rivers, which may spur competition and lead to partial loss in income of the licensed/contracted quarry operator. Such can cause moderate negative impact on the part of the quarry operator, but may introduce positive economic results for the LGUs of Kabankalan City.

The overall negative impact of dredging operations and quarrying of agricultural land along river banks is the difficulty in handling of disposal of spoils or dredge materials. These materials or debris end up in vacant lots and agricultural land, and may increase turbidity levels in Ilog River. The expected volume of soils and spoils, generated by the river widening will have intermediate and severe negative impact in the surrounding environment in the absence of an acceptable/appropriate disposal sites.

b) Threat of Chemical Hazards

One of the identified sources of hazards during construction is the potential generation of hazardous materials used in construction. Examples of hazardous materials that are typically found at construction sites are petroleum based products (e.g., lubricating oils, grease, etc.), fuels (e.g., gasoline, kerosene, etc.), solvents, paints, batteries, and other miscellaneous equipment and supplies. Spillage of gasoline and lubricants, used in heavy equipment maintenance and operations, can cause river water pollution. The environmental negative impacts may be considered low in magnitude and could occur during the construction process in the absence of better management practices.

c) Increase in Solid Waste Generation

Construction and demolition (CandD) debris may be generated by the demolition/removal of old revetment/slope stabilization structures. Components of CandD debris typically include concrete, wood and metals. Land clearing debris, such as stumps, rocks and dirt, are also considered CandD debris.

It is expected that during construction, spoils and other debris will be generated. However, waste streams are difficult to estimate because composition varies widely.

d) Change in Air Quality

The magnitude of potential air pollutants during the construction of the project is minimal considering the project size and type of construction activities. Re-suspension of dusts can happen due to the civil and ground works especially when the weather is dry. NO_x and SO_x may be emitted by heavy equipment used in the construction activities.

The increase in air pollution is only temporary and can be naturally dispersed by the wind movement in this river basin. As such, the impact on air quality and atmosphere at the local level is short-term and low in magnitude.

e) Air and Noise Emission from the Mobilization of Equipment

The mobilization of heavy equipment during the pre-construction stage may generate dust and other suspended particulates in the vicinity. Increase in vehicle emissions such as CO2, CO, NO_x and other suspended particulates are expected and can be a nuisance to the nearby residents. Noise level in the area may also increase due to the operation of construction equipment. The magnitude of noise disturbance is expected to be low and intermittent.

f) Noise Pollution from Construction Equipment/Machines

Unavoidable noise increase is expected in the construction sites due to heavy equipments operations. Such increase in noise level varies with time and can affect the area in the short-term. Among the affected receptors are residential households along the riverbanks.

However, the magnitude of noise disturbance is expected to vary intermittently from low to moderate.

The river improvement works may require earthworks equipment such as jackhammers, bulldozers, graders, payloaders, generators, backhoe, compressors and heavy trucks, which are known sources of noise. Some of this equipment will be used in constructing the earth dike and other river improvement facilities as well as in the dredging operations. The expected noise levels at various distances from the equipment are shown in Tab.I-3-18. The maximum allowable noise level is also shown in Tab.I-3-19 which is based on DENR standards for noise in general areas.

g) Change in Water Quality and Quantity

There will be an increase in water demand as a requirement for the civil works and the domestic consumption of laborers. The volume of demand however will be minimal. Any

water quantity concerns during the construction phase can be considered to have short-term effect and practically will not affect the existing water resources.

Excavation works, dredging of spoils, increasing the channel carrying capacity and the construction of flood control structures are expected to provide negative impacts to the water quality of Ilog and Hilabangan Rivers. The possible deterioration of the water quality in the said Rivers is just temporary in nature and can still be restored to the existing river quality. Among the potential changes in water quality are increased of suspended solids, turbidity, discoloration, presence of inorganic substance, i.e., oils, etc.

Such changes in the water quality may significantly cause adverse impacts to the existing aquatic biota in the water bodies, especially the estuarine ecosystem composed of mangroves. The extent of environmental impact may be treated as negative, localized and low effects.

Contamination of coastal waters during construction phase is possible due to improper disposal of construction debris which includes excavated (dredged) wastes/spoils.

(2) Dungcaan River Basin

1) Ecological Impacts

The civil works and earthmoving activities will entail the removal of ornamental plants and natural vegetation (patches of grasses) along the river banks. However, this removal is very minimal. There are no endangered species of wildlife (mammals) specifically living or can be found in the area.

a) Loss of Vegetation and Increase in Soil Erosion

The removal of fruit bearing trees, ornamental plants and natural vegetation (patches of grasses, banana, ferns, etc.) along Dungcaan River (where civil works and earthmoving activities are proposed) is unavoidable but considered short-term only. This may increase soil erosion in the affected site.

b) Disturbance to Fish and Wildlife

Results of the field investigation and records of secondary baseline information showed non-existence of wildlife along or nearby the proposed flood control facilities. Small numbers of fish were noticed while taking water quality samples along Dungcaan River. The observed kinds of fish were common in the area particularly those which escaped from fishponds operating by small creeks of Dungcaan River. There are also fishponds in Sitio Paradise Island, which are already abandoned due to the frequent escape of fish by the effect of tidal flood. No other similar types of fishponds are found along Dungcaan River. The release of construction debris and substance like cement mix may pose threat to the survival of the fish. Considering this current situation, the potential construction phase impact will be temporary and localized.

c) Endangered and Threatened Species

Based on the DENR PAWB list of endangered flora and fauna, the proposed project will have no impact since species that may be classified as endangered or threatened do not live or thrive in the impact areas.

d) Protected Areas

The proposed project activities and its component flood control infrastructures including the non-structural measures will complement and enhance the existing protected area in Baybay City. With the proposed project scenario, beneficial outcome and enhancement of the local and regional environmental conditions outweighs the adverse impact that can be mitigated.

2) Physico-Chemical Impacts

a) Soil Resettlement from Quarrying/Dredging

Quarries, dredge materials and borrow pits may be used to provide materials in the construction of the proposed dam/multi-purpose reservoir and other component of the civil works.

However, environmental disturbance are created during aggregate extraction and processing. This may then result in the change in geomorphology and land use.

The removal of land along the river banks as a result of increasing the channel capacity also increases the potential for soil deposition or sedimentation which can destroy natural breeding and spawning grounds of freshwater organisms.

Areas upstream of the proposed dam/multi-purpose reservoir which have poor forest cover and other agricultural land may pose potential threats to the river systems due to soil erosion, sedimentation, and siltation.

b) Threat of Chemical Hazards

One of the identified sources of hazards during construction is the potential generation of hazardous materials used in construction. Examples of hazardous materials that are typically found at construction sites are petroleum based products (e.g., lubricating oils, grease), fuels (e.g., gasoline, kerosene), solvents, paints, batteries, and other miscellaneous equipment and supplies. Spillage of gasoline and lubricants, used in heavy equipment maintenance and operations, can cause river water pollution. These impacts may be considered negligible or minimal since present construction management practices includes the correct handling of such materials.

c) Water Logging in Excavation Areas

In order to mitigate the temporary disruption and interference with surface waterways and drainage channels during construction, the contractor should provide temporary drainage diversion canals to redirect water flows. The scheme to be implemented must be able to prevent local water impoundment in the construction area and should be implemented with the least possible disturbance to the public.

d) Increase in Solid Waste Generation

Construction and Demolition (CandD) debris may be generated by the demolition/removal of old revetment/slope stabilization structures. Components of CandD debris typically include concrete, wood, and metals. Land clearing debris, such as stumps, rocks, and dirt, are also considered CandD debris.

It is expected that during construction, spoils and other debris will be generated. However, waste streams are difficult to estimate because composition varies widely.

e) Change in Air Quality

The magnitude of potential air pollutants during the construction of the project is minimal considering the project size and type of construction activities. Re-suspension of dusts can happen due to the civil and ground works especially when the weather is dry. NO_x and SO_x may be emitted by heavy equipment used in the construction activities.

Air pollution is only temporary and can be easily dispersed by the wind movement in this river basin. As such, the impact on air quality and atmosphere is nil to minimal.

f) Noise pollution from construction equipment/machines

Unavoidable noise increase is expected in the construction sites due to heavy equipments operations. Such increase in noise level varies with time and can affect the area in the short-term. Among the affected receptors are residential households along the riverbanks. However, the magnitude of noise disturbance is expected to vary from moderate to significant.

The river improvement works may require earthworks equipment such as jackhammers, bulldozers, graders, payloaders, generators, backhoe, compressors and heavy trucks which are known source of noise. Some of this equipment will be used in constructing the reservoir and other river improvement facilities as well as during dredging operations. The expected noise levels at various distances from the equipment are shown in Tab.I-3-18. The maximum allowable noise level is shown in Tab.I-3-19 which is based on DENR standards for noise in general areas.

g) Change in Water Quality and Quantity

There will be an increase in water demand as a requirement for the civil works and the domestic consumption of laborers. The volume of demand however will be minimal. Any water quantity concerns during the construction phase can be considered to have short-term effect and practically will not affect the existing water resources.

Excavation works, dredging of spoils, increasing the channel carrying capacity and the construction of flood control structures are expected to provide negative impacts to the water quality of Dungcaan River. The possible deterioration of the water quality in Dungcaan River is just temporary in nature and can still be reversed or restored to existing

river quality. Among the potential changes in water quality are increased in suspended solids, turbidity, discoloration, presence of inorganic substance i.e., oils, etc.

Such changes in the water quality may significantly cause adverse impacts to the existing aquatic biota in the water bodies, especially the estuarine ecosystem composed of mangroves and small fishes at the mouth of Dungcaan River. The extent of environmental impact may be treated as negative but short-term.

Contamination of coastal waters during construction phase is possible due to improper disposal of construction debris which includes excavated (dredged) wastes/spoils.

(3) Meycauayan River Basin

1) Ecological Impacts

The civil works and earthmoving activities will entail the removal of ornamental plants, fruit trees, locally available invasive (grows anywhere) trees and natural vegetation (patches of grasses and weeds, ferns, banana, mangrove and coconut trees) that are commonly found along the river banks of Meycauayan and Marilao Rivers.

a) Loss of Vegetation and Increase in Soil Erosion

The removal of natural vegetation (palm, ferns, etc.) along Meycauayan River is necessary to give way for the river improvement works particularly the construction of the dike. In the case of the proposed regulation pond, there is no vegetation and the proposed area which is currently idle is formerly used as fishpond.

In the removal of vegetation along the river systems the extent of negative impact can be considered negligible since the current level of pollution no longer promotes ecological growth. With the continued degradation of the river systems, the vegetation in the area will ultimately die. On top of this, the estuarine environment does not exhibit a renewable habitat because of the urbanized setup. Hence, the removal of few patches of vegetation along Meycauayan and Marilao Rivers will have short-term effect that can be mitigated by the completion of the proposed flood control facilities/measures.

The activities under alternative A may also present indirect negative impacts like increase in soil erosion in the course of clearing and grubbing the river banks during construction.

b) Disturbance to Fish and Wildlife

There have been considerable human activities in this river basin. It is presently divided into residential areas, commercial districts, industrial districts, and fishponds. There are no indications that it will be reverted to its original ecological setup. With this present land use pattern, presence of wildlife or wildlife habitat is expected to be less. The existing fishponds will not experience long-term disturbance. Although there is a potential change in water quality conditions during the construction of the dike, this can be mitigated by adopting best practices in construction. Furthermore, the final design will still allow continues supply of

river water needed in aquaculture. Nonetheless, economic compensation package of fishpond operators shall be provided during the pre-construction and construction period.

2) Physico-Chemical Impacts

a) Threat of Chemical Hazards

One of the identified sources of hazards during construction is the potential generation of hazardous materials used in construction. Examples of hazardous materials that are typically found at construction sites are petroleum based products (e.g., lubricating oils, grease), fuels (e.g., gasoline, kerosene), solvents, paints, batteries, and other miscellaneous equipment and supplies. Spillage of gasoline and lubricants, used in heavy equipment maintenance and operations, can cause river water pollution. The environmental impacts though negative may be considered low in magnitude and could occur during the construction process in the absence of better management practices.

b) Increase in Solid Waste Generation

Construction and Demolition (CandD) debris may be generated by the demolition/removal of old revetment/slope stabilization structures. Components of CandD debris typically include concrete, wood, and metals. Land clearing debris, such as stumps, rocks, and dirt, are also considered CandD debris.

It is expected that during construction, spoils and other debris will be generated. However, waste streams are difficult to estimate because composition varies widely.

c) Change in Air Quality

The magnitude of potential air pollutants during the construction of the project is minimal considering the project size and type of construction activities. Re-suspension of dusts can happen due to the civil and ground works especially when the weather is dry. NO_x and SO_x may be emitted by heavy equipment used in the construction activities.

The increase in air pollution is only temporary and can be dispersed naturally with good wind movement that is naturally prevailing along the stretch of the river systems. The negative impact on air quality and atmosphere at the local level is short-term and is low in magnitude.

d) Noise Emission from Construction Related Activities

Noise level will rise with the increase in use and continued operation of equipment during construction phase. The magnitude of noise disturbance is expected to be low and intermittent.

Unavoidable noise increase is expected in the construction sites due to heavy equipments operations. Such increase in noise level varies from low to moderate (depending on the source) and can affect the area in the short-term. Among the affected receptors are residential households, commercial establishment and industries located adjacent to the Meycauayan and Marilao River Channels.

Should the civil works (construction of dike, other river improvement facilities and dredging operations) used noise generating equipment such as jackhammers, bulldozers, graders, payloaders, generators, backhoe, compressors and heavy trucks the expected noise levels at various distances from these equipment are shown in Tab.I-3-18. Correspondingly, the operations of the construction equipment must be regulated in accordance to the maximum allowable noise level (refer to Tab.I-3-19) based on DENR standards for noise in general areas.

e) Change in Water Quality and Quantity

There will be an increase in water demand as a requirement for the civil works and the domestic consumption of laborers. The volume of demand however will be minimal. Any water quantity concerns during the construction phase can be considered to have short-term effect and practically will not affect the existing water resources.

Contamination of coastal waters during construction phase is possible due to improper disposal of construction debris which includes excavated (dredged) wastes/spoils.

(4) Kinanliman River Basin

1) Ecological Impacts

The civil works and earthmoving activities will entail the removal of ornamental plants, other locally available invasive (grows anywhere) trees, including natural vegetation which are present along the river banks.

There are no endangered species of wildlife (mammals) specifically living or can be found in the area.

a) Loss of Vegetation and Increase in Soil Erosion

The removal of fruit bearing trees, ornamental plants and natural vegetation (patches of grasses, banana, ferns, etc.) will only cover the areas within the Right-of-Way required to erect the dike.

Indirect effect of plant/vegetation removal and the construction of the dike may also present beneficial effect to the overall surface water hydrology. Beneficial outcome upon completion of the proposed facilities includes unimpeded flood water flow to the sea and controlled deposition of silts and debris.

Nonetheless, the proposed activities for each alternative will result to negative, medium-term or intermediate, moderate but reversible environmental impacts. The activities may also present indirect negative impacts like increase in soil erosion in the affected site.

b) Disturbance to Fish and Wildlife

Results of the field investigation and records of secondary baseline information showed no disturbance to wildlife. The field observation did not also reveal any presence of fish habitat or fish propagation along the main channel of Kinanliman River.

c) Endangered and Threatened Species

Based on the DENR PAWB list of endangered flora and fauna, the proposed project will have no impact since species that are classified as endangered or threatened do not lived or thrived in the impact areas. Likewise, field interviews did not reveal the presence of endangered and threatened species at the vicinity of the proposed flood control facilities.

d) Protected Areas

The flood control infrastructures – structural and the non-structural measures will complement and enhance the protected areas of the River Basin. With the proposed project scenario, beneficial outcome and enhancement of the local and regional environmental conditions outweighs the critical impact that can be mitigated.

2) Physico-Chemical Impacts

a) Soil Resettlement and Increase in Turbidity along Kinanliman River from Dredging Operations

Dredge materials and borrow pits may be used as materials in the construction of the dike and other component structures.

However, such activity would result in environmental disturbance created during aggregate extraction and processing. This may then result in the change in geomorphology and land use.

The whole component of the river improvement works although it results in channel capacity may also increase soil deposition or sedimentation.

The overall negative impact of dredging operations along river banks is the difficulty in handling and disposal of spoils or dredge materials. These materials or debris would end up in vacant lots and agricultural land and may increase turbidity levels in Kinanliman River. The expected volume of soil and spoils generated by the Channelization/dredging will have intermediate and severe negative impact in the surrounding environment in the absence of an acceptable/appropriate disposal sites.

b) Threat of Chemical Hazards

One of the identified sources of hazards during construction is the potential generation of hazardous materials used in construction. Examples of hazardous materials that are typically found at construction sites are petroleum based products (e.g., lubricating oils, grease), fuels (e.g., gasoline, kerosene), solvents, paints, batteries, and other miscellaneous equipment and supplies. Spillage of gasoline and lubricants, used in heavy equipment maintenance and operations, can cause river water pollution. The environmental impacts

though negative may be considered low in magnitude and could occur during the construction process in the absence of better management practices.

c) Increase in Solid Waste Generation

Construction and Demolition (CandD) debris may be generated by the demolition/removal of old revetment/slope stabilization structures. Components of CandD debris typically include concrete, wood, and metals. Land clearing debris, such as stumps, rocks, and dirt, are also considered CandD debris.

It is expected that during construction, spoils and other debris will be generated. However, waste streams are difficult to estimate because composition varies widely.

d) Change in Air Quality

The magnitude of potential air pollutants during the construction of the project is minimal considering the project size and type of construction activities. Re-suspension of dusts can happen due to the civil and ground works especially when the weather is dry. NO_x and SO_x may be emitted by heavy equipment used in the construction activities.

The increase in air pollution is only temporary and can be naturally dispersed by the wind movement in this river basin. As such, the impact on air quality and atmosphere at the local level is short-term and low in magnitude.

e) Air and Noise Emission from the Mobilization of Equipment

The mobilization of heavy equipment during the pre-construction stage may generate dust and other suspended particulates in the vicinity. Increase in vehicle emissions such as CO_2, CO, NO_x and other suspended particulates are expected and can be a nuisance to the nearby residents. Noise level in the area may also increase due to the operation of construction equipment. The magnitude of noise disturbance is expected to be low and intermittent.

f) Noise Pollution from Construction Equipment/Machines

Unavoidable noise increase is expected in the construction sites due to heavy equipments operations. Such increase in noise level varies with time and can affect the area in the short-term. Among the affected receptors are residential households near the riverbanks of the urban settlement near Kinanliman Bridge. However, the magnitude of noise disturbance is expected to vary intermittently from low to moderate.

The river improvement works may require earthworks equipment such as jackhammers, bulldozers, graders, payloaders, generators, backhoe, compressors and heavy trucks which are known source of noise. Some of this equipment will be used in constructing the earth dike and other river improvement facilities as well as in the dredging operations. The expected noise levels at various distances from the equipment are shown in Tab.I-3-18. The maximum allowable noise level is shown in Tab.I-3-19 which is based on DENR standards for noise in general areas.

g) Change in Water Quality and Quantity

There will be an increase in water demand as a requirement for the civil works and the domestic consumption of laborers. The volume of demand however will be minimal. Any water quantity concerns during the construction phase can be considered to have short-term effect and practically will not affect the existing water resources. Excavation works, dredging of spoils, increasing the channel carrying capacity and the construction of flood control structures are expected to provide negative impacts to the water quality of Kinanliman River. The possible deterioration of the water quality in the said river is just temporary in nature and can still be restored to existing river quality. Among the potential changes in water quality are increased in suspended solids, turbidity, discoloration, presence of inorganic substance i.e., oils, etc.

Contamination of coastal waters during construction phase is possible due to improper disposal of construction debris which includes excavated (dredged) wastes/spoils.

(5) Tuganay River Basin

1) Ecological Impacts

The civil works and earthmoving activities will entail the removal of ornamental plants, fruit trees, locally available invasive (grows anywhere) trees and natural vegetation (patches of grasses and weeds, ferns, banana, and coconut trees) that are commonly found along the river banks. There are also patches of mangroves which vary in density along the stretch of Tuganay River towards the river mouth that will be disturbed.

a) Loss of Vegetation and Increase in Soil Erosion

The removal of mangrove will only cover the areas within the Right-of-Way required to erect the dike and also areas that will receive minimal surface flow as a result of channelization.

Indirect effect of mangrove removal and the construction of the dike may also present beneficial effect to the overall sustainability of the mangrove forest. Beneficial outcome upon completion of the proposed facilities includes unimpeded flood water flow to the sea and controlled deposition of silts and debris.

Nonetheless, the proposed activities for each alternative will result to negative, medium-term, moderate but reversible environmental impacts. The activities may also present indirect negative impacts like increase in soil erosion in the affected site.

b) Disturbance to Fish and Wildlife

Results of the field investigation and records of secondary baseline information showed there is a minimal potential of disturbing the wildlife habitat in Barangay San Isidro Wildlife Sanctuary (DENR, NIPAS). This barangay has areas along the river channel of

Tuganay, Cabay-angan Rivers and Mag Creek with river improvement works from the Municipality of Carmen towards the Municipality of Braulio E. Dujali.

c) Endangered and Threatened Species

The DENR PAWB list does not specify the presence of endangered flora and fauna in this river basin. One of the Barangays (San Isidro) within this river basin has been declared by the DENR-national Integrated Protected Areas Services (NIPAS) as a protected area.

A quick scan (field interview and site inspection) in the area that are close or within the land covered by the proposed flood control project indicates non-existence of habitat of an endangered and threatened species. Nevertheless, cautious execution of civil works shall be observed during the construction of flood control infrastructures.

d) Protected Areas

The structural and non-structural flood control measures are envisioned to complement and enhance the timberland located at Barangay Tibulao (forest reserved estimated at 31 hectares) being a forest reserve declared by the DENR. The reduction in erosion brought about by the flood control project in these areas including the adjacent (east of Barangay Tibulao) wildlife sanctuary in Barangay San Isidro (estimated to cover land area of 5 hectares (Biodiversity Management Division, DENR-PAWB).

2) Physico-Chemical Impacts

a) Soil Resettlement and Increase in Turbidity in Tuganay River, Ising River, Cabay-angan River and Mag Creek from Quarrying/Dredging Operations

Quarries, dredge materials and borrow pits may be used as materials in the construction of dike/river improvement works.

However, dredging works and quarry related activities would result in environmental disturbance caused during aggregate extraction and processing. This may then result in the change in geomorphology/land use. The negative impact of dredging operations along the river banks include the difficulty in handling and finding suitable disposal sites for spoils or dredge materials. The volume of dredge materials and debris due to the removal of existing embankment/dike along the river channels would likely end up in vacant lots and agricultural land. Thus, it could eventually result in an increase in turbidity levels of the river system. The expected volume of aggregates and spoils will have intermediate and significant negative impact in the surrounding environment particularly in the absence of an acceptable/appropriate disposal sites.

b) Threat of Chemical Hazards

One of the identified sources of hazards during construction is the potential generation of hazardous materials used in construction. Examples of hazardous materials that are typically found at construction sites are petroleum based products (e.g., lubricating oils,

grease), fuels (e.g., gasoline, kerosene), solvents, paints, batteries, and other miscellaneous equipment and supplies. Spillage of gasoline and lubricants, used in heavy equipment maintenance and operations, can cause river water pollution. The environmental impacts though negative may be considered low in magnitude and could occur during the construction process in the absence of better management practices.

c) Increase in Solid Waste Generation

Construction and Demolition (CandD) debris may be generated as a result of the demolition of old slope stabilization structures. Components of CandD debris typically include concrete, wood, and metals. Land clearing debris, such as stumps, rocks, and dirt, are also considered CandD debris.

It is expected that during construction, spoils and other debris will be generated. However, waste streams are difficult to estimate because composition varies widely.

d) Change in Air Quality

The magnitude of potential air pollutants during the construction of the project is minimal considering the project size and type of construction activities. Re-suspension of dusts can happen due to the civil and ground works especially when the weather is dry. NO_x and SO_x may be emitted by heavy equipment used in the construction activities. The increase in air pollution is only temporary and can be dispersed naturally with good wind movement that is naturally prevailing along the stretch of the river systems. The negative impact on air quality and atmosphere at the local level is short-term and is low in magnitude.

e) Noise Emission from Construction Related Activities

Noise level will rise with the increase in use and continued operation of equipment during construction phase. The magnitude of noise disturbance is expected to be low and intermittent.

Unavoidable noise increase is expected in the construction sites due to heavy equipments operations. Such increase in noise level varies from low to moderate (depending on the source) and can affect the area in the short-term. Among the affected receptors are residential households at the riverbanks.

Should the civil works (construction of dike, other river improvement facilities and dredging operations) used noise generating equipment such as jackhammers, bulldozers, graders, payloaders, generators, backhoe, compressors and heavy trucks the expected noise levels at various distances from these equipment are shown in Tab.I-3-18. Correspondingly, the operations of the construction equipment must be regulated in accordance to the maximum allowable noise level (refer to Tab.I-3-19) based on DENR standards for noise in general areas.

f) Change in Water Quality and Quantity

There will be an increase in water demand as a requirement for the civil works and the domestic consumption of laborers. The volume of demand however will be minimal. Any water quantity concerns during the construction phase can be considered to have short-term effect and practically will not affect the existing water resources.

Excavation works, dredging of spoils and related activities aimed at increasing the channel carrying capacity as well as the re-construction of dike/river embankment are expected to provide negative impacts to the water quality of the river channels (Tuganay, Ising and Cabay-angan). The possible deterioration of the water quality in the said rivers is just temporary in nature and can still be restored to existing river quality. Among the potential changes in water quality are increased in suspended solids, turbidity, discoloration, presence of inorganic substance i.e., oils, etc.

Such changes in the water quality in excessive form may significantly cause adverse impacts to the water bodies. The nature and extent of environmental impact is negative, localized and has low effect.

Contamination of coastal waters during construction phase is possible due to improper disposal of construction debris which includes excavated (dredged) wastes/spoils.

(6) Dinanggasan River Basin

1) Ecological Impacts

The civil works and earthmoving activities will entail the removal of ornamental plants, fruit trees, locally available invasive (grows anywhere) trees and natural vegetation (patches of grasses and weeds, ferns, banana, and coconut trees) that are commonly found along the river banks.

a) Loss of Vegetation and Increase in Soil Erosion

The removal of fruit bearing trees, ornamental plants and natural vegetation (patches of grasses, coconut, and ferns) along Compol, Tag-Ibo and Dinanggasan Rivers is necessary to give way for the river improvement works.

In the case of the 2 proposed alternatives, the extent of negative impact may vary from negligible to moderate depending on the number of trees cut and the type of vegetation removed. Since, the construction of the dike will extend to a minimum distance of 5 meters from the river banks it will require the cutting/removal of some strips of banana plants, coconut trees, fruit trees and locally grown vegetation. The indirect effect on the loss in vegetation would impact on the residents/individuals that own the valuable resources.

This impact however will have a short-term effect and can be mitigated.

The activities under the proposed alternatives A and B may also present indirect negative impacts like increase in soil erosion in the course of clearing and grubbing the river banks during construction.

b) Disturbance to Fish and Wildlife

Results of the field investigation and records of secondary baseline information showed no disturbance to wildlife and fish.

c) Endangered and Threatened Species

The DENR PAWB listed the presence of endangered flora and fauna in the whole Camiguin Island. Their existence and habitat are mostly in the mountain ranges like the upper slopes of Mt. Hibok-Hibok.

A quick scan on the area covered by the proposed flood control project indicates that the habitat of the endangered and threatened species will not be affected. Although, cautious execution of civil works shall be observed during the construction of Sabo dam and sand pocket since these are located at the foot of Mt. Hibok-Hibok where wildlife habitat could begin. This approach enables protection of areas that are potential sites of wildlife habitat.

d) Protected Areas

The structural and non-structural flood control measures are envisioned to complement and enhance the timberland and Mt. Timpoong – Hibok-Hibok national park. The timberland is an LGU declared protected area while the latter has an ongoing procedural assessment for the declaration into a protected area. With the integration of the proposed project, beneficial outcome and enhancement of the local and regional environmental conditions is anticipated.

2) Physico-Chemical Impacts

a) Soil Resettlement and Increase in Turbidity in Compol, Tag-Ibo and Dinanggasan Rivers from Quarrying/Dredging Operations

Quarries, dredge materials and borrow pits may be used as materials in the construction of dike along Dinanggasan River and Tag-Ibo River as well as the construction of embankment in Compol River; however, dredging works and quarry related activities would result in environmental disturbance caused during aggregate extraction and processing. This may then result in the change in geomorphology and land use.

The removal of volcanic debris (i.e., boulder and sand) and the construction of the embankment along Compol River may increase soil deposition or sedimentation if inappropriately undertaken.

The negative impact of dredging operations along the river banks include the difficulty in handling and finding suitable disposal sites for spoils or dredge materials. The volume of dredge materials or debris taken from the mouth of Dinanggasan River and the volcanic debris along Compol River would likely end up in vacant lots and agricultural land. Thus, it could eventually result in an increase in turbidity levels of the river system.

The expected volume of aggregates and spoils will have intermediate and significant negative impact in the surrounding environment particularly in the absence of an acceptable/appropriate disposal sites.

b) Threat of Chemical Hazards

One of the identified sources of hazards during construction is the potential generation of hazardous materials used in construction. Examples of hazardous materials that are typically found at construction sites are petroleum based products (e.g., lubricating oils, grease), fuels (e.g., gasoline, kerosene), solvents, paints, batteries, and other miscellaneous equipment and supplies. Spillage of gasoline and lubricants, used in heavy equipment maintenance and operations, can cause river water pollution. The environmental impacts though negative may be considered low in magnitude and could occur during the construction process in the absence of better management practices.

c) Increase in Solid Waste Generation

Construction and Demolition (CandD) debris may be generated by the demolition/removal of old revetment/slope stabilization structures. Components of CandD debris typically include concrete, wood, and metals. Land clearing debris, such as stumps, rocks, and dirt, are also considered CandD debris.

It is expected that during construction, spoils and other debris will be generated. However, waste streams are difficult to estimate because composition varies widely.

d) Change in Air Quality

The magnitude of potential air pollutants during the construction of the project is minimal considering the project size and type of construction activities. Re-suspension of dusts can happen due to the civil and ground works especially when the weather is dry. NO_x and SO_x may be emitted by heavy equipment used in the construction activities.

The increase in air pollution is only temporary and can be dispersed naturally with good wind movement that is naturally prevailing along the stretch of the river systems. The negative impact on air quality and atmosphere at the local level is short-term and is low in magnitude.

e) Noise Emission from Construction Related Activities

Noise level will rise with the increase in use and continued operation of equipment during construction phase. The magnitude of noise disturbance is expected to be low and intermittent.

Unavoidable noise increase is expected in the construction sites due to heavy equipments operations. Such increase in noise level varies from low to moderate (depending on the source) and can affect the area in the short-term. Among the affected receptors are residential households at the riverbanks of Compol River, Tag-Ibo River and Dinanggasan River.

Should the civil works (construction of dike, other river improvement facilities and dredging operations) used noise generating equipment such as jackhammers, bulldozers, graders, payloaders, generators, backhoe, compressors and heavy trucks the expected noise levels at various distances from these equipment are shown in Tab.I-3-18. Correspondingly, the operations of the construction equipment must be regulated in accordance to the maximum allowable noise level (refer to Tab.I-3-19) based on DENR standards for noise in general areas.

f) Change in Water Quality and Quantity

There will be an increase in water demand as a requirement for the civil works and the domestic consumption of laborers. The volume of demand however will be minimal. Any water quantity concerns during the construction phase can be considered to have short-term effect and practically will not affect the existing water resources.

Excavation works, dredging of spoils and related activities aimed at increasing the channel carrying capacity as well as the construction of Sabo Dam are expected to provide negative impacts to the water quality of Compol, Tag-Ibo and Dinanggasan Rivers. The possible deterioration of the water quality in the said rivers is just temporary in nature and can still be restored to existing river quality. Among the potential changes in water quality are increased in suspended solids, turbidity, discoloration, presence of inorganic substance i.e., oils, etc.

Such changes in the water quality in excessive form may significantly cause adverse impacts to the water bodies. The nature and extent of environmental impact is negative, localized and has low effect.

Contamination of coastal waters during construction phase is possible due to improper disposal of construction debris which includes excavated (dredged) wastes/spoils.

3) Human-Interest Related Impacts

a) Population Dynamics

The project may induce local population increase in the event substantial amount of migrant labor is required to complete the flood control project. The population increase due to migrant entry may be temporary, depending on the length of time allotted for the construction works and the need for skilled labor which is not available in the locality.

b) Employment and Income

Unskilled workers should be sourced from the LGUs around the model river basins, direct employment would likely be on the upsurge. Local unemployment would decline although on a temporary basis, and correspondingly, household income would be augmented by salaries earned from the implementation of the flood control project. Multiplier effects on the local economy would be manifest considering that households would gain economic parity in affording more goods and services as allowed by the increase in income. Indirect

employment, on the other hand, would also increase as construction work would yield demands for goods and services that could be sourced from the formal and informal economy.

c) Dependency Burden

The ability to support children and elderly dependents would be enhanced by increases in household income from expected employment. A possible improvement would be on the school allowances given to children as well as the budget allocated for education, health care and nutrition. Inflation is also not factored in its tendency to dilute the purchasing power of the peso. Nevertheless, it is assumed that should the construction period extend beyond ten (10) months to more than a year, escalation factors would be applied to capture the effects of inflation and tender salaries competitive and adequate for household needs.

d) Housing Characteristics and Utilities

As the income stream from construction work would be short-term, the issue of whether this could be saved for future housing improvement may be insignificant although a positive outcome if realized. This would apply perhaps for minor improvements such as repair and maintenance of dilapidated sections that can be covered by temporary increases in household income.

e) Health and Safety of Construction Workers

Health and safety impacts may be negative or positive depending on its context. Increased household incomes may increase the capability of workers' families to avail of health services and purchase medical goods and supplies. As an incentive, health and accident insurance may be provided for workers thus granting them medical coverage. In this case, impacts tend to be positive and significant. Positive impacts may be realized more by skilled workers though rather than for unskilled workers who are normally classified as temporary workers without special medical privileges.

Meanwhile, the impact may be negative should construction activities not adhere to strict procedures on occupational safety. Accidents and hazards may occur on site thus there are risks facing both skilled and unskilled workers. These hazards may also be experienced in adjoining communities in activities that would generate noise, pollution and dust; hence, construction activities would have to adopt proper measures to ensure public health and safety. Another factor is whether safeguards are in place to secure the project site from outsiders and ensure that petty crimes, such as theft, trespassing and other forms of illegal entry, are prevented. Under strict enforcement of safe conditions on-site and off-site, the impact to public health would be low.

f) Health and Safety of General Public

To prevent accidents for the passerby and the community, the contractor must provide proper signage in conspicuous places and perimeter fencing in the construction area during

the entire duration of construction activities. Coordination with LGUs for possible public safety zone and coordination with nearest hospitals for instituting effective land-based response of medical units in the event workers need immediate medical attention.

g) Complaints from the General Public

As part of the public service mandate of the DPWH and the LGUs, an Environmental Officer must be assigned at the start of the project. There must be an office that can receive complaints during the entire duration of construction activities so that these complaints could be properly acted upon.

h) Visual Intrusion and Aesthetic Nuisance

During construction, the only activity that will affect the visual character of the project area is the installation of temporary scaffoldings, presence of heavy equipment and working personnel as well as construction debris. However, these will only happen during the construction phase of the project. Therefore, the impact is expected to be minimal and intermittent.

i) Effect on Local Planning, Coordination and Economic Growth

The construction activities may foster collaboration and cooperation among the project implementation unit at the local and national government level (DPWH, DENR and LGUs). In spite of this, diverse interests may arise among these groups as a result of the project implementation. As a consequence, urban land use planning may be enhanced.

j) Disruption of Local Public Utilities and Infrastructure

The river improvement works at Tag-Ibo River will require the reconstruction of the bridge to make it consistent with the hydrologic (flood peak) design requirements.

The reconstruction works will disrupt local transport and water utility line crossing the bridge deck. There will be temporary disruption and inconvenience, which may last until the completion of the newly constructed bridge.

Under such circumstance, escalating public complaints are expected and there will be an increase in hazards to the pedestrian and motorist plying the bridge.

5.2.3 Operation Phase

In the operations and maintenance phase, the proposed project is seen to improve surface water flow during storm or flooding events. This scenario brings long-term benefit and positive impact by mitigating flood damages in the model river basins.

(1) Ilog-Hilabangan River Basin

1) Ecological Impacts

a) Improved Fish and Mangrove Habitat

Upon completion of the drainage improvement project, fish habitat at the river mouth and the receiving coastal water of Panay Gulf will improve. The completion of the dike and the dredging operation will also protect the mangrove from long-term sedimentation and highly turbulent flow during flooding. However, in the short-term, the estuarine habitat may be in danger during dredging/declogging activities.

b) Improvement of Vegetative Cover and Development of Resource

The implementation of the watershed management plan will improve the current state of vegetative cover. This would also results in the stability of soil and the promotion of flora and fauna interaction in the terrestrial ecosystem.

2) Physico-Chemical Impacts

a) Improved Surface Drainage

The project is expected to mitigate flood damages as a result of the increase in the channel's flow capacity. Such condition will reduce of overflow from the river. Indirect effect of improved surface flow will help induced aeration of the water that is important in enhancing the process of natural-purification.

b) Increase in Turbidity due to Dredging Activities

The removal of river sediment or silt along Ilog River and its confluence with Hilabangan River will temporarily disturb the bottom sediment which consists of silt mixed with organic matter. The presence of organic matter is attributable to the direct discharge of untreated domestic wastewater and disposal of solid waste along the river section of the Poblacion and areas where settlement exists in the past. The absence of an appropriate domestic wastewater treatment at the local level and the uncontrolled dumping of solid waste can exacerbate siltation.

The handling of the dredged materials from the point of extraction, and stockpiling to disposal may also pose health risk to workers and the nearby residents.

c) Climate Change

Large areas of exposed water body (in the case of the proposed widening of the river channels) may promote local change in climate (micro-climate). This concept of water budget or hydrologic cycle balance will result in an increase in evaporation which would have a corresponding increase in the amount of precipitation or rainfall in this river basin. The increase in evaporation rates is the effect of the sun's radiant energy on the water. Not only this alters evaporation and precipitation but also local humidity.

The implementation of watershed management plans, e.g., reforestation, revegetation, erosion control, etc., will have long-term enhancement of local climate condition.

d) Improved Water Quality

The long-term effect of the flood control facilities besides reducing the incidence of flooding is the improvement in water quality of Ilog River and its tributaries.

With the completion of the infrastructure project, there will be minimal or controlled erosion so that it promotes natural aeration that is beneficial to the aquatic organisms.

3) Human Related Interest Impacts

a) Increase Community Awareness in Public Health and Environmental Management

The implementation of the flood control project in this river basin can provide a high level of consciousness towards environmental management. The institutional plan and the information education and communication campaign can educate the community on the potential hazards from the disposal of contaminated dredged materials.

b) Reduction in Flooding Incidence and Improve Local Livability

The basic assumption in the implementation of the proposed flood control project/measures is the mitigation of the flood damages in the downstream areas due to overflow and others. Hence, property damage, deterioration in local economy and consequently loss of lives will be prevented.

c) Development Potentials

Reduction in flooding incidence would enhance the livability of the Municipality of Ilog and the City of Kabankalan boosting commerce, industry and tourism. This positive impact can be derived with the implementation of the flood control infrastructure and non-structural measures.

d) Local Revenue and Economy

Benefits to the local economy specific to flood control works would include the following:

- Increase in the number of commercial and industrial establishments since areas, which are frequently flooded becomes conducive for investment.
- Enhancement of market activities since the transport of locally produced goods and commodities becomes unhampered by floods.
- Savings in management costs which is attributed to the decline of absences and tardiness of workers affected by flooding.
- Improvement of household income with the reduction in medical expenditures from flood related illness and diseases.
- Lower maintenance cost of vehicles, buildings and property.
- Enhanced image of the LGUs resulting to more land development, investments and increased livability for constituents.
- Increase in land revenue from increase in real property value taxes.

(2) Dungcaan River Basin

1) Ecological Impacts

a) Improved Fish Habitat

Upon completion of the project, fish habitat downstream of Dungcaan River and receiving coastal water will improve. In the short-term, these fish habitats would be in danger during dredging/declogging activities.

b) Alteration in the Composition of Flora and Fauna due to Reservoir Development

During the operation phase, the gradual filling up with water of the reservoir will cause micro-climactic change within the vicinity of the proposed dam site. Filling up the reservoir beyond the existing level will result to an immediate death to former streambank vegetation due to submergence.

The construction of the reservoir can present conditions experienced in lakes i.e., decrease local ambient air temperatures due to lake breeze circulation, partially impeded by high embankments, the continuous cool water inputs from the upstream tributaries and increase relative humidity due to lake evaporation. Precipitation or rainfall in the area may be induced with an increase in evaporation of water from larger open area of surface water that is readily exposed to the atmosphere.

The gradual change in floral composition will be brought about by inundation level creating new locations for invading riparian vegetation that will replace the species that are not tolerant to water-logging and increase in soil moisture. The non-tolerant species will gradually die and must be replaced naturally or through reforestation. There will be decrease in ambient air temperatures and increase humidity due to lake evaporation and occurrence of local precipitation which will further effect vegetation composition, and affecting faunal composition. The impact may be considered moderately significant.

c) Decrease Fish Composition

The construction of the dam could serve as an additional obstruction to the movement of some aquatic resources which migrate from the freshwater environment in the marine waters or vice versa in order to complete their life cycle. However, based on the interview there are no fish species observed by local people that have migrated either upstream or downstream during reproductive season. The decrease in water volume just below the dam will affect the velocity and depth of the water and will affect flora and fauna. This impact is unavoidable.

d) Promotion of Insect Growth

Vectors such as mosquitoes (which are known carriers of malaria and dengue) may survive in the area. Growth of other insects is also possible in the impounding reservoir and in areas where there is slow water movement. This impact is moderately significant if unmitigated.

e) Improvement of Vegetative Cover and Development of Resource

The implementation of the watershed management plan will improve the current state of vegetative cover. This would also results in the stability of soil and the promotion of flora and fauna interaction in the terrestrial ecosystem. The impoundment of water as a potential source of domestic drinking supply enhances the beneficial use system of locally available natural resource.

2) Physico-Chemical Impacts

a) Improved Surface Drainage

The project is expected to improve river discharge as a result of the increase in the channel's carrying capacity. Such condition satisfies the project objective of reducing the occurrence of flooding from peak flow and overflow.

Indirect effect of improved surface flow help induced aeration of the water that is important in enhancing the process of natural-purification.

b) Increase in Turbidity due to Dredging Activities

The removal of river sediment or silt along (sections identified in the plan) Dungcaan River will temporarily disturbed the bottom sediment which consists of silt mixed with organic matter. The presence of organic matter is attributable to the direct discharge of untreated domestic wastewater and disposal of solid waste along the river section of the Poblacion and areas where settlement exists. The absence of an appropriate domestic wastewater treatment at the local level and the dumping of solid waste exacerbate siltation.

Dredging activity will affect the quality of water in Dungcaan River as a result of the re-suspension of silts, debris and fine bed particles. The handling of the dredged materials from the point of extraction, stockpiling to disposal may also pose health risk to workers and the nearby residents.

c) Alteration of Land Feature and Land Use as a result of Dam Failure

In many literatures, the potential reasons for dam failure are seepage in the foundation or through the body of the dam, structural damage from earthquake, slippage of the dam at its base, and overturning caused by excessive hydrostatic forces.

Uncontrolled seepage may create boiling at discharge points and increase the uplift pressure at the base of the dam which can lead to overturning or sliding.

In the event that any of the modes of failure happens, the risk involves increase discharge and excessive surface velocity which might inundate downstream communities. Thus the construction of the dam/multi-purpose reservoir would lead to the change in land use and can instantaneously alter land features.

d) Climate Change

Large areas of exposed water body (in the case of the impounding reservoir) may promote local change in climate (micro-climate). This concept of water budget or hydrologic cycle

balance will result to an increase in evaporation which would have a corresponding increase in the amount of precipitation or rainfall in this river basin. The increase in evaporation rates is the effect of the sun's radiant energy on the impounded water. Not only this alters evaporation and precipitation but also local humidity.

e) Improved Water Quality

The long-term effect of the flood control facilities besides reducing the incidence of flooding is the improvement in water quality of Dungcaan River.

With the completion of the infrastructure project there will be minimal or controlled erosion. Thus, it promotes natural aeration that is beneficial to the aquatic organisms.

On the other hand, the storage of water in the dam may reduce flow velocities downstream leading to sedimentation. Sedimentation at the impounding reservoir can affect the current stream habitat.

f) Hydrologic Modifications and changes in Flow Regimes

The impoundment of water at the desired/design level will lead to changes in flow regimes, surface water quality, and groundwater quantity downstream.

During the initial impounding period, there will be limited flow in Dungcaan River. Supply or surface water flow would only come from upstream minor tributaries. The immediate stretch downstream of the dam may experience drying-up until the level of impounded water reached the higher sill portion which served as the bottom outlet in the operations stage. This impact will be temporary and only be felt during the impounding period.

In the dry season or during episode of El Niño, alteration of the hydrologic discharge and velocity of flow is unavoidable with the presence of the dam.

3) Human Related Interest Impacts

a) Increase Community Awareness in Public Health and Environmental Management

The implementation of the flood control infrastructure project in this river basin can provide a high level of consciousness towards environmental management. The institutional plan and the information education and communication campaign can educate the community on the potential hazards from the disposal of contaminated dredged materials.

b) Resettlement of Households and Right-of-Way (ROW) Acquisition

Acquisition of Right-of-Way is necessary to complete and construct the road network leading towards the proposed multi-purpose reservoir. However, acquisition of agricultural land is needed specially those that will have to be inundated due to the operations of the proposed multi-purpose reservoir.

c) Reduction in Flooding Incidence and Improve Local Livability

The basic assumption in the implementation of the proposed flood control project/measures is the complete eradication of peak floods and inundation of downstream areas due to

overflow. Hence, property damage, deterioration in local economy and consequently loss of lives are prevented.

d) Development Potentials

Reduction in flooding incidence would enhance the livability of Baybay City, boost commerce, industry and tourism. This positive impact can only be derived with the implementation of the flood control infrastructure and non-structural measures.

e) Local Revenue and Economy

Benefits to the local economy specific to drainage improvement works would include the following:

- Increase in the number of commercial and industrial establishments since areas which are frequently flooded becomes conducive for investment.
- Enhancement of market activities since the transport of locally produced goods and commodities becomes unhampered by floods.
- Savings in management costs which is attributed to the decline of absences and tardiness of workers affected by flooding.
- Improvement of household income with the reduction in medical expenditures from flood related illness and diseases.
- Lower maintenance cost of vehicles, buildings and property.
- Enhanced image of the LGUs resulting to more land development, investments and increased livability for constituents.
- Increase in land revenue from increase in real property value taxes.

(3) Meycauayan River Basin

1) Physico-Chemical Impacts

a) Improved Surface Drain

The project is expected to improve river discharge as a result of the excavation/dredging of silt and solid waste debris in the Meycauayan and Marilao channel. These will benefit the communities along the riverbanks through reduction in peak flood and the occurrence of river overflow.

Indirect effect of improved surface flow help induced aeration of the water that is important in enhancing the process of natural-purification and renewal of the currently degraded biological status of Meycauayan and Marilao Rivers.

b) Increase in Turbidity due to Dredging Activities

The removal of river sediment or silt along Marilao and Meycauayan Rivers will temporarily disturb the bottom sediment which consists of silt mixed with organic matter. The presence of organic matter is attributable to the direct discharge of untreated domestic wastewater along the rivers where settlement is conspicuous along the riverbanks.

The handling of the dredged materials from the point of extraction, stockpiling to disposal may also pose health risk to workers and the nearby residents.

c) Climate Change

The operations of the flood control project structural components are not perceived to cause change in local climate conditions. However, an improvement in local climactic condition shall be the result of implementing the non-structural reforms such as watershed management vis-à-vis erosion control.

d) Improved Water Quality

The long-term effect of the flood control facilities besides reducing the incidence of flooding is the improvement in the water quality of Marilao and Meycauayan Rivers and their respective tributaries.

With the completion of the infrastructure project there will be minimal or controlled erosion. Flow of water can also be managed through gates and drainage facilities. Thus, it promotes natural aeration that is beneficial to the aquatic organisms.

2) Human Related Interest Impacts

a) Increase Community Awareness in Public Health and Environmental Management

The implementation of the flood control infrastructure project in this river basin can provide a high level of consciousness towards environmental management. The institutional plan and the information education and communication campaign can educate the community on the potential hazards from the disposal of contaminated dredged materials.

b) Reduction in Flooding Incidence and Improve Local Livability

The basic assumption in the implementation of the proposed flood control project/measures is the complete eradication of peak floods and inundation of downstream areas due to flash flow, overflow, lahar flow and inland flooding. Hence, property damage, deterioration in local economy and consequently loss of lives are prevented.

c) Development Potentials

Reduction in flooding incidence would enhance the local livability, boost commerce, industry and tourism. This positive impact can only be derived with the implementation of the flood control infrastructure and non-structural measures.

d) Local Revenue and Economy

Benefits to the local economy specific to drainage improvement works would include the following:

- Increase in the number of commercial and industrial establishments since areas which are frequently flooded becomes conducive for investment.
- Enhancement of market activities since the transport of locally produced goods and commodities becomes unhampered by floods.

- Savings in management costs which is attributed to the decline of absences and tardiness of workers affected by flooding.
- Improvement of household income with the reduction in medical expenditures from flood related illness and diseases.
- Lower maintenance cost of vehicles, buildings and property.
- Enhanced image of the LGUs resulting to more land development, investments and increased livability for constituents.
- Increase in land revenue from increase in real property value taxes.

(4) Kinanliman River Basin

1) Ecological Impacts

a) Improved Coastal Habitat

The completion of the drainage improvement project could promote fish habitat at the river mouth and the coastal water of Polilio Strait. The completion of the dike and the dredging operation will also protect the coastal zone from long-term sedimentation and highly turbulent flow during flooding.

b) Improvement of Vegetative Cover and Development of Resource

The implementation of the watershed management plan will improve the current state of vegetative cover. This would also results in the stability of soil and the promotion of flora and fauna interaction in the terrestrial ecosystem specially the protected zone.

2) Physico-Chemical Impacts

a) Improved Surface Drainage

The project is expected to improve river discharge as a result of the increase in the channel's carrying capacity. Such condition satisfies the project objective of reducing the occurrence of flooding from peak flow, overflow and inland flooding.

Indirect effect of improved surface flow help induced aeration of the water that is important in enhancing the process of natural-purification.

b) Increase in Turbidity due to Dredging Activities

The removal of river sediments along Kinanliman River will temporarily disturbed the bottom sediment which consists of silt mixed with organic matter. The presence of organic matter is attributable to the direct discharge of untreated domestic wastewater and discarded solid waste from the Poblacion and areas where settlement exists. Such waste could have been carried off by storm water runoff in areas not covered by the current Municipal solid waste collection system.

The handling of the dredged materials from the point of extraction, stockpiling to disposal may also pose health risk to workers and the nearby residents.

c) Climate Change

The operations of the flood control project structural components are not perceived to cause change in local climate conditions. However, an improvement in local climactic condition shall be the result of implementing the non-structural reforms such as watershed management vis-à-vis erosion control and reforestation.

d) Improved Water Quality

The long-term effect of the flood control facilities besides reducing the incidence of flooding is the improvement in water quality of Kinanliman River.

With the completion of the infrastructure project there will be minimal or controlled erosion and sedimentation in downstream areas. Thus, it promotes natural aeration that is beneficial to the aquatic organisms.

3) Human Related Interest Impacts

a) Increase Community Awareness in Public Health and Environmental Management

The implementation of the flood control infrastructure project in this river basin can provide a high level of consciousness towards environmental management. The institutional plan and the information education and communication campaign can educate the community on the potential hazards from the disposal of contaminated dredged materials.

b) Reduction in Flooding Incidence and Improve Local Livability

The basic assumption in the implementation of the proposed flood control project/measures is the complete eradication of peak floods and inundation of downstream areas due to overflow and inland flooding. Hence, property damage, deterioration in local economy and consequently loss of lives are prevented.

c) Development Potentials

Reduction in flooding incidence would enhance the livability of the Municipality of Real. It can also contribute to additional commercial investment, industry and tourism. This positive impact can only be derived with the implementation of the flood control infrastructure and non-structural measures.

d) Local Revenue and Economy

Benefits to the local economy specific to flood control/drainage improvement works would include the following:

- Increase in the number of commercial and industrial establishments since areas which are frequently flooded becomes conducive for investment.
- Enhancement of market activities since the transport of locally produced goods and commodities becomes unhampered by floods.
- Savings in management costs which is attributed to the decline of absences and tardiness of workers affected by flooding.

- Improvement of household income with the reduction in medical expenditures from flood related illness and diseases.
- Lower maintenance cost of vehicles, buildings and property.
- Enhanced image of the LGUs resulting to more land development, investments and increased livability for constituents.
- Increase in land revenue from increase in real property value taxes.

(5) Tuganay River Basin

In the operations and maintenance phase, the proposed project is seen to improve surface water flow during storm events or flooding events. This scenario brings long-term benefit and positive impact by mitigating flood damages in this river basin.

1) Physico-Chemical Impacts

a) Improved Surface Drainage

The project is expected to improve river discharge as a result of the channelization in Ising River and Tuganay River. These will benefit the communities with the reduction in peak flood. Such condition also satisfies the project objective by reducing the occurrence of flooding attributed to overflow, bank erosion, and inland flooding. Indirect effect of improved surface flow help induced aeration of the water that is important in enhancing the process of natural-purification.

b) Increase in Turbidity due to Dredging Activities

The removal of river sediment or silt along Tuganay, Ising, Cabay-angan River and Mag Creek will temporarily disturb the bottom sediment which mainly consists of silt mixed with organic matter. The presence of organic matter is attributable to the direct discharge of untreated domestic wastewater and agricultural wastes along the river section of the earlier mention river channels where settlement and agricultural plantation/farm exists.

The handling of the dredged materials from the point of extraction, stockpiling to disposal may also pose health risk to workers and the nearby residents.

- During high tide, silt trap must be used by the contractor to avoid the dispersion or spread of suspended dredged materials. In this case, the impact would be minimal.
- Adherence to sound engineering practices and to Department of Labor and Employment (DOLE) Occupational Health and Safety Standards.

c) Climate Change

The operations of the flood control project structural components are not perceived to cause change in local climate conditions. However, an improvement in local climactic condition shall be the result of implementing the non-structural reforms such as watershed management vis-à-vis erosion control and reforestation.

d) Improved Water Quality

The long-term effect of the flood control facilities besides reducing the incidence of flooding is the improvement in water quality of Tuganay River and its tributaries Ising River and Cabay-angan River. With the completion of the infrastructure project there will be minimal or controlled erosion. Thus, it promotes natural aeration that is beneficial to the aquatic organisms.

2) Human Related Interest Impacts

a) Increase Community Awareness in Public Health and Environmental Management

The implementation of the flood control infrastructure project in this river basin can provide a high level of consciousness towards environmental management. The institutional plan and the information education and communication campaign can educate the community on the potential hazards from the disposal of contaminated dredged materials.

b) Reduction in Flooding Incidence and Improve Local Livability

The basic assumption in the implementation of the proposed flood control project/measures is the complete eradication of peak floods and inundation of downstream areas due to bank erosion, overflow and inland flooding. Hence, property damage, deterioration in local economy and consequently loss of lives are prevented.

c) Development Potentials

Reduction in flooding incidence would enhance the livability of the Municipality of Carmen and Municipality of Braulio E. Dujali, boost commerce, industry and tourism. This positive impact can only be derived with the implementation of the flood control infrastructure and non-structural measures.

d) Local Revenue and Economy

Benefits to the local economy specific to drainage improvement works would include the following:

- Increase in the number of commercial and industrial establishments since areas which are frequently flooded becomes conducive for investment.
- Enhance market activity as the transport of locally produced goods and commodities becomes unhampered by floods.
- Savings in management costs which is attributed to the decline of absences and tardiness of workers affected by flooding.
- Improvement of household income with the reduction in medical expenditures from flood related illness and diseases.
- Lower maintenance cost of vehicles, buildings and property.
- Enhanced image of the LGUs resulting to more land development, investments and increased livability for constituents.
- Increase in land revenue from increase in real property value taxes.

(6) Dinanggasan River Basin

1) Physico-Chemical Impacts

a) Improved Surface Drainage

The project is expected to improve river discharge as a result of the reactivation in the channel of Compol River. These will benefit both the communities alongside Dinanggasan River through reduction in peak flood and communities located at Compol River with an access in the supply of surface water. Such condition also satisfies the project objective by reducing the occurrence of flooding attributed to overflow, flash flow, lahar flow and inland flooding. Indirect effect of improved surface flow help induced aeration of the water that is important in enhancing the process of natural-purification.

b) Increase in Turbidity due to Dredging Activities

The removal of river sediment or silt along Compol, Tag-Ibo and Dinanggasan Rivers will temporarily disturbed the bottom sediment which consists of silt mixed with organic matter. The presence of organic matter is attributable to the direct discharge of untreated domestic wastewater along the river section of Dinanggasan, Tag-Ibo, and Compol Rivers where settlement has existed in the past.

The handling of the dredged materials from the point of extraction, stockpiling to disposal may also pose health risk to workers and the nearby residents.

c) Climate Change

The operations of the flood control project structural components are not perceived to cause change in local climate conditions. However, an improvement in local climactic condition shall be the result of implementing the non-structural reforms such as watershed management vis-à-vis erosion control and reforestation.

d) Improved Water Quality

The long-term effect of the flood control facilities besides reducing the incidence of flooding is the improvement in water quality of Dinanggasan River and its tributaries e.g., Tab-Ibo and Compol Rivers. With the completion of the infrastructure project there will be minimal or controlled erosion. Thus, it promotes natural aeration that is beneficial to the aquatic organisms.

2) Human Related Interest Impacts

a) Increase Community Awareness in Public Health and Environmental Management

The implementation of the flood control infrastructure project in this river basin can provide a high level of consciousness towards environmental management. The institutional plan and the information education and communication campaign can educate the community on the potential hazards from the disposal of contaminated dredged materials.

b) Reduction in Flooding Incidence and Improve Local Livability

The basic assumption in the implementation of the proposed flood control project/measures is the complete eradication of peak floods and inundation of downstream areas due to flash flow, overflow, lahar flow and inland flooding. Hence, property damage, deterioration in local economy and consequently loss of lives are prevented.

c) Development Potentials

Reduction in flooding incidence would enhance the livability of the Municipality of Catarman, boost commerce, industry and tourism. This positive impact can only be derived with the implementation of the flood control infrastructure and non-structural measures.

d) Local Revenue and Economy

Benefits to the local economy specific to drainage improvement works would include the following:

- Increase in the number of commercial and industrial establishments since areas which are frequently flooded becomes conducive for investment.
- Enhance market activity as the transport of locally produced goods and commodities becomes unhampered by floods.
- Savings in management costs which is attributed to the decline of absences and tardiness of workers affected by flooding.
- Improvement of household income with the reduction in medical expenditures from flood related illness and diseases.
- Lower maintenance cost of vehicles, buildings and property.
- Enhanced image of the LGUs resulting to more land development, investments and increased livability for constituents.
- Increase in land revenue from increase in real property value taxes.

The result of the Initial Environmental Examination is summarized in matrix format shown in Tab.I-5-1 to Tab.I-5-11.

The potential impacts identified in these tables are synthesized and lumped according to the following environmental elements: natural, socio-economic and public hazardous elements. The environmental and social parameters of each environmental element and the project activities of each alternative are presented in a decisional environmental impact matrix (refer to Tab.I-5-12 to Tab.I-5-17). Using these data, individual environmental impact score is assigned for each project activity ranging from negligible, moderate and significant. The nature of the magnitude of the impact may be negative if it has detrimental effect or positive if it leads to environmental enhancement.

The guideline shown in Tab.I-5-18 is used in scoring the magnitude of environmental impact of each project activity. The environmental impact scoring system follows a judicious rating on the magnitude (e.g., significant, moderate and negligible) of the negative or positive impacts affecting

the environmental elements. Positive impacts are not considered in the cumulative quantification of the environmental impact score for each alternative, since they would not lead to any hindrance in decisions of whether or not to proceed with the project. On the other hand, negative environmental impacts remain critical in so far as decisions in the proper selection of project alternatives. The process of quantification assigns the number of times that an environmental impact score (EISC) appears for a project activity in the pre-construction, construction and operation stage. The number of appearance of the EISC is summed up for each project alternative and compared with the total of the other project alternatives. Such comparison provides a direct estimate on the number of estimated affected parameters in each environmental element.

5.3 Critical Issues to be Addressed

5.3.1 Ilog-Hilabangan River Basin

Right-of-way acquisition and resettlement of PAPs or PAFs shall be given immediate attention as it determines the implementation and sustainability of the proposed flood control project. Poor engagement and implementation of the acquisition plan and resettlement action plan framework may pose hindrance to the successful implementation of the project components. It may also lead to non-attainment of the project objectives.

Another important environmental concern is the impact of the proposed alternatives on the wetland area (natural ecosystem) and the marsh land located along Ilog River and Old Ilog River respectively. Construction plans in these natural ecosystems shall take into consideration the concept of sustainable forest management system. The preservation of such areas may be attained with the proper design considerations for the proposed dike and revegetation of removed or cut mangroves.

The river improvement works along Ilog River is recommended consistent with the objective of reducing health, safety and infrastructure damages in the urban centers (Poblacion) and frequently inundated communities. In the case of river improvement works along Old Ilog River, careful planning and design considerations shall be made to minimize negative effect in the marsh land and the sugarcane plantation that benefits from the river.

5.3.2 Dungcaan River Basin

Resettlement of PAPs/PAFs shall be given immediate attention as it determines the sustainability of the proposed flood control project. Poor engagement and implementation of the resettlement action plan framework may pose hindrance to the successful implementation of the project components. It may also lead to non-attainment of the project objectives.

Another important environmental concern is the impact of the proposed alternatives on the wetland area (natural ecosystem) near the mouth of the river. This natural ecosystem shall be preserved during

the implementation of the project and this can be achieved with proper design considerations of the proposed dike. The river improvement works along sub-stream is recommended over the proposed river improvement works along the main stream since this will reduce negative impact on the estuarine environment.

5.3.3 Meycauayan River Basin

Resettlement of PAPs or PAFs along Marilao River and Meycauayan River (due to the proposed increase in dike height) shall be given immediate attention as it determines the implementation and sustainability of the proposed flood control project. In the Philippines, RA 7279 – Urban Development Housing Act requires immediate compensation of the persons/families resettled as a result of government or privately initiated undertakings.

The non-attainment of the project objectives may lead to the non-implementation of the project, particularly if local and community endorsement including legal requirement is not met. It is also significant to ensure that funds are available in the reconstruction of affected bridges so that they can be completed according to the design requirement. Structural sustainability issues at the bridge section may arise, i.e., convergent flow at the section of the bridge. This issue could lead to higher risk of the public transport and the flood control investment.

Another critical consideration is the development of regulation pond proposed under the VOM project study. In pursuing for such flood control component, the implementing agency shall address possible land use conflict through intensified stakeholders (fishpond operator, people living within the identified area and LGU) consultation and legal documentation, i.e., application for land conversion.

5.3.4 Kinanliman River Basin

The disposal of dredged materials as a result of river improvement shall be given immediate attention as it determines the implementation and sustainability of the proposed flood control project. Another important environmental and social aspect that must be considered alongside is the acquisition of Right-of-Way or land where river improvement shall be carried out. In the absence of a resolution on such direct and indirect impact, non-attainment of the project objectives is possible.

It is also significant to ensure substantial funds to address the need on the reconstruction of Kinanliman Bridge that will be a component of the flood control project. Structural sustainability issues at the bridge section may arise, i.e., convergent flow at the section of the bridge. This issue could lead to higher risk of the public transport and the flood control investment.

5.3.5 Tuganay River Basin

Resettlement of PAPs or PAFs in the areas where the proposed retarding basins are located and communities in Barangay Anibongan along Anibongan River (due to the proposed increase in dike height) shall be given immediate attention as it determines the implementation and sustainability of the proposed flood control project. In the Philippines, RA 7279 – Urban Development Housing Act requires immediate compensation of the persons/families resettled as a result of government or privately initiated undertakings.

The non-attainment of the project objectives may lead to the non-implementation of the project particularly if local and community endorsement including legal requirement is not met.

It is also significant to ensure that funds are available in the reconstruction of the affected bridges to assure the completion of the project with accordance to the design requirement. Structural sustainability issues at the bridge section may arise, i.e., convergent flow at the section of the bridge. This issue could lead to higher risk of the public transport and the flood control investment.

Since the river improvement works will require re-construction of the dike, the disposal of spoils, CandD wastes, and other related debris must be properly handled. The mitigation of finding for an acceptable disposal facility must be accessed prior to any physical development.

5.3.6 Dinanggasan River Basin

Resettlement of PAPs or PAFs along Compol River and Dinanggasan River shall be given immediate attention as it determines the implementation and sustainability of the proposed flood control project. In the Philippines, RA 7279 – Urban Development Housing Act requires immediate compensation of the persons/families resettled as a result of government or privately initiated undertakings.

The non-attainment of the project objectives may lead to the non-implementation of the project particularly if local and community endorsement including legal requirement is not met.

It is also significant to ensure that funds are available for the reconstruction of Tag-Ibo Bridge so that it can be completed according to the design requirement. Structural sustainability issues at the bridge section may arise, i.e., convergent flow at the section of the bridge. This issue could lead to higher risk of the public transport and the flood control investment.

6 ENVIRONMENTAL MANAGEMENT PLAN

The environmental management plan (EMP) for a flood control project is generally designed in ways that can optimize resources and minimize negative environmental and social damage. The EMP is an action plan of various key mitigation and enhancement measures for major identified impacts. It also provides the estimated investment requirements and commitments/guarantees to carry out the proposed plan.

The EMP for the flood control projects discussed below is divided into the following program areas:

- Watershed Management Program (WMP)
- Public Disclosure and Participation Program (PDPP)
- Initial Social Mitigation Framework (SMF)
- Disaster Management and Emergency Preparedness Program (DMEPP)
- Environmental Monitoring Program (EMoP)
- Institutional Plan (IP)

6.1 Watershed Management Program

Watershed management in the model river basins would provide substantial long-term beneficial results such as:

- Replenishment of Aquifers
- Minimized erosion and flooding in low-lying and flood-prone areas
- Prevention of recurrence of localized drought and drying-up of rivers or stream beds

These beneficial outcomes would bring forth holistic achievement through:

- Adequate supply of drinking water in springs and wells
- Improved soil fertility
- Reduced siltation in riverbeds
- Less costly damages from peak floods

The land should be covered by forest on steep slopes ranging from thirty percent and above where soil erosion potential is high. Moreover, soil erosion should also be regulated in agricultural areas located at eighteen percent slope and above.

Reforestation of exposed areas, existing forests, and critical slopes will result in an increase in storage capacity. In order to increase storage capacity, the watershed (particularly the upland portion) may be divided into three zones (as shown in Tab.I-6-1), namely:

- Protection Zone
- Production Zone
- Multiple Use Zone

Zones are identified based on slopes. Slopes greater than fifty percent are under the protection zone, slopes less than eighteen percent belong to the production zone, and slopes between eighteen and fifty percent fall under the multiple use zone.

The watershed management plan should institutionalize the following sub-programs (Summary and description of such programs are given in Tab.I-6-2):

1. Delineation of Area Management Zones within the basin boundary
2. Erosion Control Program
    - Agro-forestry Component
    - Nursery Establishment
3. Upper Watershed Management Program
    - Forest protection
    - Reforestation/Rain-forestation
    - Continuous stabilization of riverbank slopes
4. Re-activation of the Ilog-Hilabangan River Basin Council (IHRBC)

The continuous technical intervention strategies outlined below should be exercised in the re-activation of the IHRBC so that valuable utilization of watershed resources is achieved.

- Partnership among the implementing agencies; namely, DENR, LGU and DPWH, on the co-management arrangement of areas identified;
- Characterization and delineation of the watershed area according to the management zones, land uses and identified intervention strategies to facilitate the formulation of a comprehensive watershed management plan;
- Validation of the results of spatial analysis through community-based participatory mapping and field surveys; and
- Identification of key areas for strategic management interventions in coordination with the DENR, LGU and other stakeholders.

5. Establishment of the Watershed Management Office

The technical intervention strategies outlined below should be formulated so that the valuable utilization of watershed resources is achieved.

- Partnership among the implementing agencies; namely, DENR, LGU and DPWH, on the co-management arrangement of areas identified;
- Characterization and delineation of the watershed area according to the management zones, land uses and identified intervention strategies to facilitate the formulation of a comprehensive watershed management plan;
- Validation of the results of spatial analysis through community-based participatory mapping and field surveys; and
- Identification of key areas for strategic management interventions in coordination with the DENR, LGU and other stakeholders.

6.1.1 Erosion Control Program

Erosion control in the model river basins includes the collection, transport and disposal of silt or dredged materials during the model river basins river improvement works, etc. Greater attention shall be given to erosion control in agricultural and open lands.

Regular plowing of agricultural fields shall be minimized to reduce the degradation of topsoil and protect its fertility. This can be achieved by planting permanent crops or fruit-bearing trees with high yield potential. The watershed management office shall also evaluate the degradation of the original forest cover following the increasing demand in agricultural land.

Shifting in the cropping system (continuous plowing of land) and extensive farming methods adopted by local farmers can be minimized through the implementation of agro-forestry projects, nursery plant propagation, and plantation. Among the recommended activities under the agro-forestry project which can instill a long-term erosion prevention program are the following:

- Encouragement of local farmers (lowland and upland) to practice soil conservation measures, increase productivity and minimize soil erosion;
- Development of support facilities (micro-financing) and services that can encourage farmers towards soil conservation technologies;
- Organization of farmers into people's organizations and cooperatives;
- Conduct of agricultural technology transfer trainings and seminars; and
- Establishment of nurseries for the production of seedlings of fast-growing plantation species, endemic tree species, fruit trees, bamboo and rattan species for distribution to farmers.

(1) Agro-forestry Program

Agro-forestry is a collective name for land use management wherein woody perennials (forest trees) are deliberately incorporated with crops and/or animals in a one land use management unit. The agro-forestry project needs formal training of local farmers so that technology is transferred and adopted. Benefit packages to farmers in the model river basins for the different types of technology shall also be prepared.

Overall, agro-forestry projects can substantially reduce erosion by maintaining:

- Permanent cropping system and improved farming practices. Permanent cropping should replace shifting cultivation practices and "slash and burn" agriculture to maintain the fertility of the soil (use of fertilizer, crop rotation, coverage of legumes, etc.);
- Bench terracing in critical slopes is a proven effective erosion control practice but could be expensive in terms of labor and capital requirement;
- Sloping Agricultural Land Technology (SALT) Project where each plot is bounded by edge or nitrogen fixing trees that could reduce and eventually eliminate the top soil runoff;

- Planting of fast growing species in erosion sensitive areas (Falacata, Gemelina, Leucaena, etc.) or fruit and commercial plantations such as coffee, banana, cocoa and grass for fodder; and
- Agro-forestry practices, i.e., the integration of agriculture and forestry, with intercropping of forestry species into crops or plantations on the edge of the plot. The forestry species shall be determined by the DENR and the Department of Agriculture (DA) to determine the suitable species for agro-forestry which have commercial value.

(2) Nursery Establishment

The organization [Water Management Office (WMO) (Kinanliman), LGU (Dinanggasan)] should coordinate with the DA in the identification of program needs, e.g., recruitment of agricultural extension specialists, nursery workers, purchase of plant species, etc., prior to full-scale project implementation. The rest of the stakeholders must also be identified and strategic plant nursery sites must be established within the model river basins that can ensure increase in access of farmers.

(3) Plantation Establishment

People's organizations and cooperatives are organized and capacitated. They can be hired on a contract basis in reforestation projects of Government and also encourage plantation establishment in their own lands.

6.1.2 Upper Watershed Management Program

The long-term sustainability of flood control projects depends on the status of forest ecosystems upstream. A sustainable forest cover which serves as recharge zone, regulate stream flow and minimize soil erosion can be achieved through the implementation of the following plans.

(1) Forest Protection

Activities geared toward the application of forestry laws in the protection of the forest and vegetative cover.

(2) Reforestation/Rain-forestation

Activities that increases planting of endemic tree species and restoration of the naturally-occurring faunal species in a forest.

(3) Stream Bank Stabilization

In the long-term, the riverbank improvement program shall include re-vegetation of unstable slopes. Other indigenous materials commonly used in slope stabilization are coconut mesh which can filter the unstable soil to prevent sedimentation in Dinanggasan River, Tag-Ibo River and Compol River.

Recommended Activities:

- Planting of fast growing species, bamboos or rattan, whichever is appropriate, in two to three rows along the riprarian zone will help stabilize the soil and prevent scouring of river bank. After five years of growth, the space in-between the rows of planted species may be planted with endemic species to facilitate growth. In this manner, the dipterocarp species once lining the riverbanks will reemerge and become a stable ecosystem in the years to come; and
- Continuous monitoring and rehabilitation of embankments by way of structural measures and, whenever appropriate, siltation ponds, check dams and gabions in areas along the riverbanks where soil erosion is serious shall be installed.

6.1.3 Land Use Regulation (only for Meycauayan River Basin)

The Meycauayan river basin is highly urbanized. A plan for future land use shall be established collectively by the LGUs of Marilao and Meycauayan. In this way, urbanization which is rapidly proceeding will be controlled. With the rapid urbanization, runoff volume will increase and as a result the safety level of structural measures will decrease.

Land use regulation is necessary to control the present condition of urbanization. In the middle and upper reaches of Meycauayan and Marilao Rivers, it is highly possible for new residential areas to develop. It is recommended that buffer zones along the rivers should be kept so that residential areas will not be located at the flood risk zones along the rivers in the future.

It is necessary to identify the flood risk zones along the middle and upper reaches of rivers by detailed river and topographic surveys as well as hydrological and hydraulic simulations. Then, the identified risk zones should be kept as buffer zones.

6.2 Public Disclosure and Participation Program (PDPP)

It is important that public consultation meetings, focus group discussions and other IEC campaigns be launched to make the public aware of any potential project impact on their lives, especially on those areas where structural measures may be constructed. Based on the proposed structural measures, river widening, construction of river improvement works, and revetment walls are required.

Public participation is needed in expanding awareness, knowledge, objective opinions, and workable suggestions. It is important that the disclosure and participation program be introduced in the Visayan dialect to ensure local understanding. The recommended component of the PDPP includes:

- Dissemination of the outputs of flood control and related management studies;
- Disclosure of the chosen design and operational details of the flood control project; and
- Information on stakeholders' collaboration and arrangements in the implementation and monitoring.

6.2.1 Dissemination of the Result of the IEE as a Component of the Master Plan

Information on the IEE and the Master Plan which should be included in the presentation to the stakeholders are the following:

- Brief project description showing the chosen alternative;
- Potential environmental and socioeconomic issues/impacts per project phase;
- Mitigation and enhancement measures addressing both negative and positive impacts of the project;
- Commitments/agreements and guarantees made by the proponents to comply with all the proposed measures and recommendations; and
- Role of the stakeholders in project implementation.

6.2.2 Disclosure of Activities in the Implementation and Monitoring Phase

Public disclosure during the implementation and monitoring phase is important in generating stakeholders' participation in the areas of:

- Resettlement of PAPs/PAFs;
- Employment opportunities; and
- Protection of the watershed.

Strategies of doing the public disclosure may be in the following forms:

- Distribution of fact sheets;
- Publication in the local newspaper or any identified newsletter on a regular basis;
- Installation and maintenance of program billboards in strategic locations close to communities;
- Discussion in barangay assembly meetings; and
- Conduct of seminars/conferences.

6.3 Initial Social Mitigation Framework

6.3.1 Resettlement and Compensation Framework

The Resettlement and Compensation Framework (RCF) shall serve as guideline in the preparation of Resettlement Action Plans (RAPs). Anchored on the principle derived from the Bill of Rights of the Constitution of the Republic of the Philippines, the RCF shall adhere to:

- Article II, Section 9, "Private property shall not be taken for public use without just compensation."
- Article III, Section I, "No person shall be deprived of life, liberty, or property without due process of law, nor shall any person be denied the equal protection of the laws."

In the absence of an existing compensation plan, the project may adopt the guidelines of World Bank (WB) because of its closeness and consistency with Philippine Republic Act No. 7279 or the 1992 Urban Development and Housing Act (UDHA). The project stakeholders shall have to review the plan and agree on the applicability of such guidelines in mitigating the effects of resettlement.

- Only the project affected persons/families (PAP/PAFs) found to be residing in, doing business in, or cultivating land, or having rights over resources within, the project area as of the cut-off date (e.g., date of start of census surveys) are eligible for compensation for lost assets (i.e., land, structures and other fixed assets) and for other assistance. PAPs/PAFs will be compensated for affected land, based on their tenure status, e.g., legitimate owner, lessee, etc. Proof of ownership shall include full title, tax declaration of settlers in public land, possessory rights or usufruct, ancestral land claims, among others. However, in cases where a tax declaration over assets that are inalienable or those that cannot be titled as prescribed by law (e.g., river easement, forest reserve) is the only proof of ownership, only structures and other improvements found therein should be compensated.
- Since flood control projects are national and local government project initiatives, the mode of compensation of the PAP/PAFs are for land, structures and other fixed assets at "replacement cost."
- PAP/PAFs losing all of their lands and structures (e.g., farmland, house), or incurring partial loss but where the remaining assets and properties are determined by competent authorities as not viable anymore for continued use will be paid full compensation for the entire asset at replacement cost. The compensation for the entire asset at replacement cost may be given in cash or in kind. The national and local government agencies concerned will assume ownership (depending on the governing laws on legal ownership) of the said asset upon payment of full compensation thereof.
- In the case of PAP/PAFs whose assets are "marginally affected", compensation for the affected assets will be paid in cash.

- Informal setters who are affected by the project and who are not "professional squatters," are entitled to compensation at replacement cost for affected structures and other losses but not for land.
- Swap for "severely affected land" will be in the form of land of equivalent productive value and/or characteristics at a location acceptable to the PAP/PAFs, or if replacement land is not available, cash representing the current replacement value of the land. Replacement of residential and agricultural lands will be as close as possible to the land that was lost. All replacement lands for residence, commerce and agriculture will be provided with secured tenure status.
- In addition to compensation for crops or property acquired or damaged by any component of the flood control project, the DPWH or the LGU (whichever has jurisdiction or ownership) will provide the following resettlement assistance to eligible DPs:
  - Financial assistance to tenants/settlers/occupants.
  - Rental allowance for house tenants of affected main structures who will have to find a new place on account of the project, equivalent to the period between project site clearing and transfer to their new home but not to exceed a period of three (3) months.
  - Transportation assistance (in cash or in kind, depending on the mutual agreement of the PAP/PAFs and the DPWH or LGU to PAP/PAFs who are relocating, including displaced shanty dwellers in urban areas who opts to go back to their places of origin (e.g., province) or to shift to government relocation sites.
- Granting of rehabilitation support in the form of special skills training, project related employment, micro-credit or other self-help socio-economic support to PAP/PAFs who are severely affected due to the loss of productive assets and/or their primary source of income and which will require them to engage in some other income earning activities. If needed, the DPWH or LGU shall coordinate with other government organizations that have the mandate and the expertise to undertake the needed rehabilitation assistance.
- Rehabilitation support will also be granted to severely affected vulnerable groups such as indigenous groups, single parent households, the handicapped, the elderly, etc., who have the least capacity to cope with the adverse social and economic impacts of development projects.
- For married couples, payment of compensation and other entitlements (i.e., financial assistance and rehabilitation support) will be given in the names of both husband and wife.
- Where relocation is considered necessary, the lot owner of the proposed relocation site will also be entitled to compensation for his/her land, and depending on his/her choice, the compensation may be in cash or in the form of replacement land, of the same value, within or outside the relocation site.

- The implementing agency (DPWH or LGU) shall provide the relocation site for residential or commercial purposes with such basic services as electricity, water, drainage, sewer system, road system, etc.
- Plans for the acquisition of land and other assets will be carried out in consultation with the PAP/PAFs who will receive prior information of the compensation, relocation and other assistance available to them.
- Any acquisition of, or restriction on access to resources owned or managed by PAP/PAFs as a common property, e.g., communal forest, communal farm, or communal fishing ground, will be mitigated to ensure access of those DPs to equivalent resources on a continuing basis, where feasible, or other alternative measures to be determined in consultation with the PAP/PAFs.
- Resettlement programs will include adequate institutional arrangements to ensure effective and timely design, planning, consultation and implementation of compensation and resettlement. The implementing agency will ensure effective coordination with relevant agencies for the RAP preparation and implementation.
- The resettlement transition period will be minimized and the acquisition of assets, compensation, resettlement and rehabilitation for a segment/section or phase (except where long-term rehabilitation measures such as vocational training is recommended) will be completed at least one (1) month prior to the initiation of preparation for construction work under the respective segment/section or phase thereof.

6.3.2 Community Development Assistance

As mentioned above, resettlement alone would not suffice in terms of mitigating the impact of structural measures on the affected families. A package of assistance that will facilitate the early assimilation and adaptation to the resettlement area needs to be considered. Such package of assistance may include livelihood assistance, productivity skills training, and improved community participatory activities.

In addition, ensuring that the structural measures are sufficiently maintained, community-based river management schemes could be drawn. Capacity development programs could be initiated for the community members led by the barangay officials that will involve awareness raising and basic technical knowledge on maintenance monitoring and operations.

6.4 Disaster Management and Emergency Preparedness Plan

Being vulnerable to volcanic, climatic and geologic hazards, the municipality has been obligated to pursue comprehensive disaster preparedness. Municipal disaster and preparedness committees and

barangay disaster preparedness committees were created in every barangay. The committees prepare the Municipal Disaster Preparedness Framework Plan.

As an interim approach, the following framework is herein presented to help the LGU and other emergency response entities plan their activities towards saving human lives, reduce damage to properties or structures, and minimize environmental impacts during construction and operations. In general, the emergency preparedness plan aims to:

- Increase public safety through efficient information and coordination with appropriate authorities;
- Disclose facts to all stakeholders in emergency events; and
- Establish an executable response plan for repairs and rehabilitation works of critical flood control infrastructures to prevent negative impacts

6.5 Environmental Monitoring Plan

The following are the recommended self-monitoring activities and corresponding indices to be observed. The recommended process for Environmental Monitoring and Evaluation is the Ecosystems Approach. Aside from considering the individual environmental parameters according to its characteristic properties, this method shall evaluate the environmental components according to its structures and function within its ecosystem. The baseline information should be a basis for comparing results of the monitoring and evaluation exercises side by side with the standards set by the government and other accredited reputable local and international organizations.

All monitoring and evaluation results should be recorded, documented, submitted and certified accepted by the DPWH during the construction stage, and the entity tasked to operate and manage the drainage system during the operational stage. An environmental monitoring team, monitoring fund, laboratories and monitoring stations should then be identified prior to the operation of the project.

The monitoring team shall prepare the reports, which indicate the monitoring and evaluation conducted by team members, methodology, results and other circumstances. It should be submitted on a quarterly basis to the EMB Regional Office VI and the LGU.

6.5.1 The Monitoring Plan

To reduce the significant potential environmental impacts of the proposed alternatives into negligible and moderate levels, the Environmental Mitigation and Monitoring Plan (EMoP) shown in Tab.I-6-3 to Tab.I-6-8 shall be strictly implemented. The plan outlines the critical environment areas/issues to be mitigated and monitored. These environmental issues may arise anytime during the pre-construction, construction and operational phases of the project cycle thereby requiring corresponding mitigating measures.

In carrying out the Environmental Monitoring Plan, activities in the pre-construction, construction and operational phases of the project shall be closely assessed. Monitoring during the operation and maintenance phase would generally involve assessment of the structural integrity of the structures and the flooding condition during heavy rains or storms.

6.5.2 Hydrology Monitoring

Local hydrology shall be regularly monitored during the initial stage of operating the multi-purpose reservoir. Long-term monitoring is necessary to ensure minimum impacts on the current beneficial use of Dinanggasan River.

For surface waters such as rivers the following are the variables for monitoring:

- Siltation and sediment
- Toxicity
- BOD
- pH
- TSS
- Volume Discharge

Existing use of river systems at drainage outfalls should be noted to determine the possible sources of anthropogenic pollutants. The hydrology at siltation sections and pollution point sources should also be appraised.

6.5.3 Coastal Ecosystem Monitoring

Monitoring of the coastal ecosystem should be done annually (until the completion of the flood control project) in designated monitoring stations to evaluate the following variables:

- Oil
- Grease
- Coliform
- Sediment
- Hazardous elements
- Water biology, bacteriology and inorganic constituents
- Species survival

6.5.4 Atmosphere Monitoring

Suspended particles, odor, noise level, gas and wind direction and velocity, and gaseous emissions are the parameters pertaining to atmospheric condition to be evaluated quarterly in designated monitoring stations. Monitoring may be done using visual inspection during the construction stage.

6.5.5 Land Use Monitoring System

Conflicting land use and land conversion should be monitored.

6.5.6 Anthropological Concerns

People's activities and attitudes are the controllable parameters to avert bodies of water degradation and depletion of the resources. The following are people-centered interests and activities where water and environmental resource soundness depend:

- Waste disposal attitudes
- Tourism activities
- Socio-economic interest – employment, industries and other business
- Public safety – hazards identification caused by the project
- Housing and household growth

Unless erring people are apprehended, malpractice/resource misuse will forever continue to the detriment of the environment.

6.5.7 Project Monitoring and Evaluation

Monitoring and evaluation measures and assessment of project performance in order to manage more effectively the achievement of the project shall be executed. These will enhance the objective of the project, the planning and allocating of resources as well as the validation of results as part of the accountability of the LGU to the stakeholders. Moreover, the activities will facilitate project implementation and expedite problem-solving. With the project objective of addressing the flooding problem in the Study Area, the flood control project should be the first and foremost interest of monitoring and evaluation. Hence, health and living condition (free from floods) of the beneficiaries as well as the quality of the receiving bodies of water must be assured.

The parameters that should be monitored may include, among others, the following:

- Stability and operation of the flood control structures
- Reduction of incidence of diseases related to stagnant water
- Occurrence, severity and duration of flooding
- Water quality of the receiving waterways

6.5.8 Composition of the Monitoring Team

During the implementation of the proposed project, a Multi-Partite Monitoring Team (MMT) shall be established composed of officials of relevant government agencies, Contractor, Consultants and Local Government Units. The necessary funds for the operation of the MMT shall have to be appropriated accordingly by the DPWH in the project cost.

6.5.9 Reporting Requirements

During the pre-construction and construction stages, the construction supervision consultants (if these will be procured), the Environmental Management Specialist assigned in the project, on a monthly basis, shall prepare the monitoring report. During the operation of the project, the LGU Environmental and Natural Resources Officer shall prepare the monitoring report on a quarterly basis. These reports, together with the results of the environment-monitoring program shall be submitted by the contractor to the DPWH-ESSO and the DENR-EMB.

An appropriate data management and information system shall be developed to facilitate storage, processing and retrieval of data and information.

6.6 Institutional Plan for Environmental Management

As part of the requirement of the project, the DPWH ESSO has to oversee the project implementation. The construction supervision consultant or the contractor, together with the LGU environmental office (if in place), may provide the needed assistance to ensure that the construction plans are followed.

During the construction phase, the contractor shall fully implement the mitigation, enhancement and contingency measures presented. The DPWH should task its project management office (PMO) or regional/district engineering office to conduct construction supervision of the proposed structures. DPWH shall therefore be responsible for ensuring that the recommended measures as well as suggestions concerning environmental protection from DENR-EMB are followed and applied.

The agency (DPWH) shall closely coordinate with the contractor to ensure that provisions in the environmental program are effectively implemented. Regular inspection of the working area shall be conducted. During the operation of the project, the office designated to handle the operation and maintenance shall be responsible in ensuring that provisions stipulated in the ECC and the EMP are followed. To ensure the effective environmental management of the project, all participating parties must know their responsibilities related to the protection of environmental, biological, and socioeconomic resources and be committed in implementing appropriate measures to fulfill these responsibilities. The Contractor's plan to minimize construction impacts to the environment must include the following:

(1) Engineering Works

- Comprehensive review of the project plans and specifications before construction and during construction.
- A numerical simulation of the project using the finite element method must be conducted to fully understand the stress-strain responses and deformation behavior of the underlying rock foundation of the dam/multipurpose reservoir during and after construction and during reservoir filling.
- If clay layer is encountered in the excavation works for the reservoir foundation, a thorough investigation of the mineralogy must be done in order to assess the susceptibility of this deposit to landslide upon saturation.
- Additional and more specific tests must be conducted during the design phase for a better qualification of the rock mass in relation to the expected load and for evaluation of the subsequent remedial actions.
- Extensive geotechnical investigation prior to any excavation activity to ascertain the mechanical properties of the rocks/soils such as permeability, strength and deformability at the proximity of the fault zone (if these exist).
- Evaluation of the application of retaining walls or of shotcrete as a temporary stabilization measure to minimize soil erosion.
- Identification of areas prone to soil erosion in order to establish appropriate soil erosion control measures that include structural and biological measures. Structural measures include siltation ponds, check dams, gabions, sealing of cracks at the top of slope excavation with grout to prevent infiltration, and measures that can control soil erosion including rehabilitation and planting of fast-growing native species of trees and grasses.
- Proper orientation of workers with regard to cutting of trees that must be kept at minimum. Rehabilitation of cleared areas must immediately take place to lessen further degradation of these areas.
- Excavation works during the dry months of the year. The contractor must adjust the time schedules in order to harmonize with the climate of the area.
- Identification of an area within the project site that is suitable for disposal of dredged soil. Ensure that disposal is handled properly and ensure that the dumpsite must be equipped with structures that will prevent soil from being eroded into the river during rainfall.
- Proper disposal of oils and other chemicals used by machines and vehicles. The contractor must see to it that containers of these chemicals are properly sealed to prevent leakage. The use of any hazardous chemical must be reported to DENR by the contractor.
- Provision of a safe and healthy workplace that must be equipped with proper sanitation systems for the workers.
- Drafting a waste management plan for the camp and whole construction area.

- Installation of a monitoring and evaluation system where the contractor will supervise an inspector or group of inspectors, who in turn monitor the day to day construction activities.

(2) Labor Force Mobilization Activities

- Hiring of workers should give priority to qualified local people, especially those who will be directly affected by the project.
- Submission of reports to the Barangay about the inventory of labor force, the ratio of migrant and local workers, type of work assignment, duration of employment, amount of salary, and status of employment and the number of workers living in and outside of the housing camp.
- Dealing with disorderly conduct of workers that are detrimental to the environment, like poaching, illegal cutting of trees, and others.
- Orientation on the local people's culture, norms and taboos, to promote respect of culture among the migrant workers.
- Ensure the construction of temporary housing camps in already disturbed areas to lessen pressure on the vegetation and fauna.

(3) Occupational Health and Safety

- Provide a safe and healthy workplace equipped with proper sanitation systems especially for migrant workers.
- Provide worker's safety instructions in the workplace and appropriate equipment for the job to avoid hazards that may occur at any time.
- Provide precautionary measures necessary to protect workers and property.
- Ensure that workers have undergone proper training and briefing regarding the nature of their job.
- Comply with the requirements and standards set by the Philippine Occupational Safety and Health Standards.
- Install warning devices for accidents that might affect not only the workers but also the people living near the project site. The contractor must also develop a Contingency Plan which shall include possible relocation and relief operations if accidents happen.

7 CONCLUSION

7.1 Results of the Initial Environmental Examination (IEE)

The IEE for the structural measures in the Project has been carried out based on the information and data collected during the Study and the consultation with concerned government entities and stakeholders. In the Matrix (Tab.I-3-10 to Tab.I-3-15), the major environmental resources are presented with horizontal lines and the activities for implementation of the proposed plan are shown in vertical lines.

The assessment of impacts was made in terms of magnitude (e.g., significant, moderate, and negligible) of the negative or positive impacts to the environment. Positive impacts were not considered in the cumulative quantification of the environmental impact score for each alternative since they would not lead to any hindrance in decisions of whether or not to proceed with the Project. On the other hand, negative environmental impacts remain critical insofar as decisions in the proper selection of project alternatives are concerned.

As the result of assessment, it is evaluated that channel widening as well as the demolition and reconstruction of existing bridges would likely cause adverse impacts to the area. The evaluation of these impacts to particular river basins is as described below.

7.1.1 Ilog-Hilabangan River Basin

(1) Social Environment

1) Resettlement

Resettlement is one of the most critical social impacts in project identification. The number of project-affected-families (PAFs) was estimated to be more than 30. The adverse impacts to be caused by the Project should be mitigated to enable the project-affected-persons (PAPs) improve their living standards with more income opportunities, or at least restore their living condition including income to the pre-project level. A resettlement framework plan is required, which could be used as a guideline to establish the compensation for displaced entities.

2) Loss of Agricultural Land

The widening of Ilog River and the cut-off channel will result in the loss of agricultural land that currently functions as sugarcane plantation. Hence, Right-of-Way (ROW) or land acquisition concerns will also be a significant issue. In such instance, public/stakeholders consultation meetings are required to be carried out because this is a mandatory component of social acceptability under the Philippine EIS System.

3) Disruption of Local Transport

Other significant impacts of channel widening which would be inevitable are the disruption of local transport and the substantial financial requirement in the reconstruction of bridges

associated to all the alternatives. The potential expansion in length and width to attain structural stability of the bridges will require a separate IEE documentation. The IEE document should be substantiated to include traffic impact assessment that will ascertain the extent of impact and develop a traffic management plan for use by the LGU during the project construction phase. As specified in DENR DAO 2003-30, bridges greater than 80 meters in length or >/= 50% increase in capacity (length/width) falls under Category B (Philippine EIS System), which requires an IEE report for the application and issuance of an Environmental Clearance Certificate (ECC).

(2) Natural Environment

1) Removal of Plants/Mangroves

During the construction period, the civil works and earthmoving activities will entail the removal of ornamental plants, other locally available invasive (grows anywhere) trees, including natural vegetation (patches of grasses and weeds, patches of bamboo, plantation of sugarcane, root crops) which are present along the river banks. Negative ecological impacts may also arise in the removal of mangrove strips near the river mouth as well as in other sites along Ilog River.

Although the extent of mangrove removal is not towards clear cutting operations, the implementing agency should consider re-vegetation of mangroves along coastlines as prescribed under Section 43 of the Revised Forestry Code of the Philippines (RA 7161) and Section 12 of DENR DAO 1990-15.

2) Public Hazard (Disposal of Dredged Materials)

The widening of Ilog River and the existing cut-off channel will generate voluminous amounts of soil material. These can pose a significant aesthetic threat to the surroundings and may increase the turbidity of the river. Other physical and chemical effects that will likely occur are the increase in total suspended particulates from the unmanaged stockpile of spoils released or re-suspended in the atmosphere. Such scenario may ensue from the indiscriminate disposal of spoils and dredged materials in vacant lots and agricultural land. The indiscriminate disposal of dredged materials could spur competition in the available land for cropping/planting and other agricultural activities.

The foregoing scenario can be addressed at the onset by looking for an acceptable and appropriate disposal site. The eventual disposal of spoils is not at present critical in terms of health and sanitation since heavy metal content is substantially below the permissible level for toxicity set by USEPA. However, it is important to have the site identified collaboratively with the LGU and the DENR so that the physico-chemical impacts mentioned above including the social concerns are addressed and regulatory compliance is achieved.

7.1.2 Dungcaan River Basin

(1) Social Environment (Resettlement)

In the pre-construction stage, the resettlement of PAPs/PAFs which are mostly residential households is inevitable since it is necessary to clear the area for the dam and to give way for the road level to be increased due to the construction of the dike. The number of PAFs was estimated as more than 20 at the dam site, some 114 families in Sitio Brandy Island, and more than 20 families in Sitio Paradise Island for the river improvement works by the implementation of Alternative C. In terms of implementing Alternative A or B, some 114 families in Sitio Brandy Island and more than 20 families in Barangay Sto. Rosario will be displaced to facilitate construction of the river improvement works.

This number of potentially displaced PAPs/PAFs requires extensive public consultation meetings/hearings and, depending on the experiences/professional judgment of the DENR-EMB (as determined by the EIA review committee), this may lead to a full-scale Environmental Impact Study (EIS). Based on the World Bank (WB) guidelines on involuntary resettlement, once the number of PAPs/PAFs reaches 200 or more, a full resettlement action plan (RAP) is required.

(2) Natural Environment (Mangrove and Faunal Communities)

Damage on mangroves as well as other faunal communities whose habitat may be found in the mangrove sites will be the most significant impact of the proposed activities. Should the project be implemented, the result of the Study shall be submitted to the DENR and it shall include the proposed action plans (replanting of cut mangroves, etc.) consistent with the concept of forest management systems within mangrove areas. Although the extent of mangrove removal is not towards clear cutting operations, the implementing agency should consider re-vegetation of mangroves along coastlines as prescribed under Section 43 of the Revised Forestry Code of the Philippines (RA 7161) and Section 12 of DENR DAO 1990-15.

(3) Public Hazard

1) Disposal of Dredged Materials and Spoils

The extent and magnitude of the proposed river improvement works would likely cause the indiscriminate disposal of dredge materials. With the absence of an acceptable disposal site, the dredge materials may end up in vacant lots and agricultural lands resulting to irreversible negative aesthetic impacts. Hence, it is a primordial concern to identify, procure and prepare the land for ultimate disposal prior to the start of construction work.

2) Deterioration of Water Quality

The possible deterioration of water quality in Dungcaan River will be temporary and can still be reversed or restored to the presently existing river quality. Among the potential changes in water quality is the increased suspended solids, turbidity, discoloration, presence of inorganic substances, i.e., oils, etc. Such changes in the water quality may significantly cause adverse impacts to the existing aquatic biota in the water bodies, especially the estuarine ecosystem composed of mangroves and small fishes at the mouth of Dungcaan River. The extent of environmental impact may be treated as negative but short-term.

7.1.3 Meycauayan River Basin

(1) Social Environment (Resettlement)

Social impacts such as displacement of communities (residential households, commercial and industrial establishments) will likely occur once the construction of the dike starts along the densely populated stretch of the Meycauayan and Marilao riverbanks. The areas proposed as regulation ponds will increase the more than 90 PAPs estimated in Meycauayan and the additional 90 PAPs in the section along Marilao River. The number of PAPs is a consortium of residential, commercial and industrial entities situated along the riverbanks. The rate at which the population is increasing in those areas will continue because of urbanization and the poor regulation of local zoning and implementation of land use ordinances/laws.

In pushing for the implementation of the flood control project, the project proponent should be able to anticipate high financial requirements including opposition from the affected communities. To reduce the social impact, the IEE shall be substantiated to include social preparation activities like community/stakeholders consultation meetings, preparation of framework plan for resettlement/compensation and preparation of resettlement action plans (RAP).

The implementation of social mitigation activities will not only encourage community participation but also help the project satisfy the provision of DAO 2003-30 regarding social acceptability and compliance to the compensation requirement of Philippine Republic Act No. 7279 or the 1992 Urban Development and Housing Act (UDHA).

(2) Natural Environment

As regards ecological impact of the project, there will be expected a minimum or negligible impact on fish habitat in the areas used as fishponds or wildlife since the project area is predominantly urban and nearly devoid of any wildlife habitat.

(3) Pollution

1) Disposal of Dredged Materials and Spoils

The extent and magnitude of the project would likely cause the indiscriminate disposal of dredged materials. With the absence of an acceptable disposal site, the dredge materials may end up in vacant lots resulting to irreversible negative aesthetic impacts. Hence, it is a primordial concern to identify, procure and prepare the land for ultimate disposal prior to the start of construction work.

2) Others

The physico-chemical effects (e.g., increase in air pollution, increase in noise level and ground vibration, accidental spill of cement and oil-based products used in the construction, etc.) of secondary activities on the natural environment can be treated as negligible because they can be addressed by the proposed mitigating and management measures outlined in this IEE report.

7.1.4 Kinanliman River Basin

(1) Social Environment

1) Disruption of Local Transport

With the demolition and reconstruction of Kinanliman Bridge the local transport will be disrupted together with the water pipeline situated on the bridge crossing. This can be mitigated with the implementation of a traffic management plan that should be prepared in collaboration with the local traffic bureau. The unavailability of domestic water in areas affected by the project can be addressed by means of proper coordination with the local water district of Real, Quezon.

2) Resettlement

The resettlement of displaced communities will not be an issue because there are no PAPs/PAFs at the vicinity of the proposed flood control structures. Thus, the proposed project is socially acceptable with mostly beneficial outcomes advantageous to the LGU upon the completion of the flood control facilities.

(2) Natural Environment (Removal of Vegetation)

According to the result of the IEE, long-term and irreversible effects resulting from altered terrain and topography at the vicinity of the dam as well as the permanent removal of vegetation will likely occur. The removal of fruit bearing trees, ornamental plants and natural vegetation (patches of grasses, banana, ferns, etc.) will cover only the areas within the right-of-way required to erect the dike. Beneficial effect of plant/vegetation removal due to

the construction of dike is the overall improvement in surface water hydrology. Upon completion of the proposed facilities, it is expected that unimpeded flood water flow to the sea and controlled deposition of silts and debris will ensue. Hence, it is necessary to remove some of the vegetation found along the proposed site for dike construction without negative impact in the estuarine environment. It is however equally important that the project shall obtain tree cutting permit from the Philippine Coconut Authority (PCA) for coconut trees that will be uprooted. The implementing agency may also adopt as a mitigating measure the replanting of trees within the river channel's buffer strip (varies from 10 – 25 meters for tributaries).

(3) Pollution (Disposal of Dredge Materials and Spoils)

The unavoidable impact which has a moderate effect is the generation of dredged materials/spoils due to the channelization at the site proposed for the construction of the spur dike. Short-term physico-chemical impacts (e.g., increase in turbidity in the river water and the increase in noise level from the operation of dredging equipment) related with the construction of the spur dike can be mitigated following the EMP in Chapter 6 of this Supporting Report I. Overall, the results of the IEE satisfy the requirement of the Philippine EIS System for the project to secure the needed ECC.

7.1.5 Tuganay River Basin

(1) Social Environment

1) Resettlement

Potential conflicts in land use may arise with the proposal to utilize 225 hectares of land as retarding basins (e.g., agricultural activities and the displacement of PAPs/PAFs). Such condition will require approval from the LGU of Carmen, Davao del Norte, and permit from the Department of Agriculture (DA) for the land to be converted into special use from agricultural use.

The preparation and implementation of a resettlement plan will have to be immediately executed to address the needs of more than 34 residential households living within the proposed retarding basins. A similar mitigating measure will be needed for the more than 15 residential households to be affected by the re-construction of the dike in Barangay Anibongan.

As such, the IEE report shall be substantiated to include social preparation activities like community/stakeholders consultation meetings, preparation of framework plan for resettlement and preparation of resettlement plans. Only upon the completion of such activities can the project satisfy the provision of DENR DAO 2003-30 regarding social

acceptability as well as the project's compliance to the compensation requirement of Philippine Republic Act No. 7279 or the 1992 Urban Development and Housing Act (UDHA).

2) Disruption of Existing Infrastructure

Another environmental impact that was identified in the IEE is the disruption of local transport and the water utility line crossing the bridge deck. Such instance would lead to the temporary disruption of the said facilities and inconvenience which may be experienced until the completion of construction of the new bridge. Based on the thresholds set by DENR DAO 2003-30, the expansion/rehabilitation works may be covered by the permitting process once the bridge exceeds 80 meters in length or an equivalent 50% increase in capacity in terms of length/width. In the event the proposed bridge rehabilitation falls outside the coverage of the Philippine EIS System, it is still recommended that a traffic management plan should be prepared in collaboration with the local traffic bureau considering the minimum number (approximately 5) of bridges that will be affected by the river improvement works.

(2) Natural Environment (Removal of Plants and Mangroves)

Ecological negative impacts resulting from the permanent removal of some strips of coconut trees, bananas, rice and patches of mangroves are expected with the reconstruction of the dike along Tuganay River and Ising River. Since it is inevitable to cut coconut trees in the estuarine zone, any coconut tree removal would require approval from the Philippine Coconut Authority (PCA). Similarly, the removal of mangroves located along Ising River has a high potential of disturbance since the channelization in some portions of the river will shift the flow to the new channel line.

(3) Public Hazard

During the construction stage, the changes in the local air quality conditions, noise level and river water quality resulting from the demolition/excavation of the existing dike including its reconstruction will likely occur.

With regard to turbidity and total suspended particulates, and since more than 42 kilometers of dike length is proposed to be reconstructed, an increase in Total Suspended Particulates (TSP) will likely occur in the working areas. A corresponding increase in noise level will also happen with the operation of construction equipment and the use of construction materials. Such alteration in air quality and noise level, however, have a short-term effect and can be mitigated by means of regular watering of work areas, controlled vehicular/equipment movement (speed <10kph), covering of stockpiled construction materials, installation of enclosure in work areas and the regular maintenance of construction equipment. The potential increase in turbidity along Ising River and Tuganay River can be mitigated with the immediate removal of spoils/dredged materials, installation of silt ponds and the proper handling of wastes.

7.1.6 Dinanggasan River Basin

(1) Social Environment

1) Resettlement

Resettlement is one of the most critical social impacts in project identification. The displacement of approximately 18 residential households along Compol River will be caused by the civil (construction) works. The construction of the dike will also disrupt local transport since the river improvement works requires bridge reconstruction – a case of Tag-ibo Bridge.

Even though the social or human related impacts are reversible in nature, a short-term solution must be quickly engaged to avoid project delays and economic loss (in case the project is implemented using funds borrowed from lending institutions). This solution shall include the immediate resettlement of PAPs/PAFs (displaced) and consultation with the community/stakeholders that will be directly affected by the disruption of local transport in the area.

2) Reconstruction of Tag-Ibo Bridge

The reconstruction of Tag-Ibo Bridge will no longer need a separate and more detailed environmental impact assessment since the limits (more than 80 meters in length or more than 50% increase in length/width) prescribed under DENR DAO 2003-30 is not expected to be surpassed. However, it may require traffic impact assessment to properly carve-out a traffic management plan that can address the traffic hazards and negative impact of reconstructing Tag-Ibo Bridge.

(2) Natural Environment

1) Removal of Plants

Ecological impact may ensue with the removal of vegetation within the riparian environment. Among the vegetation that will be removed and will require the issuance of tree cutting permit from the Philippine Coconut Authority are strips of coconut trees found along the river channels.

2) Construction of Sabo Dam

With the construction of Sabo dam, the composition of soil and the topography of the immediate vicinity will be altered. However, the operation of the Sabo dam will contribute to the long-term positive impact of reducing downstream siltation and the decrease in danger to life and property caused by the occurrence of lahar flow.

(3) Pollution

1) Disposal of Dredge Materials and Spoils

The extent and magnitude of the proposed activities would likely cause the indiscriminate disposal of dredge materials. With the absence of an acceptable disposal site, the dredge materials may end up in vacant lots and agricultural lands resulting to irreversible negative aesthetic impacts. Hence, it is a primordial concern to identify, procure and prepare the land for ultimate disposal prior to the start of the construction work.

2) Increase in Turbidity

The water level of the turbidity along Dinanggasan River will increase alongside the proposed dredging activities. On the other hand, turbidity may not be an issue in the case of constructing the embankment along Compol River since the whole stretch of the river is mostly dried-up and the flow is currently along the Dinanggasan River channel. With the provision of silt traps, the increase in turbidity will be short-term and insignificant since there is no wildlife or sensitive habitat of aquatic fauna.

7.2 Management/Mitigation Plan

Overall, the environmental management and mitigation plan shall be strictly implemented during the development phase of the major project components in order to minimize if not totally eradicate the negative environmental impacts. Due to the several potential adverse impacts identified in the evaluation, it is concluded that Environmental Impact Assessment (EIA) is required in the succeeding study period.

Tab.I-1-1 Summary of the Data Sources of the Environmental and Socio-Economic Studies for Flood Control/Mitigation Project

Element	Environmental Studies and Surveys	Classification of Data Obtained		Sources of Secondary Data
		Primary Data	Secondary Data	
Physical Environment	Meteorological Characteristics			Nearest PAGASA Synoptic Stations and LGU Profile
	· Climate		○	
	· Rainfall		○	
	· Temperature		○	
	· Tropical Cyclone		○	
	· Relative humidity		○	
	· Prevailing surface winds (wind rose)		○	
	· Cloudiness		○	
	· Topography	○	○	a) NAMRIA
	· Regional and River Hydrology	○	○	b) Rapid Assessment Report
	· Affected Water Bodies (Marsh System, River, etc.)	○	○	NWRB, Local Water Utilities Office, BSWM & Local DA Office
	· Soil Quality (Fertility, Agricultural Use, etc.)	○	○	MGB, BSWM and LGU Profile
	· Lithology and Stratigraphy		○	PHILVOLCS, MGB & LGU Profile
	· Regional Tectonic Setting		○	
	· Landslides and Soil Erosion	○	○	
	· Aquifer Characteristics	○	○	NWRB, Local Water Utilities Office, BSWM, Local DA Office and LGU Profile
	· Rivers	○	○	
	· Creeks	○	○	
	· Flood Occurrence	○	○	
	· Air Quality Survey	○		DENR – EMB Records
Biological Environment	Vegetation	○	○	DENR-PAWB, CENRO/PENRO, and LGU Profile
	Fish and Wildlife	○	○	
	Endangered/Threatened Species	○	○	
Socio-Economic Environment	Land and Resource Use (Land-use conflict, land drainage issues, groundwater contamination, etc.)	○	○	City Planning and Development Office/ Actual Perception Survey
	Socio-Economic Aspects (Indigenous People, Health and Sanitation issues, etc.)	○	○	
	Key Informant Interview	○	○	

Tab.I-3-1 Heavy Metal Concentration in Sediments Samples (Ilog-Hilabangan)

Parameters / Sampling Ztation / Geographic Position	Units	1(Ilog) 10° 1'4.20"N 122°45'0.36"E	2(Ilog) 10° 1'45.78"N 122°47'18.78"E	3(Ilog) 10° 1'18.24"N 122°47'2.16"E	4(Ilog) 9°59'24.36"N 122°48'2.10"E	5(Hilabangan) 9°57'16.98"N 122°48'59.94"E	6(Hilabangan) 9°58'5.82"N 122°50'16.50"E	MCL *
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	75
Cadmium Cd)	mg/L	<0.003	<0.003	0.02	0.02	0.03	0.02	85
Copper (Cu)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	4,300
Lead (Pb)	mg/L	0.24	0.15	0.32	0.31	0.35	0.35	840
Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	57
Chromium Cr)	mg/L	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	3,000
Cyanide (CN)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	-

* Maximum Contaminant Level (mg/kg), USEPA Standards (instantaneous)
Conversion : 1 ppm = mg/kg = mg/L

Tab.I-3-2 Heavy Metal Concentration in Sediments Samples (Dungcaan)

Parameters / Sampling Station / Geographic Position	Units	Dungcaan River 1 10°40'50.00"N 124°49'14.00"E	2 10°40'19.00"N 124°50'48.00"E	3 10°38'5.00"N 124°52'14.00"E	4 10°36'51.00"N 124°52'58.00"E	MCL*
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	<0.01	75
Cadmium (Cd)	mg/L	<0.003	<0.003	<0.003	<0.003	85
Copper (Cu)	mg/L	<0.05	<0.05	<0.05	<0.05	4,300
Lead (Pb)	mg/L	<0.005	<0.005	<0.005	<0.005	840
Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	57
Chromium (Cr)	mg/L	<0.006	<0.006	<0.006	<0.006	3,000
Cyanide (CN)	mg/L	<0.002	<0.002	<0.002	<0.002	-

* Maximum Contaminant Level (mg/kg), USEPA Standards (instantaneous)
Conversion : 1 ppm = mg/kg = mg/L

Tab.I-3-3 Heavy Metal Concentration of Sediments Samples (Meycauayan)

Parameters / Sampling Station / Geographic Position	Units	Sampling Station Number: Marilao 14°46'16.18"N 120°57'49.64"E	Marilao 14°45'38.47"N 120°56'58.07"E	Saluysoy, Meyc. 14°44'18.21"N 120°56'35.83"E	Meycauayan 14°43'50.46"N 120°57'40.09"E	Polo River 14°43'13.56"N 120°56'11.49"E	Obando 14°42'8.07"N 120°55'46.06"E	MCL*
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	75
Cadmium (Cd)	mg/L	<0.003	<0.003	0.02	0.02	0.03	0.02	85
Copper (Cu)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	4,300
Lead (Pb)	mg/L	0.24	0.15	0.32	0.31	0.35	0.35	840
Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	57
Chromium (Cr)	mg/L	<0.006	<0.006	<0.006	<0.006	<0.006	<0.006	3,000
Cyanide (CN)	mg/L	<0.002	0.004	0.005	0.06	<0.002	0.004	-

* Maximum Contaminant Level (mg/kg), USEPA Standards (instantaneous)
Conversion : 1 ppm = mg/kg = mg/L

Tab.I-3-4 Heavy Metal Concentration in Sediments Samples (Kinanliman)

Parameters	Units	Sampling Station No. and Geographical Position			MCL*
Sampling Station		1	2	3	
Geographic Position		14°39'33.84"N 121°36'17.36"E	14°39'34.00"N 121°36'2.00"E	14°39'19.01"N 121°35'25.66"E	
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	75
Cadmium (Cd)	mg/L	<0.003	<0.003	<0.003	85
Copper (Cu)	mg/L	<0.05	<0.05	<0.05	4,300
Lead (Pb)	mg/L	<0.005	<0.005	<0.005	840
Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	57
Chromium (Cr)	mg/L	<0.006	<0.006	<0.006	3,000
Cyanide (CN)	mg/L	<0.002	<0.002	<0.002	-

* Maximum Contaminant Level (mg/kg), USEPA Standards (instantaneous)
Conversion : 1 ppm = mg/kg = mg/L

Tab.I-3-5 Heavy Metal Concentration of Sediments Samples (Tuganay)

Parameters	Units	Sampling Station No. Along Tuganay River				MCL*
Sampling Station		1	2	3	4	
Geographic Position		7°19'9.05"N 125°44'3.99"E	14°39'34.00"N 121°36'2.00"E	14°39'19.01"N 121°35'25.66"E	7°23'32.00"N 125°41'23.00"E	
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	<0.01	75
Cadmium (Cd)	mg/L	<0.003	<0.003	<0.003	<0.003	85
Copper (Cu)	mg/L	0.42	<0.05	<0.05	<0.05	4,300
Lead (Pb)	mg/L	<0.005	<0.005	<0.005	<0.005	840
Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	57
Chromium (Cr)	mg/L	<0.006	<0.006	<0.006	<0.006	3,000
Cyanide (CN)	mg/L	<0.002	<0.002	0.003	<0.002	-

* Maximum Contaminant Level (mg/kg), USEPA Standards (instantaneous)
Conversion : 1 ppm = mg/kg = mg/L

Tab.I-3-6 Heavy Metal Concentration of Sediments Samples (Dinanggasan)

Parameters	Units	Dinanggasan River					MCL*
Sampling Station		1	2	3	4	5	
Geographic Position		9° 7'56.00"N 124°40'2.00"E	9° 8'16.45"N 124°40'7.10"E	9° 8'26.00"N 124°40'17.99"E	9° 8'54.04"N 124°40'19.01"E	9° 9'38.01"N 124°40'25.99"E	
Arsenic (As)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	75
Cadmium (Cd)	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	85
Copper (Cu)	mg/L	0.42	<0.05	<0.05	<0.05	<0.05	4,300
Lead (Pb)	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005	840
Mercury (Hg)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	57
Chromium (Cr)	mg/L	<0.006	<0.006	<0.006	<0.006	<0.006	3,000
Cyanide (CN)	mg/L	<0.002	<0.002	0.003	0.003	0.003	-

* Maximum Contaminant Level (mg/kg), USEPA Standards (instantaneous)
Conversion : 1 ppm = mg/kg = mg/L

Tab.I-3-7 National Redlist of Philippine Wildlife (1/2)

	Common Name	Scientific Name	Habitat
Ilog-Hilabangan			
	Cervidae Philippine Spotted Deer/	Tarsius syrichta	Dense primary and secondary tropical forests
	Suidae Visayan Warty Pig	Sus philippensis	Lowland and highland grasslands as well as primary and secondary forest
	Cercopithecidae Crab-eating Macaque/Long-tailed macaque	Crunomys melanius	Primary, secondary, coastal, mangrove, swamp, and riverine forests
	Golden-crowned Flying Fox	Acerodon jubatus	Primary and secondary lowland forest
	Negros White-toothed	Cynocephalus volans	Primary lowland and montane forest
	Grey-headed Fishing Eagle	Spilomis Holospilus	Reported in Province of Negros
	Philippine Serpent-Eagle	Circus melanoleocus	Reported in Province of Negros
	Pied Harner	Egretta eulophotes	Reported in Province of Negros
	Japanese night heron	Gorsachius goisagi	Reported in Province of Negros
	Rufous-lored kingfisher	Alcedo argentata	Reported in Province of Negros
	Philippine duck	Ceyx melanurus	Reported in Province of Negros
	Darter	Todiramphus winchelli	Reported in Province of Negros
	Walden's hornbill	Buceros hydrocorax	Reported in Province of Negros
	Visayan tarictic hornbill	Charadrius peronii	Reported in Province of Negros
	White-winged cuckoo-shrike	Chloropsis flavipennis	Reported in Province of Negros
	Nicobar pigeon	Ducula poliocephala	Reported in Province of Negros
	Pink-bellied imperial pigeon	Ducula poliocephala	Reported in Province of Negros
	Negros bleeding-heart	Gallicolumba keayi	Reported in Province of Negros
	Negros fruit dove	Ptilinopus arcanus	This specimen was taken from Mt. Kanla-on in 1953
	Visayan flowerpecker	Dicaeum haematostictum	Reported in Province of Negros
	Green-faced parrotfinch	Erythrura viridifacies	Reported in Province of Negros
	Tabon scrubfowl	Megapodius cumingii	Reported in Province of Negros
	Celestial blue monarch	Hypothymis coelestis	Reported in Province of Negros
	Ashy-breasted flycatcher	Muscicapa randi	Reported in Province of Negros
	White-throated jungle flycatcher	Rhinomyias albigularis	Reported in Province of Negros
	Philippine Cockatoo	Cacatua haematuropygia	Reported in Province of Negros
	Blue-napped parrot	Tanygnathus lucionensis	Reported in Province of Negros
	Streaked reed-warbler	Acrocephalus sorghophilus	Reported in Province of Negros
	Flame-templed babbler	Stachyris speciosa (=Dasycrotapha speciosa)	Reported in Province of Negros
	Negros striped-babbler	Stachyris nigrorum	Reported in Province of Negros
	Philippine sailfin lizard	Hydrosaurus postulatus	Reported in Province of Negros
	Green sea turtle	Chelonia mydas	Reported in Province of Negros
	Leatherback turtle	Dermochelys coriacea	Reported in Province of Negros
	Hawksbill turtle	Eretmochelys imbricata	Reported in Province of Negros
	Olive ridley sea turtle	Lepidochelys olivacea	Reported in Province of Negros
	Hazel's forest frog	Platymantis hazelae	Reported in Province of Negros
	Negros forest tree frog	Platymantis negrosensis	Reported in Province of Negros
	Negros limestone frog	Platymantis spelaeus	Reported in Province of Negros
Dungcaan			
	Tarsier	Tarsius syrichta	Second growth, secondary forest, and primary forest
	Philippine Warty Pig	Sus philippensis	Formerly abundant from sea level to at least 2800 m, in virtually all habitats, now common only in remote forests
	Mindanao Shrew-Mouse	Crunomys melanius	From near sea level to 900 m, probably in primary rain forest
	Golden-crowned Flying Fox	Acerodon jubatus	Primary and secondary lowland forest
	Cynocephalidae Flying Lemur	Cynocephalus volans	Forest - Subtropical/Tropical Dry, Artificial/Terrestrial – Plantations
	Philippine Serpent-Eagle	Spilomis Holospilus	Reported to exist in Leyte
	Pied Har	Circus melanoleocus	Reported to exist in Leyte
	Chinese Egret	Egretta eulophotes	Reported to exist in Leyte
	Japanese night heron	Gorsachius goisagi	Reported to exist in Leyte
	Silvery kingfisher	Alcedo argentata	Reported to exist in Leyte
	Philippine dwarf kingfisher	Ceyx melanurus	Reported to exist in Leyte
	Rufous-lored kingfisher	Todiramphus winchelli	Reported to exist in Leyte
	Rufous hornbill	Buceros hydrocorax	Reported to exist in Leyte
	Malaysian plover	Charadrius peronii	Reported to exist in Leyte
	Philippine leafbird	Chloropsis flavipennis	Reported to exist in Leyte
	Pink-bellied imperial pigeon	Ducula poliocephala	Reported to exist in Leyte
	Mindanao bleeding-heart	Gallicolumba criniger	Reported to exist in Leyte

Tab.I-3-7 National Redlist of Philippine Wildlife (2/2)

	Common Name	Scientific Name	Habitat
	Visayan broadbill	Eurylaimus samarensis	Reported to exist in Leyte
	Tabon scrubfowl	Megapodius cumingii	Reported to exist in Leyte
	Little slaty flycatcher	Ficedula basilanica	Reported to exist in Leyte
	Azure-breasted pitta	Pitta steerii	Reported to exist in Leyte
	Philippine Cockatoo	Cacatua haematuropygia	Reported to exist in Leyte
	Blue-napped parrot	Tanygnathus lucionensis	Reported to exist in Leyte
	Philippine eagle owl	Bubo philippensis	Reported to exist in Leyte
	Philippine sailfin lizard	Hydrosaurus postulatus	Reported to exist in Leyte
	Philippine pond turtle	Heosemys leytensis	Reported to exist in Leyte
	Green sea turtle	Chelonia mydas	Reported to exist in Leyte
	Leatherback turtle	Dermochelys coriacea	Reported to exist in Leyte
	Hawksbill turtle	Eretmochelys imbricate	Reported to exist in Leyte
	Olive ridley sea turtle	Lepidochelys olivacea	Reported to exist in Leyte
	Malay monitor lizard	Varanus salvator cumingi	Reported to exist in Leyte
	Mindanao fanged frog	Limnonectes magnus	Reported to exist in Leyte
	Rabor's forest frog	Platymantis rabori	Reported to exist in Leyte
Meycauayan			
	Spot-billed Pelican	Pelecanus philippensis	Recorded in Bulacan and Candava Swamp
	Black-faced	Spoonbill Platalea minor	Recorded in Obando, Bulacan
	Green-faced parrotfinch	Erythrura viridifacies	Recorded in Bulacan
	Nordmann's greenshank	Tringa guttifer	Recorded in Bulacan
Kinanliman			
	Golden-crowned Flying Fox	Acerodon jubatus	Primary and secondary lowland forest
	Philippine Monkey	Macaca fascicularis	Reported to exist in Quezon
	Southern Luzon giant clout rat	Phloeomys cumingi	Reported to exist in Quezon
	White-winged fruit bat	Pteropus leucopterus	Reported to exist in Quezon
	Flame-breasted fruit dove	Ptilinopus marchei	Reported to exist in Quezon
	Cream-bellied fruit dove	Ptilinopus merrilli	Reported to exist in Quezon
	Sarus crane	Grus antigone	Reported to exist in Quezon
	Philippine sailfin lizard	Hydrosaurus postulatus	Reported to exist in Quezon
	Hawksbill turtle	Eretmochelys imbricata	Reported to exist in Quezon
	Philippine crocodile	Crocodylus mindorensis	Reported to exist in Quezon
	Gray's monitor lizard	Varanus olivaceus	Reported to exist in Quezon
	Polillo forest tree frog	Platymantis polilloensis	Reported to exist in Quezon
Tuganay			
	Philippine tarsier	Tarsius syrichta	Second growth, secondary forest, and primary forest
	Philippine Warty Pig	Sus philippensis	Formerly abundant from sea level to at least 2800 m, in virtually all habitats, now common only in remote forests
	Philippine Monkey	Macaca fascicularis	Found in Davao del Norte
	Golden-crowned Flying Fox	Acerodon jubatus	Primary and secondary lowland forest
	Cynocephalidae Flying Lemur	Cynocephalus volans	Forest - Subtropical/Tropical Dry, Artificial/Terrestrial-Plantations
	Philippine brown deer	Cervus mariannus	Reported to exist in Davao del Norte
	Golden-crowned fruit bat	Acerodon jubatus	Reported to exist in Davao del Norte
	Giant flying fox	Pteropus vampyrus	Reported to exist in Davao del Norte
Dinanggasan			
	Philippine Warty Pig	Sus philippensis	Formerly abundant from sea level to at least 2800 m, in virtually all habitats, now common only in remote forests
	Mindanao Shrew-Mouse	Crunomys melanius	From near sea level to 900 m, probably in primary rain forest
	Small Rufous Horseshoe Bat	Rhinolophus subrufus	Poorly known
	Writhed hornbill	Aceros leucocephalus	Reported to exist in Camiguin
	Whistling green-pigeon	Treron formosae	Reported to exist in Camiguin
	Tabon scrubfowl	Megapodius cumingii	Reported to exist in Camiguin
	Philippine sailfin lizard	Hydrosaurus postulatus	Reported to exist in Camiguin
	Green sea turtle	Chelonia mydas	Reported to exist in Camiguin
	Hawksbill turtle	Eretmochelys imbricata	Reported to exist in Camiguin
	Mindanao fanged frog	Limnonectes magnus	Reported to exist in Camiguin

Source: 2004 Statistics on Philippine Protected Areas and Wildlife Resources, 2004, DENR Protected Areas and Wildlife Bureau (http://www.pawb.gov.ph/)
Mammalian Fauna of the Philippine Islands. (http://www.fieldmuseum.org)

Tab.I-3-8 Protected Area

Name of River Basin	Name of Protected	Area Location	Legislation	Date	Area (ha)
Ilog-Hilabangan	Ilog-Hilabangan WFR	Himamaylan and Kabankalan Negros Occidental	Proc. 602	6/28/1990	10,211
Ilog-Hilabangan	Kabangkalan WFR	Kabankalan, Negros Occidental	Proc. 820	10/25/1991	432
Dungcaan	Kuapnit Balinsasayao NP	Baybay and Abuyog, Leyte	Proc. 142	4/16/1937	364
Kinanliman	Buriquela NP	Real, Quezon	Proc. 1636	4/18/1977	23,592
Kinanliman	University of Philippine Land Grant	Real, Quezon	Proc. 129-D	-	6436
Tuganay	San Isidro Wildlife Sanctuary	Barangay San Isidro, Carmen, Davao del Norte	NIPAS Area	-	5
Tuganay	Tibulao Forest Reserve	Barangay TIbulao, Carmen, Davao del Norte	NIPAS Area	-	31
Dinanggasan	Timberland	Portions of Mt. Timpooing, Mt. Catarman and Mt.Vulcan, Catarman, Camiguin	LGU declared forest area	-	610
Dinanggasan	Marine Reserve Area	Sunken Cemetery, Barangay Bonbon, Catarman	Ongoing Legal procedures and social preparations	-	-
Dinanggasan	Mount Timpoong-Hibok, Hibok Nature Park	Catarman, Camiguin	Proposed and recommended for NIPAS inclusion	-	-

Source:
Biodiversity Management Division, PAWB
Watershed Forest Reserve (WFR)
National Park (NP)
National Integrated Protected Areas Service (NIPAS)
CLUP of Carmen, Davao del Norte
Municipal Assessors Office, Catarman, Camiguin

Tab.I-3-9 Labor & Employment

Selected Indicators	Philippines (National)	Region				
		III	VI	VIII	X	XI
Labor Force Participation Rate	63.6	60.2	67.4	65.3	68.8	62.8
Employment Rate	92.2	88.5	90.3	95.3	93.1	90.8
Unemployment Rate	7.8	11.5	9.7	4.7	6.9	9.2
Underemployment Rate	22.0	14.1	21.5	29.2	30.3	15.0

Source: National Statistics Office, July 2007 Labor Force Survey

Tab.I-3-10 Employed Persons and Class of Worker 2004 (in thousand)

Class of Worker	Philippines (National)	Region					
		III	IV	VI	VIII	X	XI
Wage & Salary Workers	16,472	1,961	2,318	1,417	600	732	829
Worked in Private Establishment	12,552	1,629	1,882	1,063	388	533	640
Worked in Private HH	1,371	119	179	139	53	60	69
Worked in Family- Operated Activity	129	13	14	10	5	6	10
Worked for Government	2,420	201	243	205	156	134	110
Own-Account Workers	11,615	968	1,129	971	729	640	606
Self-Employed	10,011	840	1,034	757	655	557	532
Employer	1,604	128	95	214	75	83	74
Unpaid Family Workers	3,527	169	219	321	279	346	172

Source: NSO, Labor Force Survey, Public Use Files

Tab.I-3-11 Classification of Fresh Surface Water

River Water Class	Applicable Water Use
AA	Public Water Supply Class I. This class is intended primarily for waters having watersheds which are uninhabited and otherwise protected and which require only approved disinfection in order to meet the National Standards for Drinking Water (NSDW) of the Philippines.
A	Public Water Supply Class II. For sources of water supply that will require complete treatment (coagulation, sedimentation, filtration and disinfection) in order to meet the National Standards for Drinking Water (NSDW).
B	Recreational Water Class I. For primary contact recreation such as bathing, swimming, skin diving, etc. (particularly those designated for tourism purpose)
C	(1)Fishery Water for the propagation and growth of fish and other aquatic resources (2)Recreational Water Class II (Boating, etc.) (3)Industrial Water Supply Class I (For manufacturing processes after treatment)
D	(1)For agriculture, irrigation, livestock watering, etc. (2)Industrial Water Supply Class II (e.g. cooling, etc.) (3)Other inland waters, by their quality, belong to this classification.

Source: DENR Administrative Order No. 34 March 20, 1990

Tab.I-3-12 Water Quality of Ilog-Hilabangan River

Water Quality Parameters	Units	Sampling Station No. and Location						DENR Standards* (yearly average)		
		1 Cut-off Channel	2 Ilog River	3 Ilog River	4 Ilog River	5 Hilabangan River	6 Hilabangan River	Class C	Class A	Class B
Geographic Position		10° 1' 4.20"N 122°45' 0.36"E	10° 1' 45.78"N 122°47' 18.78"E	10° 1' 18.24"N 122°47' 2.16"E	9°59' 24.36"N 122°48' 2.10"E	9°57' 16.98"N 122°48' 59.94"E	9°58' 5.82"N 122°50' 16.50"E			
Dissolved Oxygen	mg/l	7.10	7.00	7.10	7.50	7.60	8.00	5.0	5.0	5.0
Biochemical Oxygen Demand (BOD)	mg/l	144	268	199	239	319	124	7	5	5
Total Suspended Solids	mg/l	240	142	524	456	60	70	(a)	50	(c)
pH	range	7.00	7.00	7.00	6.50	7.00	7.50	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Total Coliform	MPN/100ml	90,000	5,000	30,000	90,000	5,000	5,000	5,000 (b)	1,000 (b)	1,000 (b)
Fecal Coliform	MPN/100ml	9,000	5,000	8,000	5,000	5,000	1,100	-	100 (b)	200 (b)

Tab.I-3-13 Water Quality of Dungcaan River

Water Quality Parameters	Units	Dungcaan River Sampling Station No.				DENR Standards* (yearly average)		
		1	2	3	4	Class C	Class A	Class B
Geographic Position		10°40'50.00"N 124°49'14.00"E	10°40'19.00"N 124°50'48.00"E	10°38'5.00"N 124°52'14.00"E	10°36'51.00"N 124°52'58.00"E			
Dissolved Oxygen	mg/l	8.57	6.12	9.05	7.35	5.0	5.0	5.0
Biochemical Oxygen Demand (BOD)	mg/l	7	10	4	6	7	5	5
Total Suspended Solids	mg/l	35	8	10	<2	(a)	50	(c)
pH	range	7.77	7.60	7.83	7.52	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Total Coliform	MPN/100ml	14	6	17	33	5,000 (b)	1,000 (b)	1,000 (b)
Fecal Coliform	MPN/100ml	9	6	8	4	-	100 (b)	200 (b)

Tab.I-3-14 Water Quality of Meycauayan River

Water Quality Parameters	Units	Sampling Station No. and Location						DENR Standards* (yearly average)		
		Marilao	Marilao	Saluysoy, Meyc.	Meycauayan	Polo River	Obando	Class C	Class A	Class B
Geographic Position		14°46' 16.18"N 120°57' 49.64"E	14°45' 38.47"N 120°56' 58.07"E	14°44' 18.21"N 120°56' 35.83"E	14°43' 50.46"N 120°57' 40.09"E	14°43' 13.56"N 120°56' 11.49"E	14°42' 8.07"N 120°55' 46.06"E			
Dissolved Oxygen	mg/l	0.25	0.47	0.01	0.66	0.45	7.52	5.0	5.0	5.0
Biochemical Oxygen Demand (BOD)	mg/l	104	30	16	529	14	21	7	5	5
Total Suspended Solids	mg/l	174	4	62	230	<2	190	(a)	50	(c)
pH	range	8.19	8.25	8.30	8.00	8.26	8.66	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Total Coliform	MPN /100ml	9x106	5x106	1.6x106	1.6x106	2.4x106	3x106	5,000 (b)	1,000 (b)	1,000 (b)
Fecal Coliform	MPN/ 100ml	9x106	5x106	1.6x106	9x106	900,000	3x106	-	100 (b)	200 (b)

Tab.I-3-15 Water Quality of Kinanliman River

Water Quality Parameters	Units	Sampling Station No. and Location			DENR Standards* (yearly average)		
		1	2	3	Class C	Class A	Class B
Geographic Position		14°39'33.84"N 121°36'17.36"E	14°39'34.00"N 121°36'2.00"E	14°39'19.01"N 121°35'25.66"E			
Dissolved Oxygen	mg/l	7.7	8.7	8.14	5.0	5.0	5.0
Biochemical Oxygen Demand (BOD)	mg/l	2	3	1	7	5	5
Total Suspended Solids	mg/l	<2	3	<2	(a)	50	(c)
pH	range	7.78	8.06	8.04	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Total Coliform	MPN/100ml	50,000	30,000	24,000	5,000 (b)	1,000 (b)	1,000 (b)
Fecal Coliform	MPN/100ml	Not Analyzed	Not Analyzed	Not Analyzed	-	100 (b)	200 (b)

Tab.I-3-16 Water Quality of Tuganay River

Water Quality Parameters	Units	Sampling Station No. and Location				DENR Standards* (yearly average)		
		1	2	3	4	Class C	Class A	Class B
Geographic Position		7°19'9.05"N 125°44'3.99"E	14°39'34.00"N 121°36'2.00"E	14°39'19.01"N 121°35'25.66"E	7°23'32.00"N 125°41'23.00"E			
Dissolved Oxygen	mg/l	4.89	3.63	3.63	4.97	5.0	5.0	5.0
Biochemical Oxygen Demand (BOD)	mg/l	22	13	19	35	7	5	5
Total Suspended Solids	mg/l	39	327	88	256	(a)	50	(c)
pH	range	6.77	7.16	6.97	7.61	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Total Coliform	MPN/100ml	9,000	1.6 x108	16,000	1.6 x108	5,000 (b)	1,000 (b)	1,000 (b)
Fecal Coliform	MPN/100ml	9,000	1.6 x107	16,000	1.6 x107	-	100 (b)	200 (b)

Tab.I-3-17 Water Quality of Dinanggasan

Water Quality Parameters	Units	Sampling Station No. and Location					DENR Standards* (yearly average)		
		1	2	3	4	5	Class C	Class A	Class B
Geographic Position		9° 7'56.00"N 124°40'2.00"E	9° 8'16.45"N 124°40'7.10"E	9° 8'26.00"N 124°40'17.99"E	9° 8'54.04"N 124°40'19.01"E	9° 9'38.01"N 124°40'25.99"E			
Dissolved Oxygen	mg/l	7.76	6.32	6.45	7.24	6.53	5.0	5.0	5.0
Biochemical Oxygen Demand (BOD)	mg/l	2	4	2	31	4	7	5	5
Total Suspended Solids	mg/l	4	2	<2	4	<2	(a)	50	(c)
pH	range	7.27	6.97	7.07	7.06	7.17	6.5 – 8.5	6.5 – 8.5	6.5 – 8.5
Total Coliform	MPN/100ml	24,000	2,400	2,400	2,400	1,600	5,000 (b)	1,000 (b)	1,000 (b)
Fecal Coliform	MPN/100ml	24,000	500	500	300	23	-	100 (b)	200 (b)

Tab.I-3-18 Expected Noise Levels from Construction Equipment, dB(A) at Various Distances

Equipment	Distance, meters				
	15	30	60	120	240
Earthmoving Equipment					
Front loaders	75	69	63	57	51
Backhoes	85	79	73	67	61
Graders	88	82	76	70	64
Trucks	91	85	79	73	67
Materials Handling					
Concrete mixers	82	79	73	67	61
Cranes	83	77	71	65	59
Stationary Sources					
Generators	78	72	66	60	54
Compressors	81	75	69	63	57
Pumps	76	70	64	58	52
Impact Equipment					
Pile drivers	101	95	89	83	77
Jackhammers	88	82	76	70	64

Tab.I-3-19 DENR Standards for Noise in General Areas

Maximum Allowable Noise Level, dB(A)			
Area	Daytime	Morning/Early Eve.	Nighttime
Schools, Hospitals	50	45	40
Residential	55	50	45
Commercial	65	60	55
Light Industrial	70	65	60
Heavy Industrial	75	70	65

Tab.I-3-20 DENR Ambient Noise Levels According to Time and Location

Time	Category Area				
	AA	A	B	C	D
Day Time (9 am - 6 pm)	50	55	65	70	75
Morning/Evening (5 am - 9 am) (6 pm - 10 pm)	45	50	60	65	70
Nighttime (10 pm - 5 am)	40	45	55	60	65
Area AA	Section or contiguous area which requires quietness, such as an area within 100 meters from school sites, nursery school, hospitals and special homes for the aged;				
Area A	Section or contiguous area which is primarily used for residential purposes				
Area B	Section or contiguous area which is primarily a commercial area				
Area C	Section primarily reserved as a light industrial area				
Area D	Section which is primarily reserved as a heavy industrial area				

Source: National Pollution Control Commission, 1978

Tab.I-5-1 Potential Impacts in the Implementation of the Proposed Alternatives (Ilog-Hilabangan Alternative A - River Improvement and Enhancement of Flow along the Main Channel) (1/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Pre-construction Phase	<u>Resettlement of Project Affected Persons/Families</u>							
	• Preparation of resettlement action plan	➢ Relocation of project affected families whose houses are located within the proximity of the proposed structural measures	➔ Proximity of relocation site to work, school, market and socio-cultural venue of the resettled families;	(-)	L	R	HI	LT
			➔ Displacement of approximately 30 families whose houses are located in either the right or left bank of the river;	(-)	L	R	HI	LT
			➔ Displacement of families and individuals, especially schooling of school-aged children;	(-)	L	R	HI	ST
			➔ Threat to livelihood and income;	(-)	L	R	HI	ST
			➔ Opportunities for expanding social relationships and community networks in new site.	(+)	L	NA	MED	ST
	<u>Land Acquisition</u>							
	• Consultation and negotiations with landowners	➢ Clearing of several sugarcane and banana plantations in project affected areas and other critical zone	➔ Impact on nearly 8 sugar plantations, 9 nipa/mangrove sites, 3 banana plantations, 2 fishponds, and power transmission lines;	(-)	W	IR	HI	LT
			➔ Financial challenge to the local government units in the acquisition of privately-owned lands in project affected areas;	(-)	L	R	HI	MT
			➔ Land use conflict may arise;	(-)	L	R	HI	MT
			➔ Reduction in production of affected agricultural products	(-)	L	R	HI	MT
	<u>Project Mobilization</u>							
	• Hiring of local staff and construction labor	➢ Staffing and labor sourcing	➔ Increased employment opportunities for local workers;	(+)	L	NA	MED	MT
			➔ Competition by migrant skilled workers and construction/management experts	(-)	L	R	MED	ST
Construction Phase	<u>Construction of Earth Dike</u>							
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation of construction vehicles, equipment and from transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Dredging along riverbanks for foundation and footworks	➢ Removal and disposal of spoils or dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
	• Removal of vegetation along riverbank	➢ Site clearing and grubbing of soil	➔ Permanent removal of vegetation commonly found along the channel e. g., sugarcane, bamboo, banana, bakawan (downstream),root crops and weeds.	(-)	L	IR	HI	ST
	• Compaction of earth/soil dike	➢ Operation of compaction equipment	➔ Increase in ground vibration	(-)	L	R	MED	MT

Tab.I-5-1 Potential Impacts in the Implementation of the Proposed Alternatives (Ilog-Hilabangan Alternative A - River Improvement and Enhancement of Flow along the Main Channel) (2/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	• Removal of debris (old slope protection, old/dilapidated riprap, use of construction materials, etc)	➢ Handling and disposal of construction waste	➔ Insufficiency of disposal sites	(-)	L	R	HI	MT
	<u>Installation/Construction of Sluice Gates</u> • Dredging at the riverbank for construction/setup of sluice gate structure and footworks	➢ Removal and disposal of spoils or dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
	• Removal of vegetation at the proposed site of the sluice gate	➢ Site clearing and grubbing of soil	➔ Reduction in sediments/debris including peaking of major tributary due to regulation of flow from tributaries	(+)	W	NA	HI	LT
			➔ Permanent removal of vegetation	(-)	L	IR	HI	ST
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	MED	ST
	<u>Bank Erosion Protection Work (Revetment)</u> • Removal of debris (old slope protection, old/dilapidated riprap, use of construction materials, etc)	➢ Handling and disposal of construction waste	➔ Insufficiency of disposal sites	(-)	L	R	HI	MT
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	MED	ST
	<u>Channel Widening Along Ilog River</u> • Excavation of land and alignment along river channel	➢ Removal of vegetation	➔ Permanent removal of vegetation along riverbanks including vegetation in the marsh land (mangrove (Bakawan and Nipa), root crops, weeds and sugarcane.	(-)	L	IR	HI	ST

Tab.I-5-1 Potential Impacts in the Implementation of the Proposed Alternatives (Ilog-Hilabangan Alternative A - River Improvement and Enhancement of Flow along the Main Channel) (3/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	Channel Widening Along Ilog River • Excavation of land and alignment along river channel	➢ Extension/Expansion of Talubangi Bridge, Malabong Bridge and a newly constructed unnamed bridge located in Kabankalan City	➔ Indiscriminate disposal of dredge spoils to vacant lots, agricultural land and Insufficiency of disposal sites	(-)	W	IR	HI	MT
			➔ Disruption in water pipeline and a few electric lamp post at bridge abutment	(-)	L	R	HI	ST
			➔ Increase risk/hazard of nearby community and local transport	(-)	L	R	HI	ST
	Dredging and Excavation • Removal and transport of dredge materials/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
O & M Phase	Dredging and Excavation • Removal and transport of dredge sediments/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	LT
	Watershed Management • Delineation of area management zone • Erosion control program • Upper Watershed Management Program (forest protection, reforestation, continued monitoring and maintenance of river bank slopes)	➢ Preparation and implementation of watershed management plan	➔ Improved local terrestrial and environmental conditions ➔ Reduction in siltation in Ilog River ➔ Improved water quality of the river systems ➔ Reduction in bank erosion due to less turbulent river flow from non-frequent flood peaks ➔ Reduction in flood related diseases	(+) (+) (+) (+) (+)	W L W W W	NA NA NA NA NA	HI HI HI HI HI	LT LT LT LT LT
	Installation of Flood Warning System • Organization/Establishment of Community based flood warning system	➢ Institutionalization/Enhancement/ Operationalization of Ilog-Hilabangan River Basin Council	➔ Improved emergency preparedness and capacity building of local community ➔ Reduction in human casualty and flood related damages	(+) (+)	W W	NA NA	HI HI	LT LT

Legend:

Beneficial Outcome
(+) = positive impact
(-) = negative impact

Area Extent
W =widespread effect
L = localized effect

Probability
LOW = low
MED = medium
HI = high

Reversibilty
R = reversible
IR = irreversible

Duration
ST = short term
LT = long term
MT = medium term

Tab.I-5-2 Potential Impacts in the Implementation of the Proposed Alternatives (Ilog-Hilabangan Alternative B - River Improvement and Enhancement of Flow along the Secondary Channel) (1/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Pre-construction Phase	Resettlement of Project Affected Persons/Families • Preparation of resettlement action plan	➢ Relocation of project affected families whose houses are located within the proximity of the proposed structural measures	➔ Proximity of relocation site to work (plantation/sugar mills), school, market and socio-cultural venue of the resettled families;	(-)	L	R	HI	LT
			➔ Displacement of approximately 38 families whose houses are located in either the right or left bank of the river;	(-)	L	IR	HI	LT
			➔ Displacement of families and individuals, especially schooling of school-aged children;	(-)	L	IR	HI	ST
			➔ Threat to livelihood and income;	(-)	L	R	HI	ST
			➔ Opportunities for expanding social relationships and community networks in new site.	(+)	L	R	MED	ST
	Land Acquisition • Consultation and negotiations with landowners	➢ Clearing of project affected areas and other critical zone	➔ Impact on nearly 13 sugar plantations, 13 nipa/mangrove sites, 5 banana plantations, 3 fishponds, power plant with transmission lines, and a prawn farm near the mouth of the river;	(-)	W	IR	HI	LT
			➔ Financial challenge to the local government units in the acquisition of privately-owned lands in project affected areas;	(-)	L	R	HI	MT
			➔ Land use conflict may arise;	(-)	L	IR	HI	MT
			➔ Reduction in production of affected agricultural and fishery products	(-)	L	R	MED	MT
	Project Mobilization • Hiring of local staff and construction labor	➢ Staffing and labor sourcing	➔ Increased employment opportunities for local workers;	(+)	L	R	LO	ST
			➔ Labor competition of migrant skilled workers and construction/management experts	(-)	L	R	LO	ST
Construction Phase	Construction of Earth Dike • Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Dredging along riverbanks for foundation and footworks	➢ Removal and disposal of spoils or dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
	• Removal of vegetation along riverbank	➢ Site clearing and grubbing of soil	➔ Permanent removal of vegetation commonly found along the channel e. g., sugarcane, bamboo, banana, bakawan (downstream), root crops and weeds.	(-)	L	IR	HI	ST
	• Compaction of earth/soil dike	➢ Operation of compaction equipment	➔ Increase in ground vibration	(-)	L	R	MED	MT

Tab.I-5-2 Potential Impacts in the Implementation of the Proposed Alternatives (Ilog-Hilabangan Alternative B - River Improvement and Enhancement of Flow along the Secondary Channel) (2/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	• Removal of debris (old slope protection, old/dilapidated riprap, use of construction materials, etc)	➢ Handling and disposal of construction waste	➔ Insufficiency of disposal sites	(-)	L	R	HI	ST
	<u>Installation/Construction of Sluice Gates</u>							
	• Dredging at the riverbank for construction/setup of sluice gate structure and footworks	➢ Removal and disposal of spoils or dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
	• Removal of vegetation at the proposed site of the sluice gate	➢ Site clearing and grubbing of soil	➔ Reduction in sediments/debris including peaking of major tributary due to regulation of flow from tributaries	(+)	W	R	HI	LT
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Permanent removal of vegetation ➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-) (-)	L L	IR R	HI LO	ST ST
	<u>Bank Erosion Protection Work (Revetment)</u>							
	• Removal of debris (old slope protection, old/dilapidated riprap, use of construction materials, etc)	➢ Handling and disposal of construction waste	➔ Insufficiency of disposal sites	(-)	L	R	HI	ST
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	<u>Widening Along Cut-off Channel</u>							
	• Excavation of marshland and agricultural land including the alignment of the cut-off channel	➢ Removal of vegetation	➔ Permanent removal of vegetation along riverbanks including vegetation in the marsh land (mangrove (Bakawan and Nipa), root crops, weeds and sugarcane.	(-)	L	IR	HI	ST

Tab.I-5-2 Potential Impacts in the Implementation of the Proposed Alternatives (Ilog-Hilabangan Alternative B - River Improvement and Enhancement of Flow along the Secondary Channel) (3/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
		➢ Relocation of nearby NAPOCOR transmission line (over head power line)	➔ Temporary disruption in the distribution of electricity	(-)	W	R	HI	ST
		➢ Expansion/Extension of Consuelo Bridge	➔ Disruption in water pipeline and a few electric lamp post at bridge abutment	(-)	L	R	HI	ST
			➔ Increase risk/hazard of nearby community and local transport	(-)	L	R	HI	ST
	<u>Dredging and Excavation</u> • Removal and transport of dredge materials/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
			➔ Insufficiency of disposal sites	(-)	L	R	HI	ST
O & M Phase	<u>Dredging and Excavation</u> • Removal and transport of dredge sediments/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	LT
			➔ Insufficiency of disposal sites	(-)	L	R	HI	ST
	<u>Watershed Management</u> • Delineation of area management zone	➢ Preparation and implementation of watershed management plan	➔ Improved local terrestrial and environmental conditions	(+)	L	NA	HI	LT
	• Erosion control program		➔ Reduction in siltation in Ilog River	(+)	L	NA	HI	LT
	• Upper Watershed Management Program (forest protection, reforestation, continued monitoring and maintenance of river bank slopes)		➔ Improved water quality of the river systems	(+)	W	NA	HI	LT
			➔ Reduction in bank erosion due to less turbulent river flow from non-frequent flood peaks	(+)	W	NA	HI	MT
	<u>Installation of Flood Warning System</u> • Organization/Establishment of community based flood warning system	➢ Institutionalization/Enhancement/Operationalization of Ilog-Hilabangan River Basin Council	➔ Reduction in flood related diseases	(+)	W	NA	HI	LT
			➔ Improved emergency preparedness and capacity building of local community	(+)	W	NA	HI	LT
			➔ Reduction in human casualty and flood related damages	(+)	W	NA	HI	LT

Legend:

Beneficial Outcome
(+) = positive impact
(-) = negative impact

Area Extent
W =widespread effect
L = localized effect

Probability
LOW = low
MED = medium
HI = high

Reversibilty
R = reversible
IR = irreversible

Duration
ST = short term
LT = long term
MT = medium term

Tab.I-5-3 Potential Impacts in the Implementation of the Proposed Alternatives (Dungcaan Alternative A - River Improvement Works along the Main Channel) (1/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Pre-Constructoin Phase	<u>Resettlement of Project Affected Persons/Families</u> • Preparation of resettlement action plan	➢ Relocation of project affected persons	➔ Proximity of relocation site to work, school, market and socio-cultural venue of the resettled families;	(-)	L	IR	HI	ST
			➔ Displacement of some 114 families in Sitio Brandy Island and more than 20 families in Barangay Sto. Rosario for the river improvement;	(-)	L	IR	HI	ST
			➔ Displacement of families and individuals, especially schooling of school-aged children;	(-)	L	IR	HI	ST
			➔ Threat to livelihood and income;	(-)	L	R	HI	ST
			➔ Opportunities for expanding social relationships and community networks in new site;	(+)	L	NA	LO	ST
			➔ Financial/Administrative challenge to the local government units in the relocation efforts;	(-)	L	R	HI	MT
	<u>Land Acquisition</u> • Consultation and negotiations with landowners	➢ Clearing of project affected areas and other critical zone	➔ Land use conflict may arise.	(-)	L	R	HI	LT
			➔ Availability of land for resettlement area;	(-)	L	R	HI	ST
			➔ Impact on fishponds production;	(-)	L	R	HI	MT
			➔ Financial challenge to the local government units in the acquisition of privately-owned lands in project affected areas.	(-)	L	R	HI	MT
	<u>Project Mobilization</u> • Hiring of local staff and construction labor	➢ Staffing and labor sourcing	➔ Increased employment opportunities for local workers;	(+)	L	NA	LO	ST
			➔ Local labor competition due to migration of skilled workers and construction/management experts	(-)	L	R	LO	ST
Construction Phase	<u>Construction of Concrete Dike with Access Road</u> • Mobilization of construction equipment and delivery/transport of construction materials	➢ Operation of construction equipment	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Dredging the stretch of Dungcaan River (left and right side of river embankment) from the river mouth extending beyond 500 meters upstream of Dungcaan Bridge	➢ Removal and disposal of spoils or dredge materials	➔ Nuisance and land contamination due to indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
			➔ Temporary increase in turbidity at excavation site	(-)	L	R	HI	MT

Tab.I-5-3 Potential Impacts in the Implementation of the Proposed Alternatives (Dungcaan Alternative A - River Improvement Works along the Main Channel) (2/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	• Site clearing to pave way for the construction works	➢ Removal of vegetation	➔ Disturbance of habitat (mangrove and fish) in the wetland area	(-)	L	IR	HI	MT
			➔ Permanent removal of approximately 1427 meters strip of mangroves (nipa and bakawan) located along the main channel of Dungcaan River	(-)	L	IR	HI	ST
	• Increasing the elevation of existing road network at the vicinity of the dike following the finished elevation/grade and extending to a width of approximately 20 meters.	➢ Use of construction materials i.e. cement, etc.	➔ Alteration of water quality	(-)	L	R	HI	MT
		➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise and air contaminant – TSP	(-)	L	R	LO	ST
	<u>Bank Erosion Protection Work (Revetment and Foot Protection)</u> • Mobilization of construction equipment and delivery/transport of construction materials	➢ Construction works	➔ Upon completion, Improve access during emergency cases	(+)	L	NA	HI	LT
			➔ Nuisance and land contamination due to indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT
	• Dredging of sediments at the riverbank and the construction of 20 meter strip length revetment structure underneath the bridge	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Alteration in the quality of water due to cement and other chemical based construction materials	(-)	L	R	HI	ST
	<u>Construction of Spur Dike</u> • Excavation of land and channelization across the proposed spur dike	➢ Handling and disposal of excavated materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	ST
	• Mobilization of construction equipment, delivery/transport of construction materials and construction works	➢ Operation of construction equipment and of transportation of construction materials	➔ Reduction in the recurrence of peak floods due to increase in channel capacity	(+)	NA	NA	HI	LT

Tab.I-5-3 Potential Impacts in the Implementation of the Proposed Alternatives (Dungcaan Alternative A - River Improvement Works along the Main Channel) (3/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	Construction of Small Bridge and Mini Park within the Mangrove/Wetland Area • Construction of Walk bridge and setting up of mini-park station	➢ None	➔ None	NA	NA	NA	NA	NA
	Dredging and Excavation • Removal and transport of dredge sediments/spoils at the location of silted sections (across the location of the spur dike and mangrove section near the river mouth) along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land ➔ Disturbance of wetland habitat e.g. fish, mangroves, etc.	(-) (-)	W L	IR R	HI HI	MT ST
O & M Phase	Dredging and Excavation • Removal and transport of dredge sediments/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land ➔ Disturbance of wetland habitat e.g. fish, mangroves, etc.	(-) (-)	L L	IR R	HI HI	ST ST
	Watershed Management • Delineation of area management zone • Erosion control program • Upper Watershed Management Program (forest protection, reforestation, continued monitoring and maintenance of river bank slopes)	➢ Preparation and implementation of watershed management plan	➔ Improved local terrestrial and environmental conditions with reforestation ➔ Reduction in siltation downstream of River ➔ Improved water quality of the river systems ➔ Reduction in bank erosion due to less turbulent river flow from non-frequent flood peaks	(+) (+) (+) (+)	W W W W	NA NA NA NA	HI HI HI HI	LT LT LT LT
	Installation of Flood Warning System • Organization/Establishment of Community based flood warning system	➢ Creation and Operationalization of a Local Emergency Preparedness and Flood Mitigation Plan	➔ Reduction in flood related diseases ➔ Improved emergency preparedness and capacity building of local community ➔ Reduction in human casualty and flood related damages	(+) (+) (+)	W W W	NA NA NA	HI HI HI	LT LT LT

Legend:

Beneficial Outcome
(+) = positive impact
(-) = negative impact

Area Extent
W =widespread effect
L = localized effect

Probability
LOW = low
MED = medium
HI = high

Reversibilty
R = reversible
IR = irreversible

Duration
ST = short term
LT = long term
MT = medium term

Tab.I-5-4 Potential Impacts in the Implementation of the Proposed Alternatives (Dungcaan Alternative B - River Improvement Works along the Secondary Channel) (1/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Pre-Construction Phase	<u>Resettlement of Project Affected Persons/Families</u> • Preparation of resettlement action plan	➢ Relocation of project affected persons	➔ Proximity of relocation site to work, school, market and socio-cultural venue of the resettled families;	(-)	L	IR	HI	LT
			➔ Displacement of some 114 families in Sitio Brandy Island and more than 20 families in Barangay Sto. Rosario for the river improvement;	(-)	L	IR	HI	ST
			➔ Displacement of families and individuals, especially schooling of school-aged children;	(-)	L	IR	HI	ST
			➔ Threat to livelihood and income;	(-)	L	R	HI	ST
			➔ Opportunities for expanding social relationships and community networks in new site;	(+)	L	NA	LO	ST
			➔ Financial/Administrative challenge to the local government units in the relocation efforts;	(-)	L	R	HI	MT
	<u>Land Acquisition</u> • Consultation and negotiations with landowners	➢ Clearing of project affected areas and other critical zone	➔ Land use conflict may arise.	(-)	L	R	HI	LT
			➔ Availability of land for resettlement area;	(-)	L	R	HI	ST
			➔ Impact on fishponds production;	(-)	L	R	HI	MT
			➔ Financial challenge to the local government units in the acquisition of privately-owned lands in project affected areas.	(-)	L	R	HI	MT
	<u>Project Mobilization</u> • Hiring of local staff and construction labor	➢ Staffing and labor sourcing	➔ Increased employment opportunities for local workers;	(+)	L	NA	LO	ST
			➔ Local labor competition due to migration of skilled workers and construction/management experts	(-)	L	R	LO	ST
Construction Phase	<u>Construction of Concrete Dike with Access Road</u> • Mobilization of construction equipment and delivery/transport of construction materials	➢ Operation of construction equipment	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Dredging the stretch of Dungcaan River (left and right side of river embankment) from the river mouth extending beyond 500 meters upstream of Dungcaan Bridge	➢ Removal and disposal of spoils or dredge materials	➔ Nuisance and land contamination due to indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
			➔ Temporary increase in turbidity at excavation site	(-)	L	R	HI	ST
			➔ Disturbance of habitat (mangrove and fish) in the wetland area	(-)	L	R	HI	ST

Tab.I-5-4 Potential Impacts in the Implementation of the Proposed Alternatives (Dungcaan Alternative B - River Improvement Works along the Secondary Channel) (2/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	• Site clearing and grubbing of soil to pave way for the construction works	➢ Removal of vegetation	➔ Permanent removal of 500 meter strip of mangroves (nipa and bakawan) located along the secondary channel of Dungcaan River	(-)	L	IR	HI	ST
	• Increasing the elevation o f existing road network at the vicinity of the dike following the finished elevation/grade and extending to a width of approximately 20 meters.	➢ Use of construction materials i.e. cement, etc.	➔ Alteration of water quality	(-)	L	R	HI	MT
		➢ Construction works	➔ Upon completion, enhanced mobility and access within the area particularly during evacuation	(+)	W	NA	HI	LT
	<u>Bank Erosion Protection Work (Revetment and Foot Protection)</u> • Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Nuisance and land contamination due to indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT
	• Dredging of sediments at the riverbank and the construction of 20 meter strip length revetment structure underneath the bridge	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Alteration in the quality of water due to cement and other chemical based construction materials	(-)	L	R	HI	MT
	<u>Construction of Spur Dike</u> • Excavation of land and channelization across the proposed spur dike	➢ Handling and disposal of excavated materials	➔ Nuisance due to Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	ST
			➔ Reduction in the recurrence of peak floods due to increase in channel capacity	(+)	W	NA	HI	LT
			➔ Reduction in the occurrence of bank erosion	(+)	W	NA	HI	MT
	• Mobilization of construction equipment, delivery/transport of construction materials and construction works	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	NA	HI	ST
	<u>Construction of Small Bridge and Mini Park within the Mangrove/Wetland Area</u> • Construction of bridge and setting up of mini-park station	➢ None	➔ Not expected to pose significant negative impact	NA	NA	NA	NA	NA

Tab.I-5-4 Potential Impacts in the Implementation of the Proposed Alternatives (Dungcaan Alternative B - River Improvement Works along the Secondary Channel) (3/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	<u>Dredging and Excavation</u> • Removal and transport of dredge sediments/spoils at the location of silted sections (across the location of the spur dike and mangrove section near the river mouth) along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT
			➔ Disturbance of wetland habitat e.g. fish, mangroves, etc.	(-)	L	IR	HI	ST
O & M Phase	<u>Dredging and Excavation</u> • Removal and transport of dredge sediments/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	ST
	<u>Watershed Management</u> • Delineation of area management zone • Erosion control program • Upper Watershed Management Program (forest protection, reforestation, continued monitoring and maintenance of river bank slopes)	➢ Preparation and implementation of watershed management plan	➔ Improved local terrestrial and environmental conditions with reforestation ➔ Reduction in siltation downstream of River ➔ Improved water quality of the river systems ➔ Reduction in bank erosion due to less turbulent river flow from non-frequent flood peaks	(-) (-) (+) (+)	L L W W	NA NA NA NA	HI HI HI HI	LT LT LT MT
	<u>Installation of Flood Warning System</u> • Organization/Establishment of Community based flood warning system	➢ Creation and Operationalization of a Local Emergency Preparedness and Flood Mitigation Plan	➔ Reduction in flood related diseases ➔ Improved emergency preparedness and capacity building of local community ➔ Reduction in human casualty and flood related damages	(+) (+) (+)	W W W	NA NA NA	HI HI HI	LT LT LT

Legend:

Beneficial Outcome
(+) = positive impact
(-) = negative impact

Area Extent
W =widespread effect
L = localized effect

Probability
LOW = low
MED = medium
HI = high

Reversibilty
R = reversible
IR = irreversible

Duration
ST = short term
LT = long term
MT = medium term

Tab.I-5-5 Potential Impacts in the Implementation of the Proposed Alternatives (Dungcaan Alternative C - River Improvement and Construction of the Multi-Purpose Reservoir) (1/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Pre-construction Phase	<u>Resettlement of Project Affected Persons/Families</u> • Preparation of resettlement action plan	➢ Relocation of project affected families whose houses are located within the proximity of the proposed structural measures	➔ Proximity of relocation site to work, school, market and socio-cultural venue of the resettled families;	(-)	L	IR	HI	ST
			➔ Displacement of not less than 20 families in Brgy. Amguhan - dam site, some 114 families in Sitio Brandy Island and not less than 20 families in Sitio Paradise Island for the river improvement;	(-)	L	IR	HI	ST
			➔ Displacement of families and individuals, especially schooling of school-aged children;	(-)	L	IR	HI	ST
			➔ Threat to livelihood and income;	(-)	L	R	HI	ST
			➔ Opportunities for expanding social relationships and community networks in new site	(+)	L	NA	LO	ST
			➔ Financial/Administrative challenge to the local government units in the relocation efforts;	(-)	L	R	HI	MT
			➔ Land use conflict may arise;	(-)	L	IR	HI	LT
			➔ Availability of land for resettlement area;	(-)	L	IR	HI	ST
			➔ Impact on fishponds;	(-)	L	R	HI	MT
	<u>Land Acquisition</u> • Consultation and negotiations with landowners	➢ Clearing of housing structures in project affected areas and other critical zone	➔ Financial challenge to the local government unit in the acquisition of privately-owned lands in project affected areas;	(-)	L	R	HI	MT
	<u>Project Mobilization</u>		➔ Increased employment opportunities for local workers;	(+)	L	NA	LO	ST
	• Hiring of local staff and construction labor	➢ Staffing and labor sourcing	➔ Competition of migrant skilled workers and construction/management experts with local labor	(-)	L	R	LO	ST
Construction Phase	<u>Construction of Concrete Dike with Access Road</u> • Mobilization of construction equipment and delivery/transport of construction materials	➢ Operation of construction equipment	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Dredging the stretch of Dungcaan River (left and right side of river embankment) from the river mouth extending beyond 500 meters upstream of Dungcaan Bridge	➢ Removal and disposal of spoils or dredge materials	➔ Nuisance and land contamination due to indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	LT
			➔ Temporary increase in turbidity at excavation site	(-)	L	R	HI	MT

Tab.I-5-5 Potential Impacts in the Implementation of the Proposed Alternatives (Dungcaan Alternative C - River Improvement and Construction of the Multi-Purpose Reservoir) (2/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Construction Phase	• Site clearing and grubbing of soil to pave way for the construction works	➢ Removal of vegetation	➔ Permanent removal of vegetation mostly composed of nipa, bakawan, coconut trees and local weeds/grasses.	(-)	L	IR	HI	ST
	• Increasing the elevation of existing road network at the vicinity of the dike following the finished elevation/grade and extending to a width of approximately 20 meters.	➢ Use of construction materials i.e. cement, etc.	➔ Alteration of water quality	(-)	L	R	HI	MT
		➢ Construction works	➔ Upon completion, enhanced mobility and access within the area particularly during events of evacuation	(+)	L	NA	HI	LT
	<u>Bank Erosion Protection Work (Revetment and Foot Protection)</u> • Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Dredging of sediments at the riverbank and the construction of 20 meter strip length revetment structure underneath the bridge	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Nuisance and land contamination due to indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	ST
			➔ Alteration in the quality of water due to cement and other chemical based construction materials	(-)	L	R	HI	MT
			➔ Reduced erosion of soil along river embankment upon completion	(+)	W	NA	MED	LT
	<u>Construction of Spur Dike</u> • Excavation of land and channelization across the proposed spur dike	➢ Handling and disposal of excavated materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	ST
			➔ Reduction in the recurrence of peak floods due to increase in channel capacity	(+)	W	NA	HI	LT
			➔ Reduction in the occurrence of bank erosion	(+)	W	NA	HI	MT
	• Mobilization of construction equipment, delivery/transport of construction materials and construction works	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST

Tab.I-5-5 Potential Impacts in the Implementation of the Proposed Alternatives (Dungcaan Alternative C - River Improvement and Construction of the Multi-Purpose Reservoir) (3/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	Construction of the Multi-Purpose Reservoir • Mobilization of construction equipment and delivery/transport of construction materials • Dredging/excavation at the vicinity of the proposed Dam/Reservoir • Removal and transport of dredge materials/spoils at the location of silted sections along river channel • Removal of vegetation along riverbank and immediate vicinity/area of the Dam	➢ Removal of vegetation	➔ Minimal increase in noise level (but this is insignificant) and slight increase in air quality contaminant level	(-)	L	R	HI	ST
			➔ Temporary increase in turbidity and alteration in water quality conditions	(-)	L	R	HI	MT
			➔ Alternation of the natural topography/terrain at the vicinity of the Dam	(-)	L	IR	HI	LT
			➔ Inundation of the vicinity of the Dam	(-)	L	IR	HI	LT
			➔ Increase in sediment deposit upstream of the Dam	(-)	L	R	HI	LT
			➔ Beneficial use of Dam as impounding reservoir for domestic water supply	(+)	L	NA	HI	LT
			➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
			➔ Permanent removal of vegetation i.e. weeds, ferns, other types of grass including local fruit bearing trees like coconut.	(-)	L	R	HI	ST
	Construction of Small Bridge and Mini Park within the Mangrove/Wetland Area • Construction of walk bridge and setting up of mini-park station	➢ None	➔ Not expected to pose significant negative impact	NA	NA	NA	NA	NA
	Dredging and Excavation • Removal and transport of dredge sediments/spoils at the location of silted sections (across the location of the spur dike and mangrove section near the river mouth) along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
			➔ Disturbance of wetland habitat e.g. fish, mangroves, etc.	(-)	L	IR	HI	ST

Tab.I-5-5 Potential Impacts in the Implementation of the Proposed Alternatives (Dungcaan Alternative C - River Improvement and Construction of the Multi-Purpose Reservoir) (4/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
O & M Phase	Dredging and Excavation • Removal and transport of dredge sediments/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT
			➔ Disturbance of wetland habitat e.g. fish, mangroves, etc.	(-)	L	IR	HI	ST
	Watershed Management • Delineation of area management zone	➢ Preparation and implementation of watershed management plan	➔ Improved local terrestrial and environmental conditions with reforestation	(+)	W	NA	HI	LT
	• Erosion control program • Upper Watershed Management Program (forest protection, reforestation, continued monitoring and maintenance of river bank slopes)		➔ Reduction in siltation downstream of River	(+)	W	NA	HI	LT
			➔ Improved water quality of the river systems	(+)	W	NA	HI	LT
			➔ Reduction in bank erosion due to less turbulent river flow from non-frequent flood peaks	(+)	W	NA	HI	MT
	Installation of Flood Warning System • Organization/Establishment of Community based flood warning system	➢ Creation and Operationalization of a Local Emergency Preparedness and Flood Mitigation Plan	➔ Reduction in flood related diseases	(+)	W	NA	HI	LT
			➔ Improved emergency preparedness and capacity building of local community	(+)	W	NA	HI	LT
			➔ Reduction in human casualty and flood related damages	(+)	W	NA	HI	LT

Legend:

Beneficial Outcome
(+) = positive impact
(-) = negative impact

Area Extent
W =widespread effect
L = localized effect

Probability
LOW = low
MED = medium
HI = high

Reversibilty
R = reversible
IR = irreversible

Duration
ST = short term
LT = long term
MT = medium term

Tab.I-5-6 Potential Impacts in the Implementation of the Proposed Alternatives (Meycauayan Alternative A – River and Drainage Improvement) (1/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur	Duration
Pre-construction Phase	<u>Resettlement of Project Affected Persons/Families</u> • Preparation of resettlement action plan	➢ Relocation of project affected families whose houses are located within the proximity of the proposed structural measures	➔ Proximity of relocation site to work area, school, market and socio-cultural venue of the resettled families;	(-)	L	R	LO	ST
			➔ Displacement of > 90 families in Meycauayan and nearly 90 families in Marilao;	(-)	L	IR	HI	ST
			➔ Displacement of families and individuals, especially schooling of school-aged children;	(-)	L	R	HI	ST
			➔ Threat to family livelihood and income, as well as business establishments;	(-)	L	R	HI	ST
			➔ Social conflict may arise.	(-)	L	R	MED	ST
			➔ Financial/Administrative challenge to the local government units in the relocation efforts;	(-)	L	R	HI	MT
			➔ Opportunities for expanding social relationships, community networks, and business opportunities in new site	(+)	L	NA	LO	ST
	<u>Land Acquisition</u> • Consultation and negotiations with affected communities	➢ Clearing of housing structures in project affected areas and other critical zone	➔ Availability of land for resettlement area;	(-)	W	R	HI	ST
			➔ Financial challenge to the local government unit in the acquisition of privately-owned lands in project affected areas that will be used for resettlement as well as in the establishment of regulation ponds;	(-)	W	R	HI	MT
	<u>Project Mobilization</u> • Hiring of local staff and construction labor	➢ Staffing and labor sourcing	➔ Increased employment opportunities for local workers;	(+)	L	NA	HI	MT
			➔ Competition in local labor with the migration of skilled workers and construction/management experts	(-)	L	R	LO	ST
Construction Phase	<u>Construction of Dike and Increasing the Elevation of Existing Road Surface</u> • Mobilization of construction equipment and delivery/transport of construction materials	➢ Operation of construction equipment/ transportation of construction materials including effluent discharges	➔ Noise level and air pollution level will be increased by transportation of construction equipment as well as construction materials	(-)	L	R	MED	MT
	• Dredging the stretch of the riverbanks (along the sections of the proposed dike) in preparation of foundation and foot works	➢ Removal and disposal of spoils or dredge materials	➔ Increase in effluent discharges associated with use of construction materials and operation of construction equipment	(-)	L	R	HI	MT

Tab.I-5-6 Potential Impacts in the Implementation of the Proposed Alternatives (Meycauayan Alternative A – River and Drainage Improvement) (2/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur	Duration
	• Excavation and filling up of affected road segment	➢ Site clearing and grubbing of soil	➔ Reduced vehicular movement/mobility around pumping stations/dikes/retarding basin and proposed increase in road elevation	(-)	W	R	HI	MT
			➔ Obstructions and visual intrusion with the presence of construction vehicles	(-)	L	R	HI	MT
			➔ Construction waste will increased	(-)	L	R	HI	MT
			➔ Disruption of water, power and communication utilities	(-)	L	R	LO	ST
	• Removal of vegetation along riverbank	➢ Site clearing	➔ Permanent removal of vegetation e. g., banana, coconut, (upstream), locally grown trees and weeds.	(-)	L	IR	ST	ST
	<u>Construction of Revetment</u>							
	• Concreting of slopes and safety improvement of embankment to prevent dike breach	➢ Mixing of cement and concreting activities	➔ Minimal increase in noise level and slight increase in water quality and air quality contaminant level	(-)	L	R	MED	MT
			➔ Reduced structural damage and bank erosion	(+)	L	R	HI	LT
	<u>Excavation</u>							
	• Excavation of riverbed at silted sections	➢ Noise production and air emission from the operation construction equipment	➔ Indiscriminate disposal of dredge spoils to vacant lots and waterways	(-)	L	R	MED	MT
	• Mobilization of construction equipment, delivery/transport of construction materials and construction works	➢ Movement of dredger/excavator	➔ Reduced access/mobility of informal residents/settlers within work areas	(-)	W	R	HI	MT
	<u>Construction of Gate & Drainage Facility</u>							
	• Excavation of land, installation/construction of flood gates and improvement of channel alignment at outlets of small tributaries draining at Meycauayan River	➢ Handling and disposal of excavated materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and waterways	(-)	L	R	HI	MT
			➔ Reduction in sediments/debris including flood peaks due to regulation of flow from tributaries	(+)	L	NA	HI	LT

Tab.I-5-6 Potential Impacts in the Implementation of the Proposed Alternatives (Meycauayan Alternative A – River and Drainage Improvement) (3/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur	Duration
	• Mobilization of construction equipment, delivery/transport of construction materials and construction works	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	MED	MT
	<u>Reconstruction of Bridge</u> • Excavation of land at the proposed improvement/reconstruction site	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and waterways	(-)	L	R	HI	MT
	• Mobilization of construction equipment, delivery/transport of construction materials and construction works	➢ Operation and movement of construction equipment	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	MED	MT
		➢ Resettlement of informal settlers underneath and at the immediate proximity of Marilao Bridge, McArthur Bridge and Marcos Bridge,	➔ Opposition/resistance and demands coming from the PAPs/PAFs	(-)	L	R	HI	ST
			➔ Temporary disruption of local transport, utilities e.g. water, electrical, and communication cables located at the bridge crossing	(-)	L	R	MED	ST
			➔ Resettlement and land acquisition	(-)	L	R	HI	ST
	<u>Structures in the VOM Flood Control Project/Area</u> • Excavation and construction of Dike • Construction/Installation of Pumping Stations and Flood Gates • Establishment of Regulation Pond	➢ Movement and operation of equipment and the physical alteration of land associated with the establishment of regulation pond and construction of structural measures	➔ Disruption of urban mobility and increase in nuisance	(-)	W	R	HI	MT
			➔ Increase in TSP concentrations and effluent discharges from the use and operation of construction materials and equipment	(-)	L	R	HI	MT

Tab.I-5-6 Potential Impacts in the Implementation of the Proposed Alternatives (Meycauayan Alternative A – River and Drainage Improvement) (4/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur	Duration
O & M Phase	Dredging and Excavation • Removal and transport of dredge sediments/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Reduced flood risk with the channel's operation at its design capacity	(+)	W	NA	HI	LT
			➔ Improve surface water quality thru the enhancement of river flow	(+)	W	NA	HI	LT
	Watershed Management/Conservation (Part of the area covered by Marilao, Bulacan and Novaliches Watershed) • Delineation of area management zone • Erosion control program • Upper Watershed Management Program (forest protection, reforestation, continued monitoring and maintenance of river bank slopes)	➢ Preparation and implementation of watershed management plan with private and local stakeholders	➔ Improved local urban environmental conditions	(+)	W	NA	HI	LT
			➔ Reduction in siltation in Meycauayan, Marilao and smaller tributaries of the major river system	(+)	W	NA	HI	LT
			➔ Improved water quality of the river systems	(+)	W	NA	HI	LT
			➔ Reduction in bank erosion due to less turbulent river flow from non-frequent flood peaks	(+)	W	NA	HI	LT
	Installation of Flood Warning/Disaster Management System • Organization/Establishment of Community and Local Government Unit (LGU) based flood warning system	➢ Creation and institutionalization of information and education program thru local government partnership	➔ Sustainability of flood control facilities and reduced risk of flood to human health and infrastructure damages	(+)	W	NA	HI	LT

Legend:

Beneficial Outcome
(+) = positive impact
(-) = negative impact

Area Extent
W =widespread effect
L = localized effect

Probability
LOW = low
MED = medium
HI = high

Reversibilty
R = reversible
IR = irreversible

Duration
ST = short term
LT = long term
MT = medium term

Tab.I-5-7 Potential Impacts in the Implementation of the Proposed Alternatives (Kinanliman Alternative A - River Improvement and Construction of Sabo Dam) (1/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Pre-construction Phase	<u>Resettlement of Project Affected Persons/Families</u> • Preparation of resettlement action plan	➢ Relocation of project affected person	➔ There are no PAP along the proposed structural measures	NA	NA	NA	NA	NA
	<u>Land Acquisition</u> • Consultation and negotiations with landowners	➢ Clearing of project affected areas and other critical zone	➔ Land acquisition on the opposite bank throughout the stretch of the spur dike where dredging and channelization is needed	(-)	L	IR	HI	ST
	<u>Project Mobilization</u> • Hiring of local staff and construction labor	➢ Staffing and labor sourcing	➔ Increased employment opportunities for local workers; ➔ Competition of local labor from migrant skilled workers and construction/management experts	(+) (-)	L L	NA R	LO LO	ST ST
Construction Phase	<u>Construction of Concrete Dike</u> • Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Dredging the stretch of the riverbanks (along the sections of the proposed dike) in preparation of foundation and foot works	➢ Removal and disposal of spoils or dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT
	• Removal of vegetation along riverbank	➢ Site clearing and grubbing of soil	➔ Permanent removal of vegetation e. g., bamboo, banana, (downstream),locally grown trees and weeds.	(-)	L	IR	ST	ST
	<u>Installation / Construction of Gate</u> • Dredging of sediments at the riverbank for construction/setup of gate structure and footworks	➢ Removal and disposal of spoils or dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land ➔ Reduction in sediments/debris including peaking of major tributary due to regulation of flow from tributaries	(-) (+)	L W	IR NA	HI HI	MT MT
	• Removal of vegetation at the proposed site of the sluice gate	➢ Site clearing and grubbing of soil	➔ Permanent removal of vegetation	(-)	L	IR	HI	ST

Tab.I-5-7 Potential Impacts in the Implementation of the Proposed Alternatives (Kinanliman Alternative A - River Improvement and Construction of Sabo Dam) (2/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	<u>Construction of Spur Dike</u> • Excavation of land and channelization across the proposed spur dike	➢ Handling and disposal of excavated materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT
			➔ Reduction in the recurrence of peak floods due to increase in channel capacity	(+)	W	NA	HI	LT
			➔ Reduction in flooding incidence in the Poblacion and other Urban Barangays	(+)	W	NA	MED	LT
	• Mobilization of construction equipment, delivery/transport of construction materials and construction works	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Removal of vegetation at the proposed site	➢ Removal of coconut trees, ferns, weeds and grass	➔ Permanent removal of vegetation	(-)	L	IR	HI	ST
	<u>Widening of Kinanliman River at the section of Kinanliman Bridge towards the river mouth</u>	➢ Extension/Expansion of Kinanliman Bridge	➔ Disruption of local transport & water pipeline crossing the bridge deck	(-)	L	R	HI	ST
	• Excavation of land and alignment along river channel		➔ Increase risk/hazard of nearby community and local transport	(-)	L	R	HI	ST
		➢ Handling and ultimate disposal o f dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT

Tab.I-5-7 Potential Impacts in the Implementation of the Proposed Alternatives (Kinanliman Alternative A - River Improvement and Construction of Sabo Dam) (3/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	<u>Construction of the Sabo Dam</u> • Mobilization of construction equipment and delivery/transport of construction materials	Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Dredging/excavation at the vicinity of the proposed Sabo Dam	➢ Removal and disposal of soil and spoils or dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT
	• Removal and transport of dredge materials/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Alteration of the natural topography/terrain at the vicinity of the Sabo Dam	(-)	L	IR	HI	LT
			➔ Increase in sediment deposit upstream of the Sabo Dam	(-)	L	R	HI	LT
	• Removal of vegetation along riverbank and immediate vicinity/area that will be identified in the design	➢ Site clearing and grubbing of soil	➔ Permanent removal of vegetation and inundation	(-)	L	IR	HI	LT
O & M Phase	<u>Dredging and Excavation</u> • Removal and transport of dredge sediments/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT
	<u>Installation of Flood Warning System</u> • Organization/Establishment of Community based flood warning system	➢ Creation and Operationalization of a Local Emergency Preparedness and Flood Mitigation Plan	➔ Reduction in flood related diseases ➔ Improved emergency preparedness and capacity building of local community ➔ Reduction in human casualty and flood related damages	(+) (+) (+)	W W W	NA NA NA	HI HI HI	LT LT LT

Legend:

Beneficial Outcome
(+) = positive impact
(-) = negative impact

Area Extent
W =widespread effect
L = localized effect

Probability
LOW = low
MED = medium
HI = high

Reversibilty
R = reversible
IR = irreversible

Duration
ST = short term
LT = long term
MT = medium term

Tab.I-5-8 Potential Impacts in the Implementation of the Proposed Alternatives (Tuganay Alternative T-A - River Improvement Only along Cabay-angan River, Tuganay River, New Ising and Old Ising River) (1/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Pre-construction Phase	Resettlement of Project Affected Persons/Families • Preparation of resettlement action plan	➢ Relocation of project affected persons	➔ Proximity of relocation site to work, school, market and socio-cultural venue of the resettled families;	(-)	L	R	LO	ST
			➔ Displacement of nearly 15 houses in a contiguous cluster including a sports complex that will be affected by the reconstruction of the dike in Brgy. Anibongan;	(-)	L	R	HI	ST
			➔ Displacement of families and individuals, especially schooling of school-aged children;	(-)	L	R	HI	ST
	Land Acquisition • Consultation and negotiations with landowners in the acquisition of land for the retarding basins and alignment of river channel (channelization)	➢ Clearing of project affected areas and other critical zone i.e. channelization, etc	➔ Threat to livelihood and income;	(-)	L	R	HI	ST
			➔ Opportunities for expanding social relationships and community networks in new site.	(+)	L	R	LO	ST
			➔ Reduction in production of affected agricultural lands e.g. banana plantations and fishponds;	(-)	L	IR	HI	MT
	Project Mobilization • Hiring of local staff and construction labor	➢ Staffing and labor sourcing	➔ Financial challenge to the local government units in the acquisition of privately-owned lands in project affected areas;	(-)	L	R	HI	MT
			➔ Land use conflict may arise;	(-)	L	IR	MED	MT
			➔ Increased employment opportunities for local workers;	(+)	L	NA	LO	ST
			➔ Competition in local labor from the migration of skilled workers and construction/management experts	(-)	L	R	LO	ST
Construction Phase	Reconstruction of Existing Dike and River Improvement Works • Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction / equipment and of /transportation of / construction materials	➔ Increase in ground vibration, noise level and slight increase in air quality contaminant level	(-)	L	R	HI	MT

Tab.I-5-8 Potential Impacts in the Implementation of the Proposed Alternatives (Tuganay Alternative T-A - River Improvement Only along Cabay-angan River, Tuganay River, New Ising and Old Ising River) (2/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	• Removal of debris (old slope protection, old/dilapidated riprap, old dike structures, use of construction materials, etc)	➢ Removal and disposal of spoils or dredge materials	➔ Nuisance due to indiscriminate disposal of construction and demolition wastes including dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
	• Excavation at the stretch of the riverbanks (along the sections of the proposed dike)	➢ Site clearing and grubbing of soil	➔ Reduction in flooding from overbank flow due to the increase in channel capacity	(+)	W	R	HI	ST
	• Removal of vegetation along riverbank		➔ Permanent removal of vegetation commonly found along the channel e. g., banana, bakawan(downstream), and weeds	(+)	W	IR	HI	ST
	• Construction of Revetment and Foot works at sections critical to bank erosion	➢ Use of cement based products/ materials	➔ Change in water quality conditions	(-)	L	R	HI	MT
			➔ Increase dike structural stability	(+)	L	NA	HI	LT
	<u>Upgrading/Construction of Approximately 10 Bridge affected by the River Improvement Works (dike, revetment, etc.)</u>	➢ Reconstruction/rehabilitation of bridges that may be affected by the proposed setback in the location of the dike	➔ Disruption in local transport	(-)	L	R	HI	ST
	• Bridge Re-construction		➔ Disruption of water pipeline and a few electric lamp post at bridge abutment	(-)	L	R	HI	ST
	<u>Installation/Construction of Gates and Drainage Facility</u>	➢ Site clearing, grubbing of soil and construction works	➔ Indiscriminate disposal of dredged spoils to vacant lots and agricultural land	(-)	L	R	HI	ST
	• Dredging of sediments at the riverbank for construction/setup of gate structure and drainage facility of small tributaries of Tuganay River	➢ Handling and ultimate disposal of excavated materials	➔ Reduction in sediment discharge and debris discharge including peaking of major tributary due to regulation of flow from tributaries	(-)	L	R	HI	ST
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise generation and air emissions from the operation of construction equipment and transport of construction materials	➔ Increase in noise level and slight increase in air quality contaminant level	(-)	W	IR	HI	MT

Tab.I-5-8 Potential Impacts in the Implementation of the Proposed Alternatives (Tuganay Alternative T-A - River Improvement Only along Cabay-angan River, Tuganay River, New Ising and Old Ising River) (3/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	• Removal of vegetation at the proposed site of the gates and drainage facility	➢ Removal of vegetation ➢ Handling and ultimate disposal of excavated materials	➔ Permanent removal of vegetation	(-)	W	NA	HI	MT
	<u>Construction of Diversion Channels</u> • Excavation and alignment of land along the proposed diversion channels	➢ Noise generation, air emissions, effluent discharges from the operation construction equipment, transportation of construction materials and construction works	➔ Permanent removal of vegetation ➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-) (-)	L W	R IR	HI HI	LT MT
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise generation, air emissions, effluent discharges from the operation construction equipment, transportation of construction materials and construction works	➔ Decrease in incidence of flooding in the adjacent flood prone areas ➔ Increase in noise level and slight increase in air quality contaminant level	(+) (-)	W L	NA R	HI HI	LT ST
	<u>Construction of Retarding Basins</u> • Mobilization of excavator/dredging equipment • Excavation of land at the proposed retarding basins		➔ Increase in noise level and slight increase in air quality contaminant level ➔ Increase in turbidity in the river sections close to work areas and lowering of static water level of nearby water sources (dug wells and shallow wells) ➔ Reduced peaking of flood in the downstream and low lying areas ➔ May be used as a facility for fish culture/propagation	(-) (-) (+) (+)	L L W L	R R NA R	HI HI HI HI	ST ST LT ST
O & M Phase	<u>Dredging and Excavation</u> • Removal and transport of dredged sediments/spoils at the location of silted sections along river channel and the river mouth	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Reduce flood occurrence with the increase in channel capacity ➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land ➔ Improved water quality conditions with enhance flow of stormwater and other effluent discharge received by the river	(+) (-) (+)	L L W	NA IR NA	HI HI HI	LT ST LT

Legend:

Beneficial Outcome
(+) = positive impact
(-) = negative impact

Area Extent
W =widespread effect
L = localized effect

Probability
LOW = low
MED = medium
HI = high

Reversibilty
R = reversible
IR = irreversible

Duration
ST = short term
LT = long term
MT = medium term

Tab.I-5-9 Potential Impacts in the Implementation of the Proposed Alternatives (Tuganay Alternative T-B - River Improvement and Construction of Retarding Basins) (1/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Pre-construction Phase	<u>Resettlement of Project Affected Persons/Families</u> • Preparation of resettlement action plan	➢ Relocation of project affected persons	➔ Proximity of relocation site to work, school, market and socio-cultural venue of the resettled families;	(-)	L	R	HI	ST
			➔ Displacement of 34 families whose houses are located within the proposed retarding basin;	(-)	L	IR	HI	ST
			➔ Displacement of families and individuals, especially schooling of school-aged children;	(-)	L	IR	HI	ST
			➔ Threat to livelihood and income;	(-)	L	R	HI	ST
			➔ Opportunities for expanding social relationships and community networks in new site.	(+)	L	R	LO	ST
	<u>Land Acquisition</u> • Consultation and negotiations with landowners	➢ Clearing of project affected areas and other critical zone	➔ Reduction in production of affected agricultural lands particularly banana plantations, and fishponds;	(-)	L	R	HI	MT
			➔ Financial challenge to the local government units in the acquisition of privately-owned lands in project affected areas;	(-)	L	R	HI	ST
			➔ Land use conflict may arise;	(-)	L	IR	HI	ST
	<u>Project Mobilization</u> • Hiring of local staff and construction labor	➢ Staffing and labor sourcing	➔ Increased employment opportunities for local workers;	(+)	L	NA	HI	MT
			➔ Competition from local labor due to migration of skilled workers and construction/management experts	(-)	L	R	LO	ST
Construction Phase	<u>Demolition and Reconstruction of Existing Dike</u> • Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction / equipment and of /transportation of / construction materials	➔ Increase in ground vibration, noise level and slight increase in air quality contaminant level	(-)	L	R	HI	MT
	• Excavation at the stretch of the riverbanks (along the sections of the proposed dike)	➢ Removal and disposal of C&D wastes including spoils or dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
	• Removal of debris (old slope protection, old/dilapidated riprap, old dike structures, use of construction materials, etc)	➢ Site clearing and grubbing of soil	➔ Reduction in flooding from overbank flow due to the increase in channel capacity	(+)	W	NA	HI	LT

Tab.I-5-9 Potential Impacts in the Implementation of the Proposed Alternatives (Tuganay Alternative T-B - River Improvement and Construction of Retarding Basins) (2/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Construction Phase	• Removal of vegetation along riverbank • Construction of Revetment and Foot works at sections critical to bank erosion	➢ Use of cement based products/ materials	➔ Change in water quality conditions ➔ Increase dike structural stability	(-) (+)	W L	IR R	HI HI	MT MT
	<u>Upgrading/Construction of Approximately 10 Bridge affected by the River Improvement Works (dike, revetment, etc.)</u> • Bridge Re-construction	➢ Reconstruction/rehabilitation of bridges that may be affected by the proposed setback in the location of the dike	➔ Disruption in local transport ➔ Disruption of water pipeline and a few electric lamp post at bridge abutment	(-) (-)	L L	R R	HI HI	ST ST
	<u>Installation/Construction of Gates and Drainage Facility</u> • Dredging of sediments at the riverbank for construction/setup of gate structure and drainage facility of small tributaries of Tuganay River	➢ Removal and disposal of C&D wastes ➢ Site clearing, grubbing of soil and construction works ➢ Handling and ultimate disposal of excavated materials ➢ Removal of vegetation ➢ Noise generation and air emissions from the operation of construction equipment and transport of construction materials	➔ Indiscriminate disposal of dredged spoils to vacant lots and agricultural land ➔ Reduction in sediment discharge and debris discharge including peaking of major tributary due to regulation of flow from tributaries ➔ Insufficiency of disposal site	(-) (+) (-)	L W W	R IR IR	HI HI HI	ST MT MT
	• Removal of vegetation at the proposed site of the gates and drainage facility	➢ Removal of vegetation	➔ Permanent removal of vegetation	(-)	L	NA	HI	LT
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Handling and ultimate disposal of excavated materials	➔ Increase in noise level and slight increase in air quality contaminant level	(-)	L	IR	HI	ST

Tab.I-5-9 Potential Impacts in the Implementation of the Proposed Alternatives (Tuganay Alternative T-B - River Improvement and Construction of Retarding Basins) (3/3)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Construction Phase	<u>Construction of Diversion Channels</u>							
	• Excavation and alignment of land along the proposed diversion channels	➢ Noise generation, air emissions, effluent discharges from the operation construction equipment, transportation of construction materials and construction works	➔ Permanent removal of vegetation	(-)	L	R	HI	LT
			➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MT
			➔ Decrease in incidence of flooding in the adjacent flood prone areas	(+)	W	NA	HI	LT
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise generation, air emissions, effluent discharges from the operation construction equipment, transportation of construction materials and construction works	➔ Increase in noise level and slight increase in air quality contaminant level	(-)	L	R	HI	ST
	<u>Construction of Retarding Basins</u>		➔ Increase in noise level and slight increase in air quality contaminant level	(-)	L	R	HI	ST
	• Mobilization of excavator/dredging equipment		➔ Increase in turbidity in the river sections close to work areas and lowering of static water level of nearby water sources (dug wells and shallow wells)	(-)	L	R	HI	ST
	• Excavation of land at the proposed retarding basins		➔ Reduced peaking of flood in the downstream and low lying areas	(+)	W	NA	HI	LT
			➔ May be used as a facility for fish culture/propagation	(+)	L	R	HI	ST
O & M Phase	<u>Dredging and Excavation</u>							
	• Removal and transport of dredge sediments/spoils at the location of silted sections along river channel and the river mouth	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT
			➔ Increase in turbidity	(-)	L	R	HI	ST

Legend:

Beneficial Outcome
(+) = positive impact
(-) = negative impact

Area Extent
W =widespread effect
L = localized effect

Probability
LOW = low
MED = medium
HI = high

Reversibilty
R = reversible
IR = irreversible

Duration
ST = short term
LT = long term
MT = medium term

Tab.I-5-10 Potential Impacts in the Implementation of the Proposed Alternatives (Dinanggasan Alternative A - River Improvement along Dinanggasan River and Tag-Ibo River with Construction of Sabo Dam) (1/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Pre-construction Phase	Resettlement of Project Affected Persons/Families • Preparation of resettlement action plan	➢ Relocation of project affected families	➔ No need for a Resettlement Action Plan	NA	NA	NA	NA	NA
	Land Acquisition • Consultation and negotiations with quarry owners and workers	➢ Clearing of project affected areas and other critical zone	➔ Impact on quarrying at the portion of Tag-Ibo River and Dinaggasan River mouth;	(-)	L	IR	HI	ST
			➔ Financial challenge to the local government units in the acquisition of privately-owned lands in project affected areas;	(-)	L	R	HI	ST
		➢ Staffing and labor sourcing	➔ Land use conflict may arise;	NA	NA	NA	NA	NA
	Project Mobilization • Hiring of local staff and construction labor		➔ Increased employment opportunities for local workers; ➔ Competition with skilled workers and construction/management experts that migrated in the area.	(+) (-)	L L	NA R	HI LO	ST ST
Construction Phase	Demolition of Tag-Ibo Bridge and Reconstruction of a New Bridge • Mobilization of demolition equipment, construction equipment, and delivery/transport of construction materials	➢ Noise production and air emission from the operation of demolition and construction equipment and the transport of construction materials ➢ Removal and disposal of concrete blocks/debris and construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
			➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	MED
			➔ Disruption in local transport particularly the mobility of goods and services	(-)	L	R	HI	ST

Tab.I-5-10 Potential Impacts in the Implementation of the Proposed Alternatives (Dinanggasan Alternative A - River Improvement along Dinanggasan River and Tag-Ibo River with Construction of Sabo Dam) (2/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Construction Phase	<u>Construction of Concrete Dike and Foot Protection Groin Along the Left and Right Bank of Dinangasan River (Lower Stream)</u>							
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Operation of construction equipment	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Dredging the stretch of the riverbanks (along the sections of the proposed dike) in preparation of foundation/foot groin	➢ Removal and disposal of spoils or dredge materials	➔ Temporary increase in turbidity at excavation site	(-)	L	R	MED	ST
	• Site clearing and grubbing of soil to pave way for the construction	➢ Removal of vegetation	➔ Permanent removal of vegetation mostly composed of gemilina tree, ferns, coconut tree, and weeds approximately 600 meters in strip length along the left bank downstream of Dinangasan River.	(-)	L	R	HI	ST
	<u>Bank Erosion Protection Work (Revetment and Foot Protection) Along Tag-Ibo River</u>							
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Excavation of the upper portion of the Tag-Ibo Bridge	➢ Handling and disposal of excavated materials	➔ Reduction in sediments/debris thereby enhancing water quality and flow of water along the tributary	(+)	L	R	HI	MT
	• Dredging of sediments at the riverbank and the construction of 20 meter strip length revetment structure underneath the bridge	➢ Site clearing and waste disposal ➢ Use of construction materials i.e. cement, etc.	➔ Nuisance and land contamination due to indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	ST

Tab.I-5-10 Potential Impacts in the Implementation of the Proposed Alternatives (Dinanggasan Alternative A - River Improvement along Dinanggasan River and Tag-Ibo River with Construction of Sabo Dam) (3/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	Construction of Sand Pocket							
	• Mobilization of dredging equipment	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level (but this is insignificant) and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Excavation of approximately 3 meters deep of soil upstream of the existing irrigation structure along Dinangasan River	➢ Removal and disposal of soil and spoils or dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and open land	(-)	W	IR	HI	ST
			➔ Reduction in the incidence of siltation in areas downstream and close to the existing irrigation structure	(+)	L	NA	HI	MT
		➢ Handling and ultimate disposal of dredge materials/spoils	➔ Minimal increase in noise level (but this is insignificant) and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	Construction of the Sabo Dam							
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Temporary increase in turbidity and alteration in water quality conditions	(-)	L	R	LO	ST
	• Dredging/excavation at the vicinity of the proposed Sabo Dam	➢ Removal and disposal of soil and spoils or dredge materials	➔ Alteration of the natural topography/terrain at the vicinity of the Sabo Dam	(-)	L	IR	HI	LT
			➔ Increase in sediment deposit upstream of the Sabo Dam	(-)	L	R	HI	LT
	• Removal and transport of dredge materials/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	W	IR	HI	ST
	• Removal of vegetation along riverbank and immediate vicinity/area of the Sabo Dam	➢ Removal of vegetation	➔ Permanent removal of vegetation	(-)	L	R	HI	ST

Tab.I-5-10 Potential Impacts in the Implementation of the Proposed Alternatives (Dinanggasan Alternative A - River Improvement along Dinanggasan River and Tag-Ibo River with Construction of Sabo Dam) (4/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
O & M Phase	Dredging and Excavation • Removal and transport of dredge sediments/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT
	Watershed Management • Delineation of area management zone • Erosion control program • Upper Watershed Management Program (forest protection, reforestation, continued monitoring and maintenance of river bank slopes)	➢ Preparation and implementation of watershed management plan	➔ Improved local terrestrial and environmental conditions with reforestation ➔ Reduction in siltation downstream of River ➔ Improved water quality of the river systems ➔ Reduction in bank erosion due to less turbulent river flow from non-frequent flood peaks	(+) (+) (+) (+)	L L W W	NA NA NA NA	HI HI HI HI	LT LT LT MT
	Installation of Flood Warning System • Organization/Establishment of Community based flood warning system	➢ Creation and Operationalization of a Local Emergency Preparedness and Flood Mitigation Plan	➔ Reduction in flood related diseases ➔ Improved emergency preparedness and capacity building of local community ➔ Reduction in human casualty and flood related damages	(+) (+) (+)	W W W	NA NA NA	HI HI HI	LT LT LT

Legend:

Beneficial Outcome
(+) = positive impact
(-) = negative impact

Area Extent
W =widespread effect
L = localized effect

Probability
LOW = low
MED = medium
HI = high

Reversibilty
R = reversible
IR = irreversible

Duration
ST = short term
LT = long term
MT = medium term

Tab.I-5-11 Potential Impacts in the Implementation of the Proposed Alternatives (Dinanggasan Alternative B - River Improvement Works along Dinanggasan River, Tag-Ibo River and Compol River with Construction of Sabo Dam) (1/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
Pre-Construction Phase	<u>Resettlement of Project Affected Persons/Families</u> • Preparation of resettlement action plan	➢ Relocation of project affected families whose houses are located within the proximity of the proposed structural measures	➔ Displacement of roughly 18 families of informal settlers along Compol River; ➔ Displacement of families and individuals, especially schooling of school-aged children; ➔ Threat to livelihood and income; ➔ Opportunities for expanding social relationships and community networks in new site.	(-) (-) (-) (+)	L L L L	R R R R	HI HI HI MED	ST ST ST ST
	<u>Land Acquisition</u> • Consultation and negotiations with quarry owners and workers	➢ Clearing of project affected areas and other critical zone	➔ Impact on numerous quarries; ➔ Land use conflict may arise;	(-) (-)	L L	R R	HI LO	ST ST
	<u>Project Mobilization</u> • Hiring of local staff and construction labor	➢ Staffing and labor sourcing	➔ Increased employment opportunities for local workers; ➔ Competition from migration of skilled workers and construction/management experts	(+) (-)	L L	NA NA	MED LO	ST ST
Construction Phase	<u>Demolition of Tag-Ibo Bridge and Reconstruction of a New Bridge</u> • Mobilization of demolition equipment, construction equipment, and delivery/transport of construction materials	➢ Noise production and air emission from the operation of demolition and construction equipment and the transport of construction materials ➢ Removal and disposal of concrete blocks/debris and construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level ➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land ➔ Disruption in local transport particularly the mobility of goods and services	(-) (-) (-)	L W L	R IR R	LO HI HI	ST ST ST
	<u>Construction of Concrete Dike and Foot Protection Groin Along the Left and Right Bank of Dinangasan River (Lower Stream)</u> • Mobilization of construction equipment and delivery/transport of construction materials	➢ Operation of construction equipment	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST

Tab.I-5-11 Potential Impacts in the Implementation of the Proposed Alternatives (Dinanggasan Alternative B - River Improvement Works along Dinanggasan River, Tag-Ibo River and Compol River with Construction of Sabo Dam) (2/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	• Dredging the stretch of the riverbanks (along the sections of the proposed dike) in preparation of foundation/foot groin	➢ Removal and disposal of spoils or dredge materials	➔ Temporary increase in turbidity at excavation site	(-)	L	R	LO	ST
	• Site clearing and grubbing of soil to pave way for the construction	➢ Removal of vegetation	➔ Permanent removal of vegetation mostly composed of gemilina tree, ferns, coconut tree, and weeds approximately 600 meters in strip length along the left bank downstream of Dinangasan River.	(-)	L	R	HI	ST
	<u>Bank Erosion Protection Work (Revetment and Foot Protection) Along Tag-Ibo River</u>							
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Excavation of the upper portion of the Tag-Ibo Bridge	➢ Handling and disposal of excavated materials	➔ Reduction in sediments/debris thereby enhancing water quality and flow of water along the tributary	(+)	L	R	HI	MT
	• Dredging of sediments at the riverbank and the construction of 20 meter strip length revetment structure underneath the bridge	➢ Site clearing and waste disposal ➢ Use of construction materials i.e. cement, etc.	➔ Nuisance and land contamination due to indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	ST
	<u>Construction of Sand Pocket</u> • Mobilization of dredging equipment	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level (but this is insignificant) and slight increase in air quality contaminant level	(-)	L	R	LO	ST

Tab.I-5-11 Potential Impacts in the Implementation of the Proposed Alternatives (Dinanggasan Alternative B - River Improvement Works along Dinanggasan River, Tag-Ibo River and Compol River with Construction of Sabo Dam) (3/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	• Excavation of approximately 3 meters deep of soil upstream of the existing irrigation structure along Dinangasan River	➢ Removal and disposal of soil and spoils or dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and open land	(-)	L	IR	HI	ST
	<u>Excavation of Compol River and Construction of Embankment</u>							
	• Mobilization of dredging equipment	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Reduction in the incidence of siltation in areas downstream and close to the existing irrigation structure	(+)	L	NA	HI	ST
	• Excavation of Compol River following the dimensions: approximately 1 meter deep of soil, embankment height is 0.6 meter, channel width of 9.0 meters, slope 1:2 and 1 kilometer in length.	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level and slight increase in air quality contaminant level	(-)	L	R	LO	ST
			➔ Indiscriminate disposal of dredge spoils to vacant lots and open land	(-)	L	IR	HI	ST
			➔ Reduction in the incidence of siltation and flooding	(+)	W	NA	HI	LT
		➢ Removal and disposal of soil and spoils or dredge materials						
	<u>Construction of Additional Embankment at the upper reach (right side) of Dinanggasan River</u>							
	• Mobilization of dredging equipment	➢ Construction of river embankment	➔ Conflict with ongoing construction of local irrigation project	(-)	L	R	HI	ST
		➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level (but this is insignificant) and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Construction of embankment approximately 300 meter in length along the stretch of river channel having a maximum height of 5 meters.	➢ Removal and disposal of soil and spoils or dredge materials	➔ Indiscriminate disposal of dredge spoils to vacant lots and open land	(-)	L	IR	HI	ST
		➢ Removal of vegetation in the “uncleared site”	➔ Reduction in the incidence of siltation and flooding	(+)	W	NA	HI	LT
			➔ Removal of trees (e.g. coconut, gemilina, and etc.), grass, shrubs, and ferns.	(-)	L	R	HI	ST

Tab.I-5-11 Potential Impacts in the Implementation of the Proposed Alternatives (Dinanggasan Alternative B - River Improvement Works along Dinanggasan River, Tag-Ibo River and Compol River with Construction of Sabo Dam) (4/4)

Project Development Phase	Project Activities	Sources of Environmental (Natural. Social, and Pollution Related) Impact	Environmental Impact	Assessment Criteria				
				Type	Extent	Status	Occur.	Duration
	Construction of the Sabo Dam							
	• Mobilization of construction equipment and delivery/transport of construction materials	➢ Noise production and air emission from the operation construction equipment and of transportation of construction materials	➔ Minimal increase in noise level (but this is insignificant) and slight increase in air quality contaminant level	(-)	L	R	LO	ST
	• Dredging/excavation at the vicinity of the proposed Sabo Dam	➢ Removal and disposal of soil and spoils or dredge materials	➔ Temporary increase in turbidity and alteration in water quality conditions	(-)	L	R	LO	ST
			➔ Alternation of the natural topography/terrain at the vicinity of the Sabo Dam	(-)	L	IR	HI	LT
	• Removal of vegetation along riverbank and immediate vicinity/area of the Sabo Dam	➢ Removal of vegetation	➔ Increase in sediment deposit upstream of the Sabo Dam	(-)	L	R	HI	LT
			➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	ST
			➔ Permanent removal of vegetation	(-)	L	R	HI	ST
O & M Phase	Dredging and Excavation							
	• Removal and transport of dredge sediments/spoils at the location of silted sections along river channel	➢ Handling and ultimate disposal of dredge materials/spoils	➔ Indiscriminate disposal of dredge spoils to vacant lots and agricultural land	(-)	L	IR	HI	MT
	Watershed Management							
	• Delineation of area management zone	➢ Preparation and implementation of watershed management plan	➔ Improved local terrestrial and environmental conditions with reforestation	(+)	W	NA	HI	LT
	• Erosion control program		➔ Reduction in siltation downstream of River	(+)	W	NA	HI	LT
	• Upper Watershed Management Program (forest protection, reforestation, continued monitoring and maintenance of river bank slopes)		➔ Improved water quality of the river systems	(+)	W	NA	HI	MT
			➔ Reduction in bank erosion due to less turbulent river flow from non-frequent flood peaks	(+)	L	NA	HI	LT
			➔ Reduction in flood related diseases	(+)	W	NA	HI	LT
	Installation of Flood Warning System	➢ Creation and Operationalization of a Local Emergency Preparedness and Flood Mitigation Plan	➔ Improved emergency preparedness and capacity building of local community	(+)	L	NA	HI	LT
	• Organization/Establishment of Community based flood warning system		➔ Reduction in human casualty and flood related damages	(+)	W	NA	HI	LT

Legend:

Beneficial Outcome
(+) = positive impact
(-) = negative impact

Area Extent
W =widespread effect
L = localized effect

Probability
LOW = low
MED = medium
HI = high

Reversibilty
R = reversible
IR = irreversible

Duration
ST = short term
LT = long term
MT = medium term

Tab.I-5-12 Environmental Impact Matrix for the Ilog-Hilabangan River Basin

Project Details		Land Features and Uses				Species and Ecosystem				Air and Water					Socioeconomic Consideration								
		Land Use	Topography/Physiographic	Geology /Soils	Aesthetics	Terrestrial Fauna	Terrestrial Flora	Aquatic Fauna	Aquatic Flora	Air Quality	Surface Water Quality	Ground Water Quality	Noise	Vibration	Population/ Settlement	Employment /Livelihood	Health	Hazardous Elements	Solid Waste	Transportation	Cultural and Historical Value	Resource use Completion	Accessibility/Infra
Case 1 - River Improvement and Enhancement of Flow Along the Main Channel																							
Resettlement of Project Affected Persons/Families (Temporary displacement of approximately 30 families whose houses are located in either the right or left bank of the river)	Pre-construction														B-	C-							B-
	Construction																						
	O & M																						
Land Acquisition	Pre-construction	C-																				C-	A-
	Construction																						
	O & M																						
Project Mobilization	Pre-construction																						
	Construction																						
	O & M																						
Construction of Earth Dike	Pre-construction																						
	Construction				A-				B-														C-
	O & M																						
Installation/Construction of Sluice Gates	Pre-construction																						
	Construction				A-				B-		A+												
	O & M																						
Bank Erosion Protection Work (Revetment)	Pre-construction																						
	Construction																						C-
	O & M																						
Channel Widening Along Ilog River	Pre-construction																						
	Construction						B-		A-									C-		C-			C-
	O & M																						
Dredging and Excavation	Pre-construction																						
	Construction				A-																		
	O & M																						
Watershed Management	Pre-construction																						
	Construction						A+				A+												
	O & M																						
Installation of Flood Warning System	Pre-construction																						
	Construction																						
	O & M																A+	A+					
Case 2 - River Improvement and Enhancement of Flow Along the Diversion Channel																							
Resettlement of Project Affected Persons/Families (Temporary displacement of approximately 30 families whose houses are located in either the right or left bank of the river)	Pre-construction														A-	C-							B-
	Construction																						
	O & M																						
Land Acquisition	Pre-construction	B-																					A-
	Construction																						
	O & M																						
Project Mobilization	Pre-construction																						
	Construction																						
	O & M																						
Construction of Earth Dike	Pre-construction																						
	Construction				A-				B-														C-
	O & M																						
Installation/Construction of Sluice Gates	Pre-construction																						
	Construction				A-		B-											A+					
	O & M																						
Bank Erosion Protection Work (Revetment)	Pre-construction																						
	Construction																						C-
	O & M																						
Widening Along Cut-off Channel	Pre-construction																						
	Construction								B-									C-		C-			B-
	O & M																						
Dredging and Excavation	Pre-construction																						
	Construction				A-																		C-
	O & M																						
Watershed Management	Pre-construction																						
	Construction																						
	O & M						B+				A+												
Installation of Flood Warning System	Pre-construction																						
	Construction																						
	O & M																A+	A+					

Environmental Impact Score:

A+: Significant positive impact
B+: Moderate positive impact
C+: Negligible positive impact
?: Unclear
A-: Significant negative impact
B-: Moderate negative impact
C-: Negligible negative impact
Blank: No negative and positive impact caused by project activities

Tab.I-5-13 Environmental Impact Matrix for the Dungcaan River Basin

Project Details		Land Features and Uses				Species and Ecosystem				Air and Water					Socioeconomic Consideration								
		Land Use	Topography/Physiographic	Geology /Soils	Aesthetics	Terrestrial Fauna	Terrestrial Flora	Aquatic Fauna	Aquatic Flora	Air Quality	Surface Water Quality	Ground Water Quality	Noise	Vibration	Population/ Settlement	Employment /Livelihood	Health	Hazardous Elements	Solid Waste	Transportation	Cultural and Historical Value	Resource use Completion	Accessibility/Infra
Case 1 - River Improvement Works Along Main Stream of Dungcaan River including Secondary Channel																							
Resettlement of Project Affected Persons/Families (some 114 families in Sitio Brandy Island and more than 20 families in Barangay Sto. Rosario)	Pre-construction														B-	B-							
	Construction																						
	O & M																						
Land Acquisition	Pre-construction	B-						C-															
	Construction																						
	O & M																						
Project Mobilization	Pre-construction																						
	Construction																						
	O & M																						
Construction of Concrete Dike with Access Road	Pre-construction																						
	Construction				A-			B-	B-		C-												
	O & M																						B+
Construction of Spur Dike	Pre-construction																						
	Construction				B-													C+					
	O & M																						
Bank Erosion Protection Work (Revetment)	Pre-construction																						
	Construction				B-						C-												
	O & M																						
Construction of Small Bridge and Mini Park within the Mangrove/Wetland Area	Pre-construction																						
	Construction																						
	O & M																						
Dredging and Excavation	Pre-construction																						
	Construction				A-			C-	C-														
	O & M				B-			C-	C-														
Watershed Management	Pre-construction																						
	Construction																						
	O & M			A+		A+	A+				A+												
Installation of Flood Warning System	Pre-construction																						
	Construction																						
	O & M																A+	A+					
Case 2 - River Improvement Works Along Main Stream of Dungcaan River Only																							
Resettlement of Project Affected Persons/Families (some 114 families in Sitio Brandy Island and more than 20 families in	Pre-construction														B-	C-							
	Construction																						
	O & M																						
Land Acquisition	Pre-construction	B-						C-															
	Construction																						
	O & M																						
Project Mobilization	Pre-construction																						
	Construction																						
	O & M																						
Construction of Concrete Dike with Access Road	Pre-construction																						
	Construction				A-			C-	B-		C-												A+
	O & M																						B+
Construction of Spur Dike	Pre-construction																						
	Construction			B+	B-													A+					
	O & M																						
Bank Erosion Protection Work (Revetment)	Pre-construction																						
	Construction				B-						C-												
	O & M																						
Construction of Small Bridge and Mini Park within the Mangrove/Wetland Area	Pre-construction																						
	Construction																						
	O & M																						
Dredging and Excavation	Pre-construction																						
	Construction				B-				B-														
	O & M																						
Watershed Management	Pre-construction																						
	Construction																						
	O & M			B+			B+				A+												
Installation of Flood Warning System	Pre-construction																						
	Construction																						
	O & M																A+	A+		A+			
(Case 3 - River Improvement and Construction of Multi-Purpose Reservoir)																							
Resettlement of Project Affected Persons/Families (20 families in the site for dam construction, some 114 families in Sitio Brandy Island	Pre-construction							C-							B-	B-							
	Construction																						
	O & M																						
Land Acquisition	Pre-construction																						
	Construction																						
	O & M																						
Project Mobilization	Pre-construction																						
	Construction																						
	O & M																						
Construction of Concrete Dike with Access Road	Pre-construction																						
	Construction				A-				B-		C-												
	O & M																						B+
Construction of Spur Dike	Pre-construction																						
	Construction			B+	A-													A+					
	O & M																						
Bank Erosion Protection Work (Revetment)	Pre-construction																						
	Construction			B+	B-						C-												
	O & M																						
Construction of the Multi-Purpose Reservoir	Pre-construction																						
	Construction	A-	A-		A-		C-				C-		C-									B+	
	O & M																						
Construction of Small Bridge and Mini Park within the Mangrove/Wetland Area	Pre-construction																						
	Construction																						
	O & M																						
Dredging and Excavation	Pre-construction																						
	Construction				A-			B-	B-														
	O & M																						
Watershed Management	Pre-construction																						
	Construction																						
	O & M			B+			A+				A+												
Installation of Flood Warning System	Pre-construction																						
	Construction																						
	O & M																A+	A+					

Environmental Impact Score:

A+: Significant positive impact — *A-: Significant negative impact*
B+: Moderate positive impact — *B-: Moderate negative impact*
C+: Negligible positive impact — *C-: Negligible negative impact*
?: Unclear — *Blank: No negative and positive impact caused by project activities*

Tab.I-5-14 Environmental Impact Matrix for the Meycauayan River Basin

Project Details		Land Features and Uses				Species and Ecosystem				Air and Water					Socioeconomic Consideration								
		Land Use	Topography/Physiographic	Geology /Soils	Aesthetics	Terrestrial Fauna	Terrestrial Flora	Aquatic Fauna	Aquatic Flora	Air Quality	Surface Water Quality	Ground Water Quality	Noise	Vibration	Population/ Settlement	Employment /Livelihood	Health	Hazardous Elements	Solid Waste	Transportation	Cultural and Historical Value	Resource use Completion	Accessibility/Infra
Case 1 - River and Drainage Improvement																							
Resettlement of Project Affected Persons/Families (Displacement of not less than 90 families in Meycauayan and nearly 90 families in Marilao)	Pre-construction														B-	C-							
	Construction																						
	O & M																						
Land Acquisition	Pre-construction	B-																					
	Construction																						
	O & M																						
Project Mobilization	Pre-construction															C+							
	Construction																						
	O & M																						
Construction of Dike and Increasing the Elevation of Existing Road Surface	Pre-construction																						
	Construction						B-			C-	C-		C-	C-				C-	C-	B-			C-
	O & M																						
Installation/Construction of Gates and Drainage Facility	Pre-construction																						
	Construction				C-					C-			C-										
	O & M										B+						B+						
Construction of Revetment	Pre-construction																						
	Construction												C-										
	O & M																B+						
Dredging and Excavation	Pre-construction																						
	Construction				C-																		B-
	O & M																						
Reconstruction of Existing Bridge Structures	Pre-construction																						
	Construction				C-					C-			C-							C-			
	O & M																						
Structures of VOM Flood Control Project Component	Pre-construction																						
	Construction									C-					C-								B-
	O & M																						
Dredging and Excavation	Pre-construction																						
	Construction																						
	O & M										A+						A+						
Watershed Management	Pre-construction																						
	Construction																						
	O & M										A+												
Installation of Flood Warning/Disaster Management System	Pre-construction																						
	Construction																						
	O & M																A+						

Environmental Impact Score:

A+: Significant positive impact
B+: Moderate positive impact
C+: Negligible positive impact
?: Unclear
A-: Significant negative impact
B-: Moderate negative impact
C-: Negligible negative impact
Blank: No negative and positive impact caused by project activities

Tab.I-5-15 Environmental Impact Matrix for the Kinanliman River Basin

Project Details		Land Features and Uses				Species and Ecosystem				Air and Water					Socioeconomic Consideration								
		Land Use	Topography/Physiographic	Geology /Soils	Aesthetics	Terrestrial Fauna	Terrestrial Flora	Aquatic Fauna	Aquatic Flora	Air Quality	Surface Water Quality	Ground Water Quality	Noise	Vibration	Population/ Settlement	Employment /Livelihood	Health	Hazardous Elements	Solid Waste	Transportation	Cultural and Historical Value	Resource use Completion	Accessibility/Infra
Case 1 - River Improvement and Sabo Dam Construction																							
Resettlement of Project Affected Persons/Families	Pre-construction																						
	Construction																						
	O & M																						
Land Acquisition	Pre-construction																					B-	
	Construction																						
	O & M																						
Project Mobilization	Pre-construction																						
	Construction																						
	O & M																						
Construction of Concrete and FCSEC Pilot Dike	Pre-construction																						
	Construction				B-		C-																
	O & M																						
Installation/Construction of Gate	Pre-construction																						
	Construction				C-		B-											B+					
	O & M																						
Construction of Sabo Dam	Pre-construction																						
	Construction		A-	B-	B-		A-																
	O & M																						
Construcion of Spur Dike	Pre-construction																						
	Construction				B-		C-										B+	A+					
	O & M																						
Widening of Kinanliman River beginning at the section of Kinanlimna Bridge towards the river mouth	Pre-construction																						
	Construction				B-													C-		C-			
	O & M																						
Dredging and Excavation	Pre-construction																						
	Construction																						
	O & M				B-																		
Watershed Management	Pre-construction																						
	Construction																						
	O & M		B+				B+				A+												
Installation of Flood Warning System	Pre-construction																						
	Construction																						
	O & M																A+	A+					

Environmental Impact Score:

A+: Significant positive impact
B+: Moderate positive impact
C+: Negligible positive impact
?: Unclear
A-: Significant negative impact
B-: Moderate negative impact
C-: Negligible negative impact
Blank: No negative and positive impact caused by project activities

Tab.I-5-16 Environmental Impact Matrix for the Tuganay River Basin

Project Details		Land Features and Uses				Species and Ecosystem				Air and Water					Socioeconomic Consideration								
		Land Use	Topography/Physiographic	Geology /Soils	Aesthetics	Terrestrial Fauna	Terrestrial Flora	Aquatic Fauna	Aquatic Flora	Air Quality	Surface Water Quality	Ground Water Quality	Noise	Vibration	Population/ Settlement	Employment /Livelihood	Health	Hazardous Elements	Solid Waste	Transportation	Cultural and Historical Value	Resource use Completion	Accessibility/Infra
Case T-1 - River Improvement Only																							
Resettlement of Project Affected Persons/Families (15 houses in a contigous cluster and a sports complex near Anibongan Bridge)	Pre-construction														C-	C-							
	Construction																						
	O & M																						
Land Acquisition	Pre-construction	C-																				B-	
	Construction																						
	O & M																						
Project Mobilization	Pre-construction																						
	Construction																						
	O & M																						
Reconstruction of Existing Dike	Pre-construction																						
	Construction				A-		A-			C-			C-	C-									
	O & M										B+												
Upgrading/Reconstruction of Bridges (Approx. = 10)	Pre-construction																						
	Construction				A-															C-			C-
	O & M																						
Installation/Construction of Gates and Drainage Facility	Pre-construction																						
	Construction						C-						C-										
	O & M										C+												
Construction of Diversion Channel	Pre-construction																						
	Construction				A-		C-				C-		C-										
	O & M																	C+					
Dredging and Excavation	Pre-construction																						
	Construction																						
	O & M				B-						A+							B+					
Case T-2 - River Improvement and Construction of Three (3) Retarding Basins																							
Resettlement of Project Affected Persons/Families (Temporary displacement of 34 families whose houses are located within the proposed retarding basin)	Pre-construction														B-	C-							
	Construction																						
	O & M																						
Land Acquisition	Pre-construction																						
	Construction	B-																				C-	
	O & M																						
Project Mobilization	Pre-construction																						
	Construction															C+							
	O & M																						
Reconstruction of Existing Dike	Pre-construction																						
	Construction				A-		A-			C-	C-		C-	C-									
	O & M																C+	A+					
Upgrading/Reconstruction of Bridges (Approx. = 10)	Pre-construction																						
	Construction				A-															C-			C-
	O & M																						
Installation/Construction of Gates and Drainage Facility	Pre-construction																						
	Construction						B-						C-				`						
	O & M										B+												
Construction of Diversion Channel	Pre-construction																						
	Construction				A-		C-				C-		C-										
	O & M																A+						
Dredging and Excavation	Pre-construction																						
	Construction																						
	O & M				B-						C-						A+						
Construciton of Retarding Basin	Pre-construction																						
	Construction									C-	C-	C-	C-										
	O & M															C+	A+						

Environmental Impact Score:

A+: Significant positive impact
B+: Moderate positive impact
C+: Negligible positive impact
?: Unclear

A-: Significant negative impact
B-: Moderate negative impact
C-: Negligible negative impact
Blank: No negative and positive impact caused by project activities

Tab.I-5-17 Environmental Impact Matrix for the Dinanggasan River Basin

Project Details		Land Features and Uses				Species and Ecosystem				Air and Water					Socioeconomic Consideration								
		Land Use	Topography/Physiographic	Geology /Soils	Aesthetics	Terrestrial Fauna	Terrestrial Flora	Aquatic Fauna	Aquatic Flora	Air Quality	Surface Water Quality	Ground Water Quality	Noise	Vibration	Population/ Settlement	Employment /Livelihood	Health	Hazardous Elements	Solid Waste	Transportation	Cultural and Historical Value	Resource use Completion	Accessibility/Infra
Case 1 - River Improvement of Dinanggasan River and Tag-Ibo River with Construction of Sabo Dam and Sand Pocket Connecting Compol River to Dinanggasan River																							
Resettlement of Project Affected Persons/Families	Pre-construction																						
	Construction																						
	O & M																						
Land Acquisition	Pre-construction																					B-	
	Construction																						
	O & M																						
Project Mobilization	Pre-construction															C+							
	Construction																						
	O & M																						
Demolition of Tag-ibo Bridge and Reconstruction of a New Bridge	Pre-construction																						
	Construction				A-															C-			
	O & M																						
Construction of Concrete Dike and Foot Protection Groin Along the Left and Right Bank of Dinangasan River (Lower Stream)	Pre-construction																						
	Construction						C-																
	O & M																						
Construction of Sabo Dam	Pre-construction																						
	Construction		B-	C-	A-		C-																
	O & M																						
Bank Erosion Protection Work (Revetment and Foot Protection) Along Tag-ibo River	Pre-construction																						
	Construction				B-						C+												
	O & M																						
Construction of Sand Pocket	Pre-construction																						
	Construction		C-		A-																		
	O & M																						
Dredging and Excavation	Pre-construction																						
	Construction																						
	O & M				B-																		
Watershed Management	Pre-construction																						
	Construction																						
	O & M		C+		B+		C+				B+												
Installation of Flood Warning System	Pre-construction																						
	Construction																						
	O & M																B+						
Case 2 - River Improvement Works of Dinaggasan River, Tag-Ibo River and Compol River With Construction of Sabo Dam Separating Compol River from Dinanggasan River																							
Resettlement of Project Affected Persons/Families (Temporary displacement of roughly 18 families of informal settlers along	Pre-construction														C-	C-							
	Construction																						
	O & M																						
Land Acquisition	Pre-construction																					C-	
	Construction																						
	O & M																						
Project Mobilization	Pre-construction																						
	Construction																						
	O & M																						
Demolition of Tag-ibo Bridge and Reconstruction of a New Bridge	Pre-construction																						
	Construction								A-											C-			
	O & M																						
Construction of Concrete Dike and Foot Protection Groin Along the Left and Right Bank of Dinangasan River (Lower Stream)	Pre-construction																						
	Construction						C-																
	O & M																						
Construction of Sabo Dam	Pre-construction																						
	Construction		A-	C-	B-		C-																
	O & M																						
Bank Erosion Protection Work (Revetment and Foot Protection) Along Tag-ibo River	Pre-construction																						
	Construction				B-						C+												
	O & M																						
Excavation of Compol River and Construction of Embankment	Pre-construction																						
	Construction		C+		B-													B+					
	O & M																						
Construction of Additional Embankment at the upper reach (right side) of Dinangasan River	Pre-construction																						
	Construction				B-													A+				C-	
	O & M																						
Construction of Sand Pocket	Pre-construction																						
	Construction		C-		A-																		
	O & M																						
Dredging and Excavation	Pre-construction																						
	Construction																						
	O & M				B-																		
Watershed Management	Pre-construction																						
	Construction																						
	O & M		A+		C+		A+				A+						A+						
Installation of Flood Warning System	Pre-construction																						
	Construction																						
	O & M																A+	A+					

Environmental Impact Score:

A+: Significant positive impact
B+: Moderate positive impact
C+: Negligible positive impact
?: Unclear
A-: Significant negative impact
B-: Moderate negative impact
C-: Negligible negative impact
Blank: No negative and positive impact caused by project activities

Tab.I-5-18 Guideline for Scoring Magnitude of Environmental Impacts

Score	Type	Magnitude	Guideline
A	(-)	Significant	If direct and indirect impact of the project activity meets at least 3 of the following absolute impact assessment criteria: Irreversible, Long-term, Widespread and High Probability of Occurrence
B	(-)	Moderate	If direct and indirect impact of the project activity meets at least 2 of the following absolute impact assessment criteria: Irreversible, Long-term, Widespread and High Probability of Occurrence
C	(-)	Negligible	If direct and indirect impact of the project activity meets at least 1 of the following absolute impact assessment criteria: Irreversible, Long-term, Widespread and High Probability of Occurrence
A	(+)	Significant	If direct and indirect impact of the project activity meets at least 3 of the following absolute impact assessment criteria: Long-term, Widespread and High Probability of Occurrence
B	(+)	Moderate	If direct and indirect impact of the project activity meets at least 2 of the following absolute impact assessment criteria: Irreversible, Long-term, Widespread and High Probability of Occurrence
C	(+)	Negligible	If direct and indirect impact of the project activity meets at least 1 of the following absolute impact assessment criteria: Irreversible, Long-term, Widespread and High Probability of Occurrence

Tab.I-6-1 Watershed Intervention Strategies for each type of Zone

Zone	Description and rationale	Intervention strategies
Protection	This zone serves to protect soil and ecological functions. Economic activities in these zones are limited to the extraction of non-timber forest products and eco-tourism that preserve the forest structure	• Forest protection • Reforestation/Rainforestation
Multiple Use	A zone that combines protection with production	• Community-based Forest Management • Ecological conduits • Timber production • Agro-forestry • Riparian Vegetation Management
Production	A zone purely for agricultural lands	• Agriculture

Tab.I-6-2 Intervention Strategies per Zone and their Description and Rationale

Intervention Strategies	Description and Rationale
Forest Protection	Protection of the remaining forest vegetation on critical slopes from any form of land conversion in land uses, protection of the existing forest and opposition to destructive activities in the uplands should be done both legally and on the ground.
Reforestation	Upscaling tree planting along the contours on exposed slopes greater than 50%. The forest is planned to be established for absolute protection.
Ecological conduits	These are irregular micro patches of different land uses to connect a forest patch to another to facilitate larger feeding area and for the promotion of biodiversity through exchange of genetic materials using wildlife as the vehicle
Community Based Forest Management (CBFM)	CBFM is assigned to areas where there is random patches remaining forests and exposed soils at different slope classes
Timber Production	Slopes from 30-50% will be planted with native trees for the purpose of timber production on a commercial basis
Riverbank stabilization	Vegetation established in an unstable river banks helps stabilize river banks and filter the amount of sediments deposited into the stream or river. Riverbank stabilization can curtail episodes of erosion resulting in better aquatic resource management.
Nursery Establishment	Ensures timely availability of quality forest and fruit tree seedlings
Ecotourism	Eco-tourism promotes sustainable forest management, which ensures existence and protection of natural forest. Local communities are encouraged to manage this kind of tourism.
Agriculture	Protection or conservation in the absence of livelihood is not an option in the Philippine reality. Hence, livelihood activities such as agriculture should be integrated into the program. Farming of important staple crops and high value annual crops at 0 to 18% slopes could serve as substantial livelihood source of the community.

Source: Mandulog Watershed Comprehensive Management Plan, 2000

Tab.I-6-3 Environmental Monitoring Plan (Ilog-Hilabangan)

Critical/Major Issues	Mitigating Measures	Monitoring and Institutional Requirements
Air pollution	• All vehicles and equipment that will be used must pass the emission tests prescribed by the Clean Air Act. • Proper management of construction activities including storage and transport of dredged sediment, quarried soil and garbage to minimize generation of dust should be included in an environmental management plan that should form part of project implementation plan. • Stockpiles of sand, gravel and waste materials should be watered frequently to prevent the wind from turning them into sources of dust.	➢ Emission test reports for vehicles and equipment ➢ Daily monitoring of the level of air pollutants compared with Air pollution Standards, RA No.8749, 1999, Clean Air Act ➢ Form a monitoring team to monitor compliance with the environmental management plan
Deterioration in the Quality of the Ilog River and Cut-off Channel	• Provision for silt traps at work areas, adherence to best construction project management, immediate removal of construction debris at the work place • Routine check of work site for possible fuel spills, lubricant leaks and maintains routine site inspection of storage and work areas. • Confine maintenance of vehicles and equipment at the motor pool section. • Proper storage of chemicals and used oils in accordance with standard code of safety and technical specifications of the engineering works contract and the Philippine occupational Health & Safety Standards.	➢ Include in the environmental management plan and the supervision plan of the project management office ➢ Implementing agency shall require the assignment of environmental officer to provide continued monitoring and technical assistance throughout the project implementation cycle ➢ Daily and weekly progress reports and environmental monitoring records shall be integrated in the reportorial process by the Contractor
Transport and disposal of bottom sediment and construction wastes	• Temporary storage and transport of dredged materials must be considered in the construction plan. • Identify landfill or acceptable disposal sites before construction. Temporary storage, transport and disposal should conform to existing National and local sanitation laws.	➢ Monitor compliance with requirements during implementation stage. For disposal arrangements, coordinate with LGUs where sanitary landfills or appropriate disposal sites exist, otherwise plan for other disposal alternatives.
Noise and vibration	• Proper scheduling of activities to avoid use of noise and vibration producing equipment during critical periods of the day like nighttime and early mornings and near sensitive areas like church, schools, hospitals. Avoid use of much noise and vibration producing-equipment as much as possible • Should form part of environmental management plan during construction	➢ Identify location of noise and vibration sensitive areas so that works schedules should be prepared taking these into account. ➢ Monitor noise level with Noise Standards ➢ Monitoring team to monitor compliance during implementation stage.
Health and Safety	• Sufficient provisions for prevention of accidents to workers like safety gadgets. Proper construction methods and safety precautions can prevent risks to workers, pedestrians and motorists, e.g. warning signs, temporary cover for excavated areas, proper management of stockpile of construction materials or spoils from excavation, etc. All safety precautions and construction methods to prevent risks to workers' and public's life and health must be detailed in environmental management plan for construction. • Install signages and warning devices at the construction site; Coordinate with LGUs for possible public safety zone; Coordinate with nearest hospitals for instituting effective land-based response of medical units	➢ Review and approval by implementing agency – DPWH and the LGU covering the project site of environmental plans for construction before actual works. ➢ Monitoring team to monitor compliance.
Existing social and infrastructure services	• Proper construction techniques and precautionary measures employed during construction can minimize the impact of activities on utilities such as transport (roads and bridges), water, telephone and electrical connections. However as disturbance in local transport usually host other problems as seen from the screening process, it is recommended that a traffic impact assessment shall be undertaken together with an in depth environmental impact assessment in the project areas in need of bridge reconstruction as a result of channel widening and dike construction	➢ Coordination with the local traffic bureau of the concerned LGUs in preparing the traffic management plan. ➢ Review output and implement recommendations/plans of the traffic impact assessment report ➢ Compliance with Philippine EIS System requirements for Bridge reconstruction
Displacement of Households and Right of Way (ROW)/Land Acquisition (agricultural lands along Ilog River)	• This should be addressed before deciding to proceed with the project. • Prepare a partial resettlement action plan (RAP) if the number of affected persons is within 200. If the number of PAPs is >200 a full scale RAP has to be prepared. The scope of resettlement has to be discussed and agreed with the stakeholders of the project. • Coordination shall be made with the LGU and DPWH for the implementation of the relocation plan and right of way/land acquisition. • Strict implementation of the law which provides for the maintenance of a buffer zone along river banks. This will prevent the return of project-affected persons/families that are the beneficiaries of the project resettlement program.	➢ Monitoring of resettlement aspects is better handled by a resettlement monitoring task force that must be created specifically for the project. The task force must have varied sectoral representation. The monitoring task force must be created even before the preparation of the RAP so that they can participate in the RAP planning process. Institutional responsibilities will be determined by the task force members themselves. ➢ 100% agreement/approval of affected land owner including government agency regulating the issue on the right-of-way shall be achieved by Implementing agency and concerned LGU
Permanent removal of vegetation and critical natural environmental zones e.g. wetland, marshland, etc.	• Revegetation of removed or cut mangrove trees • Conduct detailed biological (flora and fauna) survey to determine the types and number of mangroves that will be affected • Ensure that prior to revegetation or cutting, clearance from the DENR is secured since the agency will determine and recommend the appropriate/regulatory and procedural requirements in the establishment and revegetation of mangrove sites	➢ Permits/Clearance issued by the DENR Regional Office (as prescribed in DAO 1990-15) in compliance with existing DENR regulations on mangrove clear cutting, management and project implementation ➢ Clearance with the concerned LGU If there are existing local ordinances or pending bills pertaining to the management and regulation in the use of the estuarine zone

Tab.I-6-4 Environmental Monitoring Plan (Dungcaan)

Critical/Major Issues	Mitigating Measures	Monitoring and Institutional Requirements
Air pollution	• All vehicles and equipment that will be used must pass the emissions tests prescribed by the Clean Air Act. • Proper management of construction activities including storage and transport of dredged sediment, quarried soil and garbage to minimize generation of dust should be included in an environmental management plan that should form part of project implementation plan • Stockpiles of sand, gravel and waste materials should be watered frequently to prevent the wind from turning them into sources of dust.	➢ Emissions test reports for vehicles and equipment ➢ Daily monitoring of the level of air pollutants compared with Air pollution Standards, RA No.8749, 1999, Clean Air Act ➢ Form a monitoring team to monitor compliance with the environmental management plan
Deterioration in the Quality of Dungcaan River	• Provision for silt traps at work areas, adherence to best construction project management, immediate removal of construction debris at the work place • Routine check of work site for possible fuel spills, lubricant leaks and maintains routine site inspection of storage and work areas. • Confine maintenance of vehicles and equipment at the motor pool section. • Proper storage of chemicals and used oils in accordance with standard code of safety and technical specifications of the engineering works contract and the Philippine occupational Health & Safety Standards.	➢ Include in the environmental management plan and the supervision plan of the project management office ➢ Implementing agency shall require the assignment of environmental officer to provide continued monitoring and technical assistance throughout the project implementation cycle ➢ Daily and weekly progress reports and environmental monitoring records shall be integrated in the reportorial process by the Contractor
Transport and disposal of bottom sediment and construction wastes	• Temporary storage and transport of dredged materials must be considered in the construction plan. • Identify landfill or acceptable disposal sites before construction. Temporary storage, transport and disposal should conform to existing National and local sanitation laws.	➢ Monitor compliance with requirements during implementation stage. For disposal arrangements, coordinate with LGUs where sanitary landfills or appropriate disposal sites exist, otherwise plan for other disposal alternatives.
Noise and vibration	• Proper scheduling of activities to avoid use of noise and vibration producing equipment during critical periods of the day like nighttime and early mornings and near sensitive areas like church, schools, hospitals. Avoid use of much noise and vibration producing-equipment as much as possible • Maintain buffer zones/enclosures at work place	➢ Identify location of noise and vibration sensitive areas so that works schedules should be prepared taking these into account. ➢ Monitor noise level with Noise Standards ➢ Monitoring team to monitor compliance during implementation stage.
Health and Safety	• Sufficient provisions for prevention of accidents to workers like safety gadgets. Proper construction methods and safety precautions can prevent risks to workers, pedestrians and motorists, e.g. warning signs, temporary cover for excavated areas, proper management of stockpile of construction materials or spoils from excavation, etc. All safety precautions and construction methods to prevent risks to workers' and public's life and health must be detailed in environmental management plan for construction. • Install signages and warning devices at the construction site; Coordinate with LGUs for possible public safety zone; Coordinate with nearest hospitals for instituting effective land-based response of medical units	➢ Review and approval by implementing agency – DPWH and the LGU covering the project site of environmental plans for construction before actual works. ➢ Monitoring team to monitor compliance.
Existing social, infrastructure services and public utilities	• Proper construction techniques and precautionary measures employed during construction can minimize the impact of activities on utilities such as transport (roads and bridges), water, telephone and electrical connections. However as disturbance in local transport usually host other problems as seen from the screening process, it is recommended that a traffic impact assessment shall be undertaken together with an in depth environmental impact assessment in the project areas in need of bridge reconstruction as a result of channel widening and dike construction	➢ Coordination with the local traffic bureau of the concerned LGUs in preparing the traffic management plan. ➢ Review output and implement recommendations/plans of the traffic impact assessment report ➢ Compliance with Philippine EIS System requirements for Bridge reconstruction (in the event Dungcaan Bridge requires reconstruction)
Right of Way (ROW)/Land Acquisition for Resettlement	• This should be addressed before deciding to proceed with the project. • Negotiate with land owner and enter into a legal agreement • Develop and implement the provision of the resettlement action plan for the displaced persons/families also known as project affected persons/families	➢ 100% agreement/approval of affected land owner including government agency regulating the issue on the right-of-way shall be achieved by Implementing agency and concerned LGU
Permanent removal of vegetation including strips of mangrove along Dungcaan River	• Ensure that prior to cutting of trees, clearance from the DENR shall be secured • Determine the appropriate approach in mangrove re-vegetation thru consultation with DENR and the LGU which has jurisdiction and legal authority in regulating activities in mangrove areas • Replant buffer zones along river bank	➢ Check for tree cutting permit/approval by the concerned entity of the government (DENR & LGU)

Tab.I-6-5 Environmental Monitoring Plan (Meycauayan)

Critical/Major Issues	Mitigating Measures	Monitoring and Institutional Requirements
Air pollution	• All vehicles and equipment that will be used must pass the emissions tests prescribed by the Clean Air Act. • Proper management of construction activities including storage and transport of dredged sediment, quarried soil and garbage to minimize generation of dust should be included in an environmental management plan that should form part of project implementation plan • Stockpiles of sand, gravel and waste materials should be watered frequently to prevent the wind from turning them into sources of dust.	➢ Emissions test reports for vehicles and equipment ➢ Daily monitoring of the level of air pollutants compared with Air pollution Standards, RA No.8749, 1999, Clean Air Act ➢ Form a monitoring team to monitor compliance with the environmental management plan
Deterioration in the Quality of the Marilao River and Meycauayan River	• Provision for silt traps at work areas, adherence to best construction project management, immediate removal of construction debris at the work place • Routine check of work site for possible fuel spills, lubricant leaks and maintains routine site inspection of storage and work areas. • Confine maintenance of vehicles and equipment at the motor pool section. • Proper storage of chemicals and used oils in accordance with standard code of safety and technical specifications of the engineering works contract and the Philippine occupational Health & Safety Standards.	➢ Include in the environmental management plan and the supervision plan of the project management office ➢ Implementing agency shall require the assignment of environmental officer to provide continued monitoring and technical assistance throughout the project implementation cycle ➢ Daily and weekly progress reports and environmental monitoring records shall be integrated in the reportorial process by the Contractor
Transport and disposal of bottom sediment and construction wastes	• Temporary storage and transport of dredged materials must be considered in the construction plan. • Identify landfill or acceptable disposal sites before construction. Temporary storage, transport and disposal should conform to existing National and local sanitation laws.	➢ Monitor compliance with requirements during implementation stage. For disposal arrangements, coordinate with LGUs where sanitary landfills or appropriate disposal sites exist, otherwise plan for other disposal alternatives.
Noise and vibration	• Proper scheduling of activities to avoid use of noise and vibration producing equipment during critical periods of the day like nighttime and early mornings and near sensitive areas like church, schools, hospitals. Avoid use of much noise and vibration producing-equipment as much as possible • Should form part of environmental management plan during construction	➢ Identify location of noise and vibration sensitive areas so that works schedules should be prepared taking these into account. ➢ Monitor noise level with Noise Standards ➢ Monitoring team to monitor compliance during implementation stage.
Health and Safety	• Sufficient provisions for prevention of accidents to workers like safety gadgets. Proper construction methods and safety precautions can prevent risks to workers, pedestrians and motorists, e.g. warning signs, temporary cover for excavated areas, proper management of stockpile of construction materials or spoils from excavation, etc. All safety precautions and construction methods to prevent risks to workers' and public's life and health must be detailed in environmental management plan for construction. • Install signage and warning devices at the construction site; Coordinate with LGUs for possible public safety zone; Coordinate with nearest hospitals for instituting effective land-based response of medical units	➢ Review and approval by implementing agency – DPWH and the LGU covering the project site of environmental plans for construction before actual works. ➢ Monitoring team to monitor compliance.
Existing social and infrastructure services	• Proper construction techniques and precautionary measures employed during construction can minimize the impact of activities on utilities such as transport (roads and bridges), water, telephone and electrical connections. However as disturbance in local transport usually host other problems as seen from the screening process, it is recommended that a traffic impact assessment shall be undertaken together with an in depth environmental impact assessment in the project areas in need of bridge reconstruction as a result of channel widening and dike construction	➢ Coordination with the local traffic bureau of the concerned LGUs in preparing the traffic management plan. ➢ Review output and implement recommendations/plans of the traffic impact assessment report ➢ Compliance with Philippine EIS System requirements for Bridge reconstruction
Displacement of Households and Right of Way (ROW)/Land Acquisition (agricultural lands along Marilao River and Meycauayan River)	• This should be addressed before deciding to proceed with the project. • Prepare a partial resettlement action plan (RAP) if the number of affected persons is within 200. If the number of PAPs is >200 a full scale RAP has to be prepared. The scope of resettlement has to be discussed and agreed with the stakeholders of the project. • Coordination shall be made with the LGU and DPWH for the implementation of the relocation plan and right of way/land acquisition. • Strict implementation of the law which provides for the maintenance of a buffer zone along river banks. This will prevent the return of project affected persons/families that are the beneficiaries of the project resettlement program.	➢ Monitoring of resettlement aspects is better handled by a resettlement monitoring task force that must be created specifically for the project. The task force must have varied sectoral representation. The monitoring task force must be created even before the preparation of the RAP so that they can participate in the RAP planning process. Institutional responsibilities will be determined by the task force members themselves. ➢ 100% agreement/approval of affected land owner including government agency regulating the issue on the right-of-way shall be achieved by Implementing agency and concerned LGU
Permanent removal of vegetation and critical natural environmental zones e.g. wetland, marshland, etc.	• Revegetation of removed or cut mangrove trees • Conduct detailed biological (flora and fauna) survey to determine the types and number of mangroves that will be affected • Ensure that prior to revegetation or cutting, clearance from the DENR is secured since the agency will determine and recommend the appropriate/regulatory and procedural requirements in the establishment and revegetation of mangrove sites	➢ Permits/Clearance issued by the DENR Regional Office (as prescribed in DAO 1990-15) in compliance with existing DENR regulations on mangrove clear cutting, management and project implementation ➢ Clearance with the concerned LGU If there are existing local ordinances or pending bills pertaining to the management and regulation in the use of the estuarine zone

Tab.I-6-6 Environmental Monitoring Plan (Kinanliman)

Critical/Major Issues	Mitigating Measures	Monitoring and Institutional Requirements
Air pollution	• All vehicles and equipment that will be used must pass the emissions tests prescribed by the Clean Air Act. • Proper management of construction activities including storage and transport of dredged sediment, quarried soil and garbage to minimize generation of dust should be included in an environmental management plan that should form part of project implementation plan • Stockpiles of sand, gravel and waste materials should be watered frequently to prevent the wind from turning them into sources of dust.	➢ Emissions test reports for vehicles and equipment ➢ Daily monitoring of the level of air pollutants compared with Air pollution Standards, RA No.8749, 1999, Clean Air Act ➢ Form a monitoring team to monitor compliance with the environmental management plan
Deterioration in the Quality of the Receiving Water Body	• Provision for silt traps at work areas, adherence to best construction project management, immediate removal of construction debris at the work place • Routine check of work site for possible fuel spills, lubricant leaks and maintains routine site inspection of storage and work areas. • Confine maintenance of vehicles and equipment at the motor pool section. • Proper storage of chemicals and used oils in accordance with standard code of safety and technical specifications of the engineering works contract and the Philippine occupational Health & Safety Standards.	➢ Include in the environmental management plan and the supervision plan of the project management office ➢ Implementing agency shall require the assignment of environmental officer to provide continued monitoring and technical assistance throughout the project implementation cycle ➢ Daily and weekly progress reports and environmental monitoring records shall be integrated in the reportorial process by the Contractor
Transport and disposal of bottom sediment and construction wastes	• Temporary storage and transport of dredged materials must be considered in the construction plan. • Identify landfill or acceptable disposal sites before construction. Temporary storage, transport and disposal should conform to existing National and local sanitation laws.	➢ Monitor compliance with requirements during implementation stage. For disposal arrangements, coordinate with LGUs where sanitary landfills or appropriate disposal sites exist, otherwise plan for other disposal alternatives.
Noise and vibration	• Proper scheduling of activities to avoid use of noise and vibration producing equipment during critical periods of the day like nighttime and early mornings and near sensitive areas like church, schools, hospitals. Avoid use of much noise and vibration producing-equipment as much as possible • Should form part of environmental management plan during construction	➢ Identify location of noise and vibration sensitive areas so that works schedules should be prepared taking these into account. ➢ Monitor noise level with Noise Standards ➢ Monitoring team to monitor compliance during implementation stage.
Health and Safety	• Sufficient provisions for prevention of accidents to workers like safety gadgets. Proper construction methods and safety precautions can prevent risks to workers, pedestrians and motorists, e.g. warning signs, temporary cover for excavated areas, proper management of stockpile of construction materials or spoils from excavation, etc. All safety precautions and construction methods to prevent risks to workers' and public's life and health must be detailed in environmental management plan for construction. • Install signage and warning devices at the construction site; Coordinate with LGUs for possible public safety zone; Coordinate with nearest hospitals for instituting effective land-based response of medical units	➢ Review and approval by implementing agency – DPWH and the LGU covering the project site of environmental plans for construction before actual works. ➢ Monitoring team to monitor compliance.
Existing social and infrastructure services	• Proper construction techniques and precautionary measures employed during construction can minimize the impact of activities on utilities such as transport (roads and bridges), water, telephone and electrical connections. However as disturbance in local transport usually host other problems as seen from the screening process, it is recommended that a traffic impact assessment shall be undertaken together with an in depth environmental impact assessment in the project areas in need of bridge reconstruction as a result of channel widening and dike construction	➢ Coordination with the local traffic bureau of the concerned LGUs in preparing the traffic management plan. ➢ Review output and implement recommendations/plans of the traffic impact assessment report ➢ Compliance with Philippine EIS System requirements for Bridge reconstruction
Right of Way (ROW)/Land Acquisition (stretch of Kinanliman River across the Spur Dike)	• This should be addressed before deciding to proceed with the project. • Negotiate with land owner and enter into a legal agreement	➢ 100% agreement/approval of affected land owner including government agency regulating the issue on the right-of-way shall be achieved by Implementing agency and concerned LGU
Permanent removal of vegetation along Kinanliman River	• Ensure that prior to cutting of trees, clearance from the DENR shall be secured • Coordination with the LGU shall also be made since they have initiated the planting of fast growing trees • Replant buffer zones along river bank	➢ Check for tree cutting permit/approval by the concerned entity of the government

Tab.I-6-7 Environmental Monitoring Plan (Tuganay)

Critical/Major Issues	Mitigating Measures	Monitoring and Institutional Requirements
Air pollution	• All vehicles and equipment that will be used must pass the emissions tests prescribed by the Clean Air Act. • Proper management of construction activities including storage and transport of dredged sediment, quarried soil and garbage to minimize generation of dust should be included in an environmental management plan that should form part of project implementation plan • Stockpiles of sand, gravel and waste materials should be watered frequently to prevent the wind from turning them into sources of dust.	➢ Emissions test reports for vehicles and equipment ➢ Daily monitoring of the level of air pollutants compared with Air pollution Standards, RA No.8749, 1999, Clean Air Act ➢ Form a monitoring team to monitor compliance with the environmental management plan
Deterioration in the Quality of the Receiving Water Body (Ising River, Tuganay River and Cabay-angan River)	• Provision for silt traps at work areas, adherence to best construction project management, immediate removal of construction debris at the work place • Routine check of work site for possible fuel spills, lubricant leaks and maintains routine site inspection of storage and work areas. • Confine maintenance of vehicles and equipment at the motor pool section. • Proper storage of chemicals and used oils in accordance with standard code of safety and technical specifications of the engineering works contract and the Philippine occupational Health & Safety Standards.	➢ Include in the environmental management plan and the supervision plan of the project management office ➢ Implementing agency shall require the assignment of environmental officer to provide continued monitoring and technical assistance throughout the project implementation cycle ➢ Daily and weekly progress reports and environmental monitoring records shall be integrated in the reportorial process by the Contractor
Transport and disposal of bottom sediment and construction wastes	• Temporary storage and transport of dredged materials must be considered in the construction plan. • Identify landfill or acceptable disposal sites before construction. Temporary storage, transport and disposal should conform to existing National and local sanitation laws.	➢ Monitor compliance with requirements during implementation stage. For disposal arrangements, coordinate with LGUs where sanitary landfills or appropriate disposal sites exist, otherwise plan for other disposal alternatives.
Noise and vibration	• Proper scheduling of activities to avoid use of noise and vibration producing equipment during critical periods of the day like nighttime and early mornings and near sensitive areas like church, schools, hospitals. Avoid use of much noise and vibration producing-equipment as much as possible • Should form part of environmental management plan during construction	➢ Identify location of noise and vibration sensitive areas so that works schedules should be prepared taking these into account. ➢ Monitor noise level with Noise Standards ➢ Monitoring team to monitor compliance during implementation stage.
Health and Safety	• Sufficient provisions for prevention of accidents to workers like safety gadgets. Proper construction methods and safety precautions can prevent risks to workers, pedestrians and motorists, e.g. warning signs, temporary cover for excavated areas, proper management of stockpile of construction materials or spoils from excavation, etc. All safety precautions and construction methods to prevent risks to workers' and public's life and health must be detailed in environmental management plan for construction. • Install signages and warning devices at the construction site; Coordinate with LGUs for possible public safety zone; Coordinate with nearest hospitals for instituting effective land-based response of medical units	➢ Review and approval by implementing agency – DPWH and the LGU covering the project site of environmental plans for construction before actual works. ➢ Monitoring team to monitor compliance.
Existing social and infrastructure services	• Proper construction techniques and precautionary measures employed during construction can minimize the impact of activities on utilities such as transport (roads and bridges), water, telephone and electrical connections. However as disturbance in local transport usually host other problems as seen from the screening process, it is recommended that a traffic impact assessment shall be undertaken together with an in depth environmental impact assessment in the project areas in need of bridge reconstruction as a result of channel widening and dike construction	➢ Coordination with the local traffic bureau of the concerned LGUs in preparing the traffic management plan. ➢ Review output and implement recommendations/plans of the traffic impact assessment report ➢ Compliance with Philippine EIS System requirements for Bridge reconstruction
Right of Way (ROW)/Land Acquisition for the Dike reconstruction and development of Retarding Basins	• This should be addressed before deciding to proceed with the project. • Negotiate with land owner and enter into a legal agreement	➢ 100% agreement/ approval of affected land owner including government agency regulating the issue on the right-of-way shall be achieved by Implementing agency and concerned LGU
Permanent removal of vegetation along Ising River, Tuganay River and Cabay-angan River	• Ensure that prior to cutting of trees, clearance from the DENR shall be secured • Coordination with the LGU shall also be made since they have initiated the planting of fast growing trees • Replant buffer zones along river bank	➢ Check for tree cutting permit/approval by the concerned entity of the government

Tab.I-6-8 Environmental Monitoring Plan (Dinanggasan)

Critical/Major Issues	Mitigating Measures	Monitoring and Institutional Requirements
Air pollution	• All vehicles and equipment that will be used must pass the emissions tests prescribed by the Clean Air Act. • Proper management of construction activities including storage and transport of dredged sediment, quarried soil and garbage to minimize generation of dust should be included in an environmental management plan that should form part of project implementation plan • Stockpiles of sand, gravel and waste materials should be watered frequently to prevent the wind from turning them into sources of dust.	➢ Emissions test reports for vehicles and equipment ➢ Daily monitoring of the level of air pollutants compared with Air pollution Standards, RA No.8749, 1999, Clean Air Act ➢ Form a monitoring team to monitor compliance with the environmental management plan
Deterioration in the Quality of the Receiving Water Body	• Provision for silt traps at work areas, adherence to best construction project management, immediate removal of construction debris at the work place • Routine check of work site for possible fuel spills, lubricant leaks and maintains routine site inspection of storage and work areas. • Confine maintenance of vehicles and equipment at the motor pool section. • Proper storage of chemicals and used oils in accordance with standard code of safety and technical specifications of the engineering works contract and the Philippine occupational Health & Safety Standards.	➢ Include in the environmental management plan and the supervision plan of the project management office ➢ Implementing agency shall require the assignment of environmental officer to provide continued monitoring and technical assistance throughout the project implementation cycle ➢ Daily and weekly progress reports and environmental monitoring records shall be integrated in the reportorial process by the Contractor
Transport and disposal of bottom sediment and construction wastes	• Temporary storage and transport of dredged materials must be considered in the construction plan. • Identify landfill or acceptable disposal sites before construction. Temporary storage, transport and disposal should conform to existing National and local sanitation laws.	➢ Monitor compliance with requirements during implementation stage. For disposal arrangements, coordinate with LGUs where sanitary landfills or appropriate disposal sites exist, otherwise plan for other disposal alternatives.
Noise and vibration	• Proper scheduling of activities to avoid use of noise and vibration producing equipment during critical periods of the day like nighttime and early mornings and near sensitive areas like church, schools, hospitals. Avoid use of much noise and vibration producing-equipment as much as possible • Should form part of environmental management plan during construction	➢ Identify location of noise and vibration sensitive areas so that works schedules should be prepared taking these into account. ➢ Monitor noise level with Noise Standards ➢ Monitoring team to monitor compliance during implementation stage.
Health and Safety	• Sufficient provisions for prevention of accidents to workers like safety gadgets. Proper construction methods and safety precautions can prevent risks to workers, pedestrians and motorists, e.g. warning signs, temporary cover for excavated areas, proper management of stockpile of construction materials or spoils from excavation, etc. All safety precautions and construction methods to prevent risks to workers' and public's life and health must be detailed in environmental management plan for construction. • Install signages and warning devices at the construction site; Coordinate with LGUs for possible public safety zone; Coordinate with nearest hospitals for instituting effective land-based response of medical units	➢ Review and approval by implementing agency – DPWH and the LGU covering the project site of environmental plans for construction before actual works. ➢ Monitoring team to monitor compliance.
Existing social and infrastructure services	• Proper construction techniques and precautionary measures employed during construction can minimize the impact of activities on utilities such as transport (roads and bridges), water, telephone and electrical connections. However as disturbance in local transport usually host other problems as seen from the screening process, it is recommended that a traffic impact assessment shall be undertaken together with an in depth environmental impact assessment in the project areas in need of bridge reconstruction as a result of channel widening and dike construction	➢ Coordination with the local traffic bureau of the concerned LGUs in preparing the traffic management plan. ➢ Review output and implement recommendations/plans of the traffic impact assessment report ➢ Compliance with Philippine EIS System requirements for Bridge reconstruction
Right of Way (ROW)/Land Acquisition	• This should be addressed before deciding to proceed with the project. • Negotiate with land owner and enter into a legal agreement	➢ 100% agreement/approval of affected land owner including government agency regulating the issue on the right-of-way shall be achieved by Implementing agency and concerned LGU
Permanent removal of vegetation along Dinaggasan River and Compol River	• Ensure that prior to cutting of trees, clearance from the DENR shall be secured • Coordination with the LGU shall also be made since they have initiated the planting of fast growing trees • Replant buffer zones along river bank	➢ Check for tree cutting permit/approval by the concerned entity of the government