DEPARTMENT OF
PUBLIC WORKS AND HIGHWAYS
THE REPUBLIC OF THE PHILIPPINES

THE PREPARATORY STUDY FOR SECTOR LOAN ON DISASTER RISK MANAGEMENT IN THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT
PART II-B
FEASIBILITY STUDY ON ILOG-HILABANGAN RIVER BASIN (KABANKALAN AND ILOG)

JANUARY 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

CTI ENGINEERING INTERNATIONAL CO., LTD.
in association with
NIPPON KOEI CO., LTD

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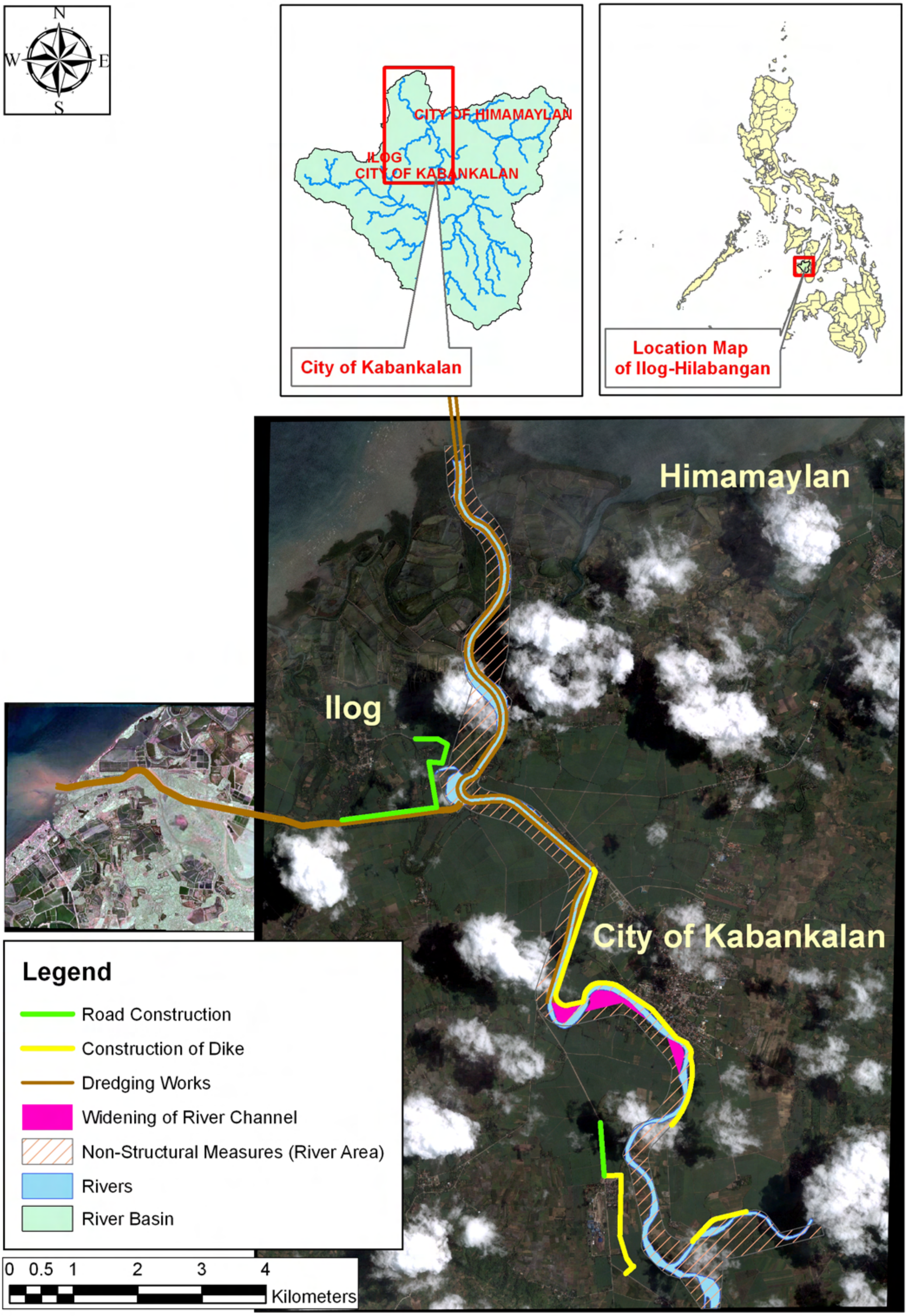

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FOR SECTOR LOAN
ON DISASTER RISK MANAGEMENT
IN THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

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CHAPTER 1 INTRODUCTION

1.1 Background of the Study

The Philippines is one of the countries most severely damaged by natural disaster in the East-Asia Region. Among the natural disasters, 92.5% are caused by typhoons that bring heavy rainfall and strong winds. Approximately twenty typhoons a year break out on the sea around the Caroline and Mariana Islands, and most of them pass through the Philippines. These typhoons cause floods, in most cases, by heavy rainfall.

Thus, the Philippines is vulnerable to flood damage. According to the flood damage records from 1970 to 2003, 544 people have died per annum and the number could be 1,487 people per annum if the missing and injured were included. The number of damaged households and disaster-affected persons was 500,000 and 2,800,000, respectively. Out of the 730,000 damaged houses, 70,000 were completely destroyed. The total direct damage was estimated at about 4.6 billion pesos a year; whereas, once in every six years the damage amounts to more than 10 billion pesos.

In the Philippines, master plans for flood control projects of the Major River Basins (12 out of 18) with catchment areas of more than 1,400 km^2 were formulated in 1982. Based on those plans, feasibility studies and projects were implemented with ODA and other international funds together with review on the master plans. Even for the Principal River Basins with catchment areas of more than 40 km^2, urgent flood control projects whenever severe flood damages occurred were implemented. However, the number of river basins where flood control works were so far implemented is very limited.

Under the circumstances, a development study known as “The Nationwide Flood Risk Assessment and the Flood Mitigation Plan for the Selected Areas in the Republic of the Philippines” (hereinafter called as “The Nationwide Flood Risk Assessment Study”) was conducted to formulate the national strategy for flood control projects. In this study, 58 river basins in which flood control projects should be implemented for the period of 26 years between 2009-2034 were selected and the implementation schedule was arranged in the order of priority by dividing the 58 river basins into three (3) groups: one group covering the 26 river basins expected to be financed with foreign funds, while the other group of 30 river basins is to be financed with local funds. The remaining 2 river basins is to be implemented as exceptional rivers for which the implementation of flood control project should be commenced immediately at that time.

On the other hand, the prioritized river basins with middle level priorities have to wait for a long time to receive funds for project implementation when each project is intended to protect the assets of the whole river basin with application for individual loans. Even for the flood control projects in highly prioritized river basins, the implementation might wait for some time since the cost for each proposed project may be so high that the implementation of some projects has to be deferred. Therefore, flood control projects for river basins implemented with local funds may also wait for a longer time judging from the previous practices on flood control projects with local funds, because the limited budget for flood control is expensed ad-hoc, only for restoration works when flood damage is observed. In fact, flood disasters may occur in every river basin even for the middle priority river basins, and the stakeholders in each basin may crave for the implementation of flood protection measures against the future disasters.

Under the circumstances, it has been recognized that there is a necessity for the early implementation of flood control projects, not for the whole river basin but only for the selected core areas that are scattered in the basin (middle level priority river basins). For this purpose, the idea of a "Sector Loan" from New JICA (the merged JICA and JBIC) has been brought up to cover several river basins as a package but only for the protection of core areas. To make arrangements for the Sector Loan, a feasibility study has to be carried out for the selected core area in the each river basin. In line with the above idea, the DPWH has decided to conduct by itself feasibility studies for the 12 river basins belonging to the group financed with local funds.

However, it is required that a conduct or review on the feasibility study has to be executed earlier for the initial implementation of candidate projects for the sector loan. In this connection, a feasibility study for three (3) candidate river basins except the 12 river basins mentioned above is one of the objectives of the Preparatory Study on Sector Loan for Disaster Risk Management conducted by DPWH with New JICA's assistance.

1.2 Objectives of the Study

1.2.1 Objectives of the Sector Loan Project on Disaster Risk Management

The objectives of the sector loan project are to strengthen the capability of Philippine Government agencies concerned in disaster risk management and mitigate flood damage in vulnerable areas through the following:

(1) The implementation of structural and non-structural measures for the improvement of rivers in selected high-risk flood damage areas. Such rivers have been selected as a result of the "Study on the Nationwide Flood Risk Assessment and the Flood Mitigation Plan for the Selected Areas in the Republic of the Philippines."

(2) The improvement of disaster risk management systems, including management of the emergency response fund for flood control.

1.2.2 Objectives of the Preparatory Study

The objective of the Preparatory Study is to prepare the basic materials necessary to implement the projects, including the following:

(1) To select three (3) objective river basins and core areas which really need urgent implementation of a flood control project;

(2) To conduct feasibility studies for the selected core areas in the three (3) river basins;

(3) To arrange the materials for preparation of the Implementation Program (I/P) in connection with the application for a Sector Loan; and

(4) To confirm and recommend, if necessary, the current institutional arrangement to manage the sector loan.

1.3 Composition of the Final Report

The Final Report is to be submitted as the final product of "The Preparatory Study on the Sector Loan for Disaster Risk Management in the Republic of the Philippines" containing the objectives listed above.

In this connection, the Final Report consists of the following six (6) volumes:

Table R 1.1 Composition of the Final Report

Volume No.	Title	Contents
-	Summary	Summary of the results of the entire study
Part I	Main Report	The results of the entire study and the framework and implementing strategy, manner, cooperative agreement and procedure of the Sector Loan.
Part II-A	Feasibility Study on the Lower Cagayan River Flood Control Project for the Sector Loan Application	Results of the review on the Feasibility Study conducted in 2002 and the Structural and Non-structural Measures for the Project Proposed for Sector Loan.
Part II-B	Feasibility Study on the Ilog-Hilabangan River Flood Control Project for the Sector Loan Application	Review of the Master Plan of 1990 and the results of Feasibility Study on the Project Proposed for Sector Loan
Part II-C	Feasibility Study on the Tagoloan River Flood Control Project for the Sector Loan Application	Review of the Master Plan of 1982 and the results of Feasibility Study on the Project Proposed for Sector Loan.
-	Needs Assessment Study on Flood Disasters Caused by Typhoons No.16 (ONDOY) and No.17 (PEPENG)	

As shown above, Volume No. Part II-B presents the result of the Feasibility Study on the Ilog-Hilabangan River Flood Control Project, which will be used for the Sector Loan Application. The result indicates that the construction of flood protection dikes with revetment on the dike slope at certain portions along the selected core areas such as the city proper of Kabankalan and essential facilities for regional economic development, widening of river channel at critical narrow portions, and dredging of the present river channel in the lower stretches to protect the areas against probable floods lower than a 25-year return period are proposed as structural measures for this Sub-Project under the Sector Loan.

CHAPTER 2 NATURAL CONDITION OF THE STUDY AREA

2.1 Location

The Ilog-Hilabangan River Basin, with a catchment area of 2,162 km^2, is situated in the central and southern portions of Negros Island. It lies generally between 122°30’ to 123°10’ E longitude, and from 9°30’ to 10’ N latitude. The main drainage is the Ilog River whose headwaters originate in the northwestern tip of the basin.

The river flows in the southeast direction until it turns to the northwest in the middle reaches and discharges into the basin. It flows generally westward in the upper reaches and then into a northwest direction, and joins the Ilog River at about 3 kilometers from Poblacion Kabankalan. The tributaries which follow a pendulous pattern appear to have been controlled by the lithologic condition and by the geologic structures.

2.1.1 Topography

(1) General

The Ilog-Hilabangan River Basin is enclosed by three (3) clusters of mountains; namely, Negros Central Mountains to the North, Negros Cordillera to the East, and Southern Negros Mountains to the Southwest. It faces Panay Gulf to the Northwest direction.

The Negros Central Mountains is a wide, middle degree of dissected mountain region having a dendritic valley with moderate to very steep slopes. The maximum elevation of the area is about 1,000 meters above mean sea level. The Negros Cordillera Mountain is of the same degree as the Negros Central Mountains. It is a long, north-trending mountain range running along the eastern edge of Negros Island with a maximum elevation of nearly 700 meters above mean sea level. The Southern Negros Mountains have a highly dissected northwest trending mountain range. The maximum elevation is nearly 700 meters above mean sea level.

The Ilog-Hilabangan Plain is situated in the middle part of the basin. It is characterized by an irregularly shaped depression and a dissected plateau that has an alluvial flat land and gently sloping hills. The highland of this plain has an elevation of less than 300 meters above mean sea level. In the northwestern part of the plain, the delta along the Ilog-Hilabangan River faces Panay Gulf. From the micro-topographical viewpoint, the delta has a very gentle slope as it comes to the seashore.

The Ilog-Hilabangan is mostly covered by hilly and mountainous lands, according to the terrain slope classification as shown in the following table.

Table R 2.1 Terrain Slope Classification in Ilog-Hilabangan River Basin

Category	Slope Degree	Area (km^2)	Share
Slope Category 1	0 to 3%	245	11 %
Slope Category 2	3 to 8%	346	16 %
Slope Category 3	8 to 15%	780	36 %
Slope Category 4	15% and more	791	37 %
Total		2,162	100 %

Slope categories 1 and 2 are made up of almost level or gently sloping areas, which are, in general, suitable for irrigation, cultivation of agricultural crops and built-up areas. Areas under the other categories hardly produce agricultural crops nor provide the residential areas without losing surface soil or landslide hazard.

In the Ilog-Hilabangan river basin as presented in the above table, the land suitable for cultivation of crops and people residing in the lower reaches has a share of only 27%. The bulk of the basin, the remaining 73%, has difficulties in intensive agricultural production. Intensive utilization of land is thus concentrated in the lower reaches where the areas are vulnerable to flood damage. In the upper reaches of the river, dominantly situated are forests, pasture/grassland and upland grain crops.

(2) Survey Works Newly Conducted

In this JICA Preparatory Study F/S, the following supplemental surveys have been conducted to obtain river data around the targeted areas.

Table R 2.2 Summary of Survey Works Newly Conducted in the JICA Preparatory Study F/S

No.	Work Item	Work Contents
1	River Profile and Cross Section Survey	Ilog-HIlabangan river (50 cross sections): 22km
		Hilabangan river (9 cross sections): 6km
		Old Ilog River (3 cross sections): 6km
2	Aerial Photography	Area:140km2, (10km (E-W), 14km (N-S))

Figure R 2.1 Location of Cross Section Survey

2.1.2 Geology

(1) Geological History of Negros Island

Negros Island is an upfield igneous sedimentary basin, named as the Negros-Siquijor basin, believed to have originated during Cretaceous. The oldest volcanic rocks of the basin with their intercalated pyroclastic and clastic rocks are dated Cretaceous. Intrusion and partial metamorphism took place during the paleocene. Intermittent igneous activity and tectonic movement with sedimentation succeeded during the period of earliest

Eocene to Recent. Coralline limestone was indicated during Eocene, Late Oligocene, Early to Late Miocene and older ones are highly cemented.

(2) Distribution of Geology

Old volcanic rocks, partly covered by later sedimentary rocks and young volcanic rocks, are exposed in the interior of the Negros Central Mountains and the Negros Cordillera. The front and foothills are generally covered by these sedimentary rocks, which include sandstone, siltstone, conglomerate, shale, and limestone. At the Southern Negros Mountain region, there is a series of old sedimentary rock with younger sedimentary rocks and volcanic rocks. The region is dominated by old volcanic rocks with the basement complex of metamorphosed igneous and sedimentary rocks. Ilog-Hilabangan plain is formed of young and old sedimentary rocks, volcanic rocks and limestone.

(3) Geologic Structure

Numerous faults and folds are found in the river basin area. The main trend of the faults strikes northwest-southeast and northeast-southwest. Folds generally exist in older sedimentary rocks. The Ilog-Hilabangan Plain and the Negros Central Mountains are bordered by faults having NNE-SSW strike and SSE dip.

(4) Possibility of Dam Construction

In the 1990 M/P, geological investigation survey, such as geological surface survey and the exploratory drilling survey, was carried out for the confirmation of foundation conditions under the candidate dam sites as shown in Figure 2.1.

Judging from the geological surveys mentioned above, some candidate dam sites were eliminated due to the existence of soft rocks and the risk of leakages. In this condition, the following three (3) dam sites remained for the study on the possibility of dam construction:

- Ilog No. 1 Upper Dam Site
- Ilog No. 1 Lower Dam Site
- Hilabangan No. 1 Dam Site

Consequently, to identify the most suitable dam site among the three (3) dam sites, comparative studies were executed in the 1990 M/P. As a result, the Ilog No. 1 Lower Dam Site was proposed as one of the applicable measures for alternative study compared with the river improvement alone plan. In the end, the construction of dam was eliminated from the optimum flood control plan in line with the economic evaluation in the 1990 M/P.

2.2 Meteo-Hydrology and River System of Ilog-Hilabangan River Basin

2.2.1 Meteorology of Ilog-Hilabangan River Basin

(1) General Climatologic Features and Storm/Rainfall

The most important factors affecting the climate of the Philippines aside from geomorphologic conditions are semi-permanent cyclones and anticyclones, air streams, ocean current, linear systems and tropical cyclones. Global distribution of semi-permanent cyclones and anticyclones, e.g., the large anticyclone centered over

Siberia in January, produce air streams and ocean currents which greatly affect the climate of the Philippines.

The principal air streams which significantly affect the Philippines are the Northeast Monsoon, the Southwest Monsoon and the North Pacific Trades. The Northeast Monsoon affects the area during the months of October to March; most dominant during January and February. The Southwest Monsoon occurs at the time of high solar altitude from May to October when the Inter-tropical Convergence Zone (ITCZ) moves over the area, and the air mass is warm and very humid.

The main ocean current affecting the Philippines is the North Equatorial Current moving westward across the North Pacific Ocean. Surface temperature in the vicinity of the Philippines is 27.3 degrees Centigrade and this value is quite uniform.

The linear systems which significantly affect the climate of the Philippines are the ITCZ, a tail end of cold fronts, and easterly waves. ITCZ affects the Philippines from May to October and is usually characterized by distributed weather conditions of widespread cloudiness, convective type precipitation, and moderate and strong winds.

Tropical cyclones largely contribute to the rainfall in the Philippines from June to December. Rainfall abnormalities such as prolonged flood conditions are mostly due to occurrence of tropical cyclones, and drought conditions are also attributed to the occurrence of less than the expected number of tropical cyclones.

(2) Local Meteorological Condition

Since there is no significant change in meteorological conditions, i.e., temperature, relative humidity, etc., the climate of the Philippines is usually classified according to rainfall pattern.

The Ilog-Hilabangan River Basin falls in Type I and Type II of the modified Corona’s climate classification. Type I where the southwest portion lies is characterized as two pronounced seasons, dry and wet; heavy rain period is from June to September during the prevalence of the southwest monsoon season. Type III is characterized with not very pronounced heavy rain period and with a short dry season lasting only from one to three months.

Monthly variations of meteorological data such as temperature, relative humidity, pan-evaporation, cloudiness, etc., at Iloilo City are tabulated in Table 2.1. There is no significant variation in temperature and relative humidity; monthly average temperature varies from 25.9 degrees Centigrade in January to 28.8 degrees Centigrade in May. Relative humidity varies from 74% in April to 85% in August.

More than 60% of the tropical cyclones which hit Negros Island occur in November and December.

(3) Annual and Monthly Rainfall

Annual rainfall for stations in Negros Island and neighboring areas are compared in Table 2-2. The features indicate that the higher rainfall zone is around Bacolod and annual rainfall amount decreases to the south, though annual variations are too large to characterize the annual rainfall distribution in this area.

Average monthly rainfall distributions of the same stations are shown in Table 2-3. The characteristics of the modified Corona's climate classification are seen in such distribution, and rainfall pattern at Kabankalan presents the intermediate characteristics of Type I and Type III. Monthly rainfalls observed at Kabankalan are given in Table 2-4. The monthly rainfall correlation coefficients between Kabankalan and other stations are shown in Figure 2-2. As shown in the figure, the correlation coefficient is low for all stations, and it is difficult to supplement the lacking rainfall data of Kabankalan from the other stations.

2.2.2 River System in Ilog-Hilabangan River Basin

(1) General Features

The Ilog-Hilabangan river system is composed mainly of two major rivers; namely, Ilog River with the length of about 120 km, the principal drainage-way of this basin, and the Hilabangan River, one of the main tributaries of the basin, with the length of 35 km, although the Ilog River diversifies into several branch rivers in the flatland of the lower reaches.

The riverbed gradient of the Ilog River, ranging from 1/140 to 1/3,100, is relatively gentler compared with that of the Hilabangan River. The change is not gradual from the upper to the lower reaches, i.e., the gradient in the lower reaches is sometimes steeper than that of the upper reaches. This means that the sediment produced in the upper reaches transports rapidly in the steeper stretch, while some sediment is deposited in the gentle gradient stretch. On the other hand, the riverbed gradient of Hilabangan River, ranging from 1/80 to 1/240, gradually changes from the upper to the lower reaches.

The width and depth of the Ilog River, which are related to the flow capacity, are variable in the upper reaches. In the lower reaches, the river width ranges between 100 m and 200 m and the river depth, between 5 m and 15 m. The branch-rivers diversifying from the Ilog River such as Bagacay, Bungul, Old Ilog River, etc., have the river width ranging between 30 m and 150 m and river depth ranging between 2 m and 5 m, while the Hilabangan River has the river width of about 150 m and river depth of about 3 m. Likewise, the Bunicuil River, which may serve as a diversion channel of Ilog River, has the river width of between 10 m and 100 m and the river depth, between 2 m and 5 m.

(2) River Discharge

The monthly average discharges of Ilog and Hilabangan rivers at the following stations during the 1956-79 period are shown in Table 2.5.

Table R 2.3 Discharge Control Points in Ilog-Hilabangan River

River	Control Station	Catchment Area (km^2)
Ilog	Pandan, Orong	1,435
Hilabangan	Pangsud	431

Average annual runoff height of the rivers at these stations is around 1,400 mm, and this amount seems appropriate in consideration of the annual rainfall and the presumed evapo-transpiration amount. This value corresponds to the specific discharge of 4.5 m^3/s/100km^2.

(3) Meandering and Change of River Course in Lower Stretch

In the alluvial plain, the river naturally meanders because of the imbalance between the sediment flow capacity of the river and friction with riverbed and bank materials, and river meandering is also influenced by obstructions that prevent the smooth flow of discharge. The behavior of the river on this matter could not be determined because of the compound elements involved.

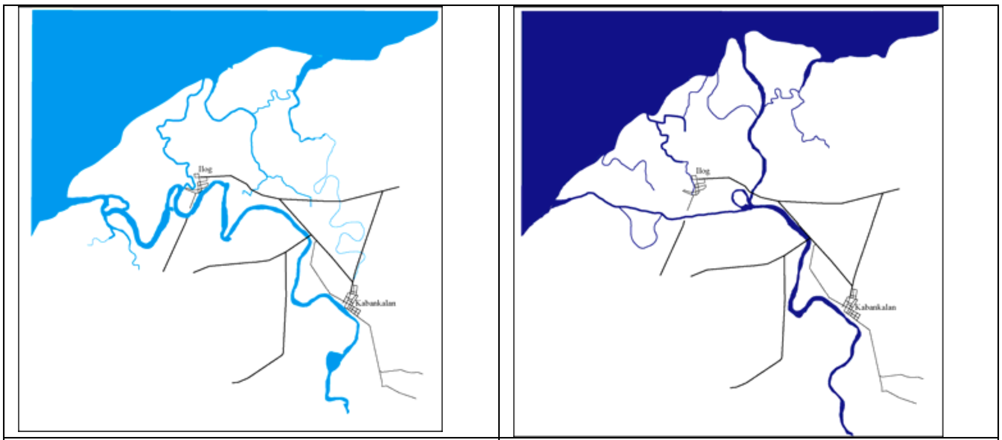
As the general condition of meandering of the Ilog-Hilabangan River, the ratio of river length to the length of the meander axis is referred. In comparison with the ratio of other rivers in the Philippines, the ratio of the Ilog-Hilabangan River is about 1.3 which is in the middle range of those of the other rivers. Judging from this fact, the meandering condition of the Ilog-Hilabangan River is not so severe.

Changes in the Ilog River course at the delta area have been identified by the comparison of various information such as the old aero-photographs, old topographic maps and river surveying results in the M/P Study in 1990 with the new satellite images as well as information from the DPWH Kabankalan District Office. The comparison had identified the following points:

(a) The change of the Ilog River at the diversion point to Bungul Diversion Channel is remarkable and the shift in its course is continuing.

(b) In the Old Ilog River Basin where the river course had once changed, the river width and depth have decreased after the Bungul Diversion Channel, and cut-off channels have been constructed. Since then, the change of river course has not been severe due to the reduced water discharge.

The changes of the river course of Ilog-Hilabangan River in the estuary between the 1950's and the present (2009) are illustrated in **Figure R 2.2** below based on the NAMRIA Topographical Map and the satellite image newly taken.



River Course in 1950's	River Course in 2005

Figure R 2.2 Changes of Ilog-Hilabangan River Course at the Estuary

2.3 Flood

According to the results of the M/P Study in 1990, the lowland area of the river basin is habitually inundated (refer to Table 2-6 surveyed in the 1991 M/S Study. The inundation condition in the lowland area is summarized as follows:

(1) Most parts of the lowland have suffered from flood damage every year or once in every few years, and even in the relatively high land of Poblacion Kabankalan, flood damage is inflicted once in every ten years.

(2) The main causes of flood are typhoons and heavy rainfall causing the overflow of rivers or drainage canals.

(3) Inundation sometimes continues for more than one day and the evacuation of inhabitants to higher places is made.

(4) The inundation water depth sometimes reaches more than 1 m in case of severe floods like the 1984 flood, and the water usually flows down with a relatively high velocity.

(5) The highest inundation depth which was marked in 1949 can be indentified from the flood mark at the church of Barangay Linao.

(6) The flood inundation area in the 1984 flood roughly covered the area of 125 km^2 in the lower reaches.

The interview-survey results in the M/P Study in 1990 indicate that the worst flood occurred in 1949 when the lower reaches was inundated for four days. A total of 730 people perished, and half of the sugarcane plantation was damaged.

Typhoon Nitang, which was considered to be the most powerful storm to batter the country since 1970, hit Western Visayas on September 2, 1984. In this region, lost were a total of 156 lives, 140 deaths of which were reported for Negros Occidental areas. People affected in the province amounted to more than 227,000, and properties and economic activities were seriously damaged. According to the report of NEDA Regional Office IV in 1984, Typhoon Nitang's total direct damage in the province was estimated in monetary term to have reached more than 600 million pesos at the 1984 price level.

Typhoon Ruping, which was more powerful than Typhoon Nitang, hit the Visayan Region on November 13, 1990 and inflicted severe damage on the Ilog-Hilabangan River Basin. In the lower reaches, several portions of the river bank were eroded by floodwaters, washing away a wooden bridge, suspending operation of the sugar mill, and damaging agricultural crops and other properties. DPWH estimated the cost for repair/rehabilitation works of various infrastructures in Regions VI and VII at 220 million and 184 million pesos, respectively, at the 1990 price level.

According to the interview with the stakeholders during the First Stakeholders' Meeting on May 22, 2009, these perennial flood damages have hampered the regional economic growth.

2.4 Related Information

2.4.1 Negros Island Integrated Water Resources Management Council

The provinces of Negros Oriental and Negros Occidental agreed, on June 26, 2008, to form the Negros Island IWRM Council which will serve as the apex and policy advisory body for integrated water resources planning and management within the Ilog-Hilabangan River Basin thereby contributing towards the realization of Millennium Development Goal No. 7, Environmental Sustainability, and the following targets: Integration of the principles of sustainable development into country policies and programs; reversal of loss of environmental resources; and reduction by half of the proportion of people without sustainable access to safe drinking water.

The Negros Island IWRM Council (hereinafter, the Negros Council), which shall serve as the apex, and the policy-making and advisory body for integrated water resources planning and management within the Ilog-Hilabangan River Basin, shall perform the following roles and functions:

- Develop, integrate and recommend policies, plans, and actions for the protection, conservation, rehabilitation, management and development of water resources within Ilog-Hilabangan River Basin;
- Harmonize the development, management, control, and regulation of land use and developments in Ilog-Hilabangan River Basin and monitor the implementation of laws and regulations governing the management and development of land, water resources, water supply and sanitation;
- Provide advice, technical, and other forms of assistance, such as formulation of forest land use plans, watershed management plans, water quality management plans and development of local water resources and supply system within Ilog-Hilabangan River Basin;
- Strengthen stakeholder linkages and institutionalize government-civil society-private sector partnership in Ilog-Hilabangan River Basin;
- Establish, operate and maintain water resources and land management information system (MIS) for Ilog-Hilabangan River Basin in coordination with other projects;
- Identify environmental indicators for Ilog-Hilabangan River Basin compatible or complementary with national indicators that can be used to monitor and report on attainment of the environmental objectives;
- Conduct relevant research activities to provide policy for handling the rehabilitation, protection, and development of water and related resources in Ilog-Hilabangan River Basin;
- Secure from any government department, bureau, office, board, agency, instrumentality, project, or unit such assistance and cooperation as may be needed, such as personnel support, technical information, maps, photos, imageries, and others, the preparation and submission of the reports, plans, recommendations and relevant documents, as it may require;
- Design and conduct information, education, communication, and behavioral change campaigns to help attain the goals in protecting, conserving, rehabilitating the Ilog-Hilabangan River Basin;
- Monitor and enforce NWRB and other relevant rules and regulations to ensure that the taking, appropriation, diversion and use of water resources are in accordance with the Water Code of the Philippines and use rules and regulations of the NWRB and the DENR;
- Regularly monitor and evaluate the quality of the water bodies and adopt rules and regulations for its protection;
- Monitor and evaluate the performance of existing water permittees, identify illegal water users and take appropriate action;
- Promote incentives for water conservation and reuse opportunities and rainwater harvesting;
- Mediate water use conflicts within the Ilog-Hilabangan River Basin to provide sustainable and win-win solutions to the problems that caused those conflicts among contending parties; and
- Exercise all the functions necessary, relevant, and incidental to accomplish the purposes and objectives for which the Council is organized consistent with existing national government policies.

2.4.2 Flood Mitigation Projects in the Past

In the Ilog-Hilabangan River, river structures and works have been provided or implemented according to the purpose, as follows:

Table R 2.4 Flood Control Works in the Ilog-Hilabangan River in the Past

Title/Explanation/Description	Year
Embankment of Bungul Diversion Channel for the stretch of 1,500m at the left side and 500m at the right side.	Started in 1957; completed in 1959
Embankment of cut-off channel for the total length of 3,500m at both sides	Started 1974; completed in 1975
Revetment of Ilog River at Talubangi for the total stretch of 425m	168m constructed in 1968; 257m extension in 1979
Revetment of Bungul Diversion Channel for the length of 65m	1979
Revetment of Ilog River at Kabankalan for the stretch of about 700m	Started in 1980; completed in 1984
Revetment of Bungul Diversion Channel for the stretch of 25m	Started in 1990; completed in 1991

CHAPTER 3 SOCIO-ECONOMY

3.1 Population and Economy

Though the land area of Kabankalan City at 727 sq km is seven times larger than that of Tuguegarao City at only 114 sq km, their population figures are almost at the same level; Tuguegarao City with 129,559 persons and Kabankalan City at 166,970 persons. While the population density of Tuguegarao is 11,136 persons/sq km, that of Kabankalan City is is 230 persons/sq km. In terms of expansion, this means that Kabankalan City enjoys considerable advantages over Tuguegarao.

While the impetus towards urbanization in Tuguegarao comes from forces outside the City, those of Kabankalan City are within control of the City Government. For instance, there are already a total of 11,000 hectares of land planted to sugar cane with a concomitant total of 10,335 planters. The materials and labor power inputs are employed by SONEDCO with the total production capacity of 9,000 MT of sugar daily with 400 workers. The other player, Dacongcogon, produces a total of 1,800 MT daily with a total number of planters at 10,335 persons in a total land area of 1,750 hectares. The plan of Dacongcogon is to expand their total sugar plantation and processing operations at par with SONEDCO at the total level of 10,000 has.

The labor availability of Kabankalan City comes from its City, Provincial and Regional levels as shown in **Figure R3.1** and **Table R3.1**.

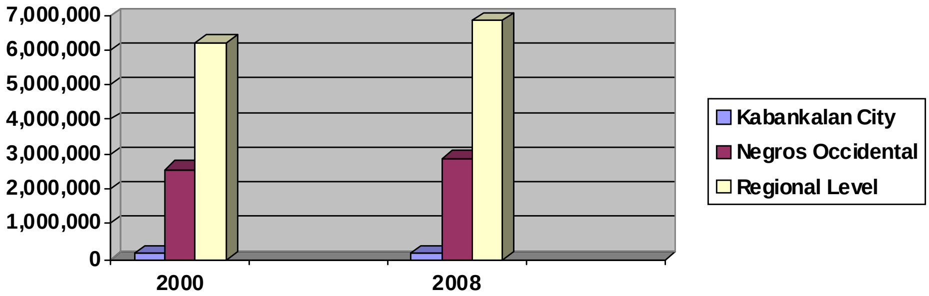


Figure R 3.1 Population Growth Rates (2000-2008)

Table R 3.1 Population Data

Areas	2000	2008
Kabankalan City	149,769	166,970
Negros Occidental	2,585,723	2,869,766
Regional Level	6,208,733	6,843,643

There is a considerable increase of population growth rate in the Hilabangan River Basin Areas. For instance, the growth rate of Kabankalan City is at 11.48% level annually; 10% growth rate for the province of Negros Occidental and 10% also at the Regional Level. While the national average of population growth rates is between 2% and 3%, this incremental rates of growth in the population of the Hilabangan River Basin is due to in-migration because of the industrial expansion as well as influx of tourism into the area totaling to 22,826 tourists annually. At present, Kabankalan City is considered a First Class City, comparable with the other top cities in the Philippines..

In order to get a clear view of Kabankalan as a First Class City and Tuguegarao City as Second Class, the basic difference is the fact that Tuguegarao is primarily agricultural while Kabankalan is already industrializing at this stage. The industrial land utilization of Kabankalan City is 26%

while Tuguegarao is barely 0.4%. In terms of agriculture, Tuguegarao has a 73% utilization of land while Kabankalan has only 25%.

Compared to population density where Tuguegarao is 11,000/sq km and Kabankalan at only has 230/sq km, the data shows the kind of an Industrialized City Kabankalan could become in the near future.

At this stage, the industrialization of Kabankalan in the Hilabangan River basin is sugar-led. SONEDCO has already reached a total of 11,000 ha utilization of land planted to sugarcane with a productive capacity of 9,000 MT/day. Its expansion plan is to cover an additional of 1,000 ha. The second largest, Dacongcogon, is already operating with a total of 1,750 ha planted to sugar and total planters of 10,335 persons. Its current capacity is only 1,800 T daily. However, its plan is to expand its industrial operations to cover a total land area of 10,000 ha planted to sugar.

3.2 Land Use

In general, the land use profile of Kabankalan City reveals that the area is already starting to industrialize where the proportion of land use is 26% industrial to 25% agricultural. **Figure R3.2** shows a visual representation of land use in the Kabankalan City area. This is also shown in **Table R3.2**.

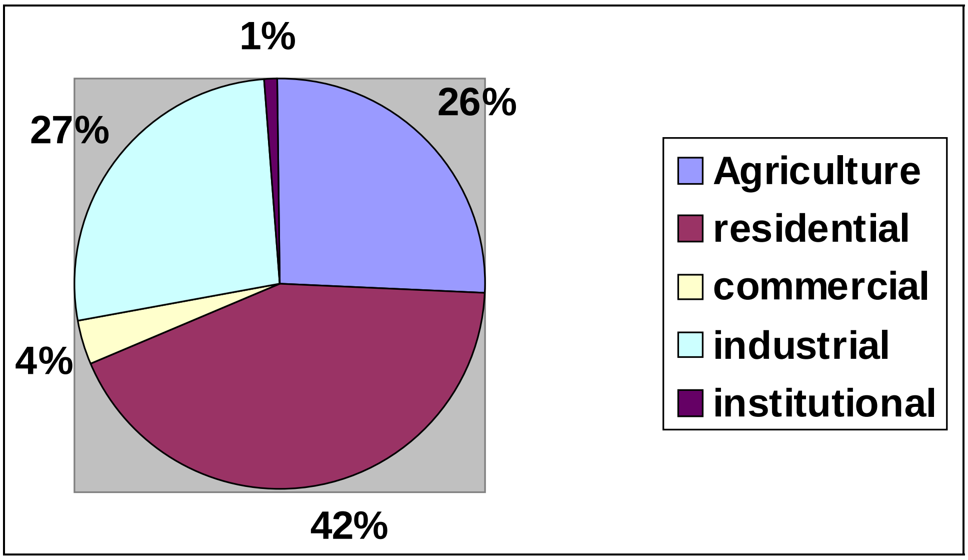


Figure R 3.2 Land Use Distribution Profile (Kabankalan City, 2009)

Table R 3.2 Land Use Distribution Profiles (Kabankalan City, 2009)

Economic sectors	**Land use** %
Agriculture	25.0
Residential	41.0
Commercial	3.7
Industrial/Institutional	26.0
Others	4.3
Total	**100.0**

The above data reveals how Kabankalan has become a first class city where its local economy has a 'value added' parameter coming from a sugar-led type of industrialization.

The actual occupation by land use is shown in **Figure 3.1**.

Aside from sugar, rice lands cover a total land area of 3,869 ha and produce a capacity of 3.46 MT/ha.

In the case of fisheries, Kabankalan City has a total coastline of 3.8 km with a total coastal area of 110 ha allocated for fish production. In addition to this, the city also has a total of 521 ha of brackish water suitable for farther development of aquatic enterprises, like shrimps and prawns, grouper and sea bass aquaculture.

It is also interesting that Kabankalan City has tourist visitors totaling to 22,826 per year. The City is able to provide commercial and hotel facilities. For instance, big players in the country such as Jollibee, Gaisano Department Stores and so forth occupy the commercial area.

The extent of this land-use profiles in the Ilog-Hilabangan River Basin Area, was confirmed in the GIS.

3.3 The General Economic Profiles

While the national economic growth rate is between 1% and 2%, the local economy of Kabankalan is at the range of 4% to 5%, which is quite high despite the current global economic crisis. It is noticeable that the total GRDP value of P98.9M in 2007 had a sharp increase to P103.2M in 2008 (**Table R3.3**). A family income level of 10,830 per month complements this farther. This level of income in the province is already within the threshold of welfare.

Table R 3.3 Gross Regional Domestic Product/Family Income (Kabankalan, 2009)

Years	Value
GRDP	
2008	103,272,196 per year
2007	98,906,685 per year
Family Income:	
2008	10,830 per month

3.4 Water Utilization

Water balance (**Table R3.4**) in the Ilog-Hilabangan River basin is calculated using the following simple water balance equation as well as long-term rainfall and evaporation data:

$$P = Q + E + Ds$$

Where

P = rainfall

Q = runoff

E = Evapotranspiration

Ds = change in storage

Table R 3.4 Water Balance Calculations

Item	Amount of Water[1/]	
	mm	MCM
Annual rainfall (P)	2,500	5,105
Surface runoff		
Surface runoff (q1)	-1,140	-2,328
Base flow (q2)	-260	-531
Evapotranspiration (E)	-1,000	-2,042
Percolation (ds)	-100	-204
Total	**0**	**0**

[1/] *Calculated using a drainage area of 2,042 sq km*

From the above table, available water from the basin consists of surface runoff (2,328 MCM), base flow (531 MCM) and percolation (assuming 50% or 102 MCM) which sums up to 2,961 MCM.

The present water utilization in the basin is apportioned as follows:

Sugarcane irrigation	-	10.4 MCM	(20%)
Paddy rice irrigation	-	8.9 MCM	(17%)
Aquaculture	-	8.3 MCM	(16%)
Domestic water	-	5.0 MCM	(9%)
Industrial water	-	19.5 MCM	(38%)
Total	-	**52.1** MCM	(100%)

The ratio of water use (52.1 MCM) against available water (2,961 MCM) is only about 2%, which means that 98% of the water resources of Ilog-Hilabangan River basin flows out into the sea without being used.

3.5 Public Hazards

3.5.1 River Overbank Flows

Inundation from uncontrolled river overbank flow is considered a serious public hazard that has to be addressed. Kabankalan City and its suburbs experience this frequent phenomenon as a result of typhoons and heavy rainfall.

To stem the adverse effects of flooding, river structures have been constructed as reported in the Master Plan as follows:

1) Embankment of Bungul diversion channel, a 1.5 km stretch on the left and 0.5 km on the right, which was completed in 1959.

2) 425 m revetment of Ilog River at Talubangi completed in 1979.

3) 65 m revetment of Bungul channel. Completed in 1979.

4) 700 m revetment of Ilog River at Kabankalan City completed in 1984.

These structures are made to withstand the effects of time but not the destructive effects of water. Their structural integrity must therefore be confirmed along with the construction of similar structures in the future.

3.5.2 Water Pollution

Possible pollution of the groundwater and other natural waterways in the area comes from the Dacongcogon Sugar Central, Sonedco and Universal Starch Industries Corp. Data from these industries are shown in **Table R3.5**.

Table R 3.5 Possible Sources of Pollution

Firm	Wastewater Generation	Source of Pollution	Type of Treatment	Receiving Body
Daconcogon Sugar Central	29,982.3 cum/day	Processing and floor washing	Biological/Lagoon	Limaco Creek
Sonedco	6,104 cum/milling	Processing and floor washing	Biological/Lagoon	Ilog River
Universal Starch Industries Corp.	No available data	Processing and floor washing	Biological/Chemical	Su-ay River

3.5.3 Solid Waste

Solid waste disposal does not seem to be a problem in Kabankalan City. In fact the city has been awarded as the most outstanding LGU in the city category for Environmental Management for 2008. However, continuous surveillance is necessary for the city to maintain this status.

CHAPTER 4 ANALYSIS OF FUTURE LAND USE AND POPULATION

4.1 Future Land Use Conditions

Compared to Tuguegarao City and Tagoloan, which are predominantly agricultural, Kabankalan City is in an advance state of industrialization and urbanization. For instance, the situation is expounded by the current land use patterns between agriculture and industry. In Kabankalan, industrialization has already set in where land use for industry is already 26% of the total land resources of 726.4 sq km. This proportion has evened out with agriculture, which utilizes 25% of the total land resource.

With total tourist visitors of 22,826 annually and around 15,000 ha of sugar land supplying the raw materials of a sugar-led type of industrialization, the current extent of commercial and trading activities in Kabankalan City made it into a First Class City.

The future land use of Kabankalan City is shown in **Figure 4.1** while **Table R4.1** shows the change of built-up area based on the CLUP.

Table R 4.1 Built-up Area

Name	Present (2009)	Future (2020)	Ratio
Kabankalan	5.62 [1/]	19.32 [2/]	3.44

[1/] *Computed by GIS based on satellite image*

[2/] *Computed by GIS based on CLUP of Kabankalan City*

Based from the CLUP of Kabankalan City, the industrial area will increase from 0.17 sq.km to 3.78 sq.km: However, this tends to be overestimated. It is more reasonable to assume that an incremental value of 50% of the industrial area is in operation as shown in **Table R4.2**

Table R 4.2 Projected Industrial Area Occupancy

Present			Future			50%	
Built-up Area (km2)	Industrial Area (km2)	Percent-age	Built-up Area (sq.km)	Industrial Area (sq.km) [1/]	Ratio	Effective I. A. (km2)	Ratio
5.62	0.17	3.02%	19.32	3.78	19.57%	1.98	10.22%

[1/] Estimated *from CLUP by GIS*

4.2 Population Projection

The population trend of Negros Occidental as projected by NSO is shown in **Table R4.3**.

Table R 4.3 Projected Population by NSO [1/]

Year	Population	Ratio	Growth Rate
2000	2,576,400		
2005	2,845,800	1.10	2.01%
2010	3,144,100	1.10	2.01%
2015	3,456,000	1.10	1.91%
2020	3,766,300	1.09	1.73%
2025	4,065,800	1.08	1.54%
2030	4,351,600	1.07	1.37%
2035	4,622,300	1.06	1.21%
2040	4,877,200	1.06	1.08%

1/ *Source: NSO website*

As shown above, there is a decreasing rate of population from 2.01% in year 2005 to 1.08% in year 2040.

However, the result of actual census taken in year 2000 and 2007 has an average of 1.61% for the province and 1.57% for Kabankalan City as shown in **Table R4.4**.

Table R 4.4 Population in Actual Census [1/]

Name	unit	2000	2007	Growth Rate
Negros Occidental	nos.	2,565,723	2,869,766	1.61%
Kabankalan	nos.	149,769	166,970	1.57%

1/ *Source: NSO website*

In this study, it is assumed that the above rate of population growth from 2000 to 2007 will continue until the target year 2020 for the future condition. The projected population based on the said assumption is shown in **Table R4.5**.

Table R 4.5 Projected Population under this Study

	2009	2010	2015	2020	Ratio (2009/2020)
Negros Occidental	2,963,075	3,010,862	3,261,605	3,533,229	1.19
Kabankalan	172,238	174,934	189,060	204,327	1.19

As listed above, the ratio of population is only 1.19 even though the ratio of built-up area is 3.44 as mentioned in Sector 4.1.

4.3 Trends of Urban Development and Population Increase

Urban congestion and chronic pollution appears remote in Kabankalan City, except the onslaught of flooding ever since typhoons have become prevalent in the Western Visayas area. As the general trend of increase in population is between 2% to 3% up to the year 2020, a dramatic rise in population growth is not expected in Kabankalan City.

However, this is only a trend. This could still be altered if there are unexpected large- scale investments to set in like those of Hanjin in the Tagloloan area. One factor that could trigger this take-off is when the new oil find in Western Visayas becomes fully commercialized by the government. This is a major event that will definitely alter the current rate of progression towards urbanization in the general Hilabangan River Basin area.

CHAPTER 5 HYDROLOGIC AND HYDRAULIC ANALYSIS

5.1 General

5.1.1 Summary of Flood Runoff Estimation in Previous Study

Calculations of probable flood discharges for the Ilog-Hilabangan River basin were done by JICA in the “Study on Ilog-Hilabangan Flood Control Project-Master Plan Report” in July 1991. The process was done in three steps, i.e., rainfall analysis, establishment of river system model and flood runoff analysis. Flood runoff of the Master Plan Study in 1991 was adopted in the Feasibility Study as a result of review.

(1) Rainfall Analysis

In the above study, the probable rainfall in the Ilog-Hilabangan River Basin was calculated as follows:

Table R 5.1 Probable Rainfall

Unit: mm

Duration	Return Period					
	100-yr	50-yr	25-yr	10-yr	5-yr	2-yr
2-day	202	181	161	133	111	76
1-day	156	135	117	93	75	49

A rainfall intensity–duration curve was derived to develop a model hyetograph shown in Figure 5.1.

(2) Establishment of River System Model

For the river system model, the basin subdivisions and river system used in the 1991 Master Plan Study were adopted. This consisted of three base points, 25 sub-basins, 62 river channels and 4 damsites as shown in Figure 5.2.

(3) Flood Runoff Analysis

The ‘Storage Function Model’, a conceptual rainfall-runoff mathematical model, was used to analyze flood runoff, following the process flowchart shown in Figure 5.3.

Results of the analysis are summarized below.

Table R 5.2 Probable Flood Discharges, Ilog-Hilabangan River Basin

River/Location	D.A.	Design Discharge, cum/s					
		2yr	5yr	10yr	25yr	50yr	100yr
Ilog River at Talubangi	1,960	920	1,880	2,630	3,690	4,540	5,430
Ilog River at Orong	1,432	750	1,510	2,090	2,920	3,510	4,270
Hilabangan River at Overflow	445	460	980	1,410	1,930	2,380	2,900

5.1.2 Approach for this Study

The hydrological results and other valuable information presented in the previous sub-section is used in the hydraulic analyses of the present study. This is decided after a careful consideration of the circumstances due to the difficulty of collecting additional rainfall data and obtaining accurate discharge data, which could have been used in updating the said study.

The general considerations for discussion under this chapter are roughly outlined as follows:

Table R 5.3 Approach for Sector Loan Study

Item	MP / FS 1/	This Study	Remarks
Report	MP 1991, JICA		
Rainfall Data	1871-1989	Not conducted	Data after 1990 is not available from PAGASA
Rainfall Analysis	2-day rainfall, converted from point rainfall	Not conducted	Based from Kabankalan data
Runoff Analysis	Storage function method	Not conducted	-
Flood Runoff	From 1991 MP	Not conducted	-
River Cross-section	Unspecified	200, 500 and 1000m interval	Done
Initial Water Level	Mean spring high tide level = 1.50m	Mean spring high tide level = 1.50m	Done
Flood Analysis	Two-dimensional unsteady flow	One-dimensional unsteady flow	Vicinity of Kabankalan and Ilog
Grid Size	500m	100m	-

[1/] *MP – Master Plan; FS – Feasibility Study*

In the hydraulic analyses, mathematical modeling runs are conducted considering the 19.7 km reach of Ilog River from its mouth to the junction with Hilabangan River, thence from the junction to about 4.0 km upstream, as well as the Hilabangan River from its junction with Ilog River to about 5.0 km upstream.

The hydraulic mathematical modeling runs are performed using the HEC-RAS Model of the US Hydrologic Engineering Center. The initial runs consist of determining the extent of inundation under different return periods or flood scales, which are presented and discussed towards the end of the chapter.

5.2 Hydrology

The probable flood discharges at the different points on the Ilog and Hilabangan River as shown in Table R 5.3 are reviewed on the basis of their completeness and accuracy, and are deemed adequate for purposes of the present undertaking

The probable flood discharges for hydraulic analysis are given at the following inflow points:

Table R 5.4 Probable Discharge in Ilog River and Hilabangan River

Return Period	Flood Discharges, cum/s		
Years	Ilog River down-stream of con-fluence w/Hilabangan	Ilog River 4km before confluence w/ Hilabangan	Hilabangan River 5km before con-fluence w/ Ilog
2	920	680	430
5	1,880	1,370	900
10	2,630	1,910	1,290
25	3,690	2,660	1,760
50	4,540	3,200	2,170
100	5,430	3,900	2,650

Figure R 5.1 shows the flood hydrographs for 2, 5, 10, 25, 50 and 100-year return periods at the Ilog-Hilabangan confluence, which are used for design.

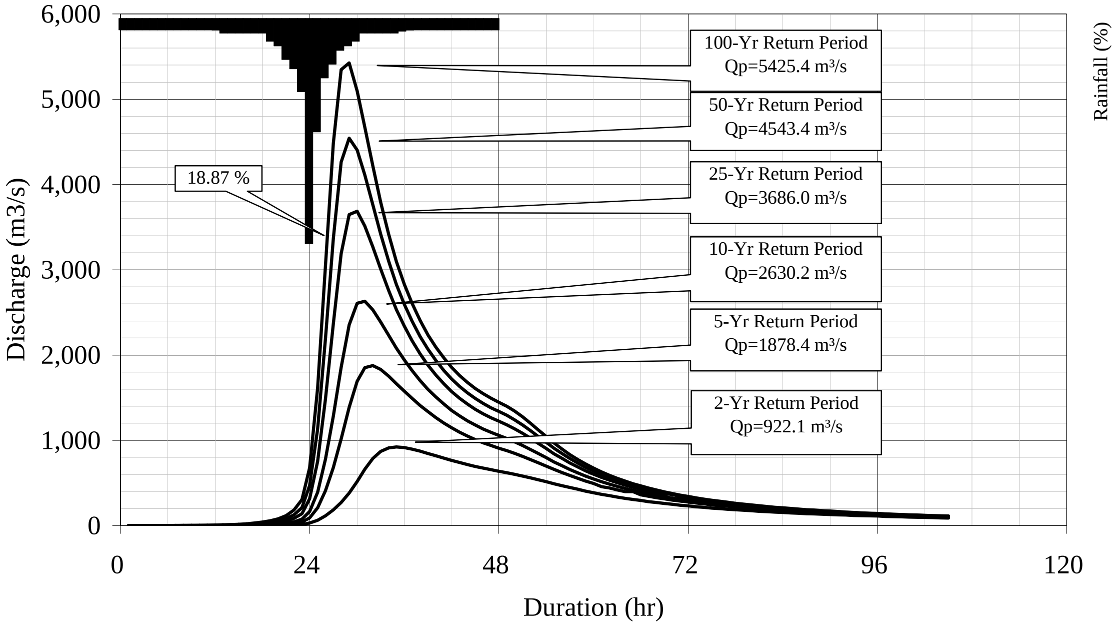


Figure R 5.1 Flood Hydrographs at Ilog-Hilabangan Confluence

5.3 Hydraulic Analysis

5.3.1 Target Area

The target area covers the stretch from Kabankalan City to the Municipality of Ilog particularly those located along the riverbanks and the immediate left and right flood plains.

5.3.2 River Cross-section Survey

The cross section geometry for the main river channel is obtained from actual field survey using GPS, Total Station, Transit Level and Echo Sounder survey instruments. The cross sections on the flood plains and/or 'dry' ground (similarly located as those taken from the actual field surveys) are derived from 1:50,000 NAMRIA topographic maps.

5.3.3 Initial Boundary Condition

Initial water level at Ilog river mouth was Mean Spring high tide of 1.50 EL.m in the previous M/P study. Same level is applied in this study taking the hardness of data collection into consideration.

5.3.4 Flow Capacity

Examination of flow capacity of Ilog River, Hilabangan River and Old-Ilog River (Consuelo River) was done with the following parameters:

- Steady flow calculation is applied to the determination of flow capacity.
- The Manning's roughness coefficient of 0.03 and 0.60 are applied to the channel and overbank.
- The initial water level at the river mouth is 1.5 m.
- The cross-sections of the river channel taken from the latest surveying results in this study.

Based on the mentioned consideration, the stretch along the Kabankalan City to the Ilog-Hilabangan junction bankful capacity ranges from 200 m3/s to 2,500 m3/s and over 1000 m3/s in most stretches as shown in Figure 5.4.

5.4 Flood Inundation Analysis

5.4.1 General

(1) Concept and Outline of the Flood Inundation Model

The river shall be modelled taking into consideration the main river channel and its left and right flood plains. Initially, the river channel in its original or existing condition shall be modelled. As for Ilog-Hilabangan, it might be necessary to make a model including upstream portion in accordance with verifiable observed data for the model. Moreover judging from geographical features in the downstream, the flood inundation is diffusion type, therefore, virtual river channel for the floodplain has to be built in the flood inundation model.

(2) Description of Software

HEC-RAS is an integrated system of software for interactive use in a multi-tasking environment. It is designed to perform one-dimensional hydraulic calculations for a full network of natural and artificial or constructed channels. It is comprised of a graphical user interface, separate analysis components, and data storage and management capabilities. The system contains a) steady flow water surface profile computation intended for steady gradually varied flow b) unsteady flow simulation primarily for subcritical flow and mixed flow regimes c) movable boundary sediment transport computation resulting from scour and deposition over moderate time periods and d) water quality analysis wherein the current version (Ver 4.0) can perform detailed temperature analysis and transport of a limited number of water quality constituents.

5.4.2 Flood Inundation Model

(1) Model Setup

The flood simulation is generally conducted in three steps; namely, calculation of flood runoff from the sub-basins, channel flood routing, and determination of flood inundation on the flood plains. The structure of the HEC-RAS model is shown in Figure R 5.2.

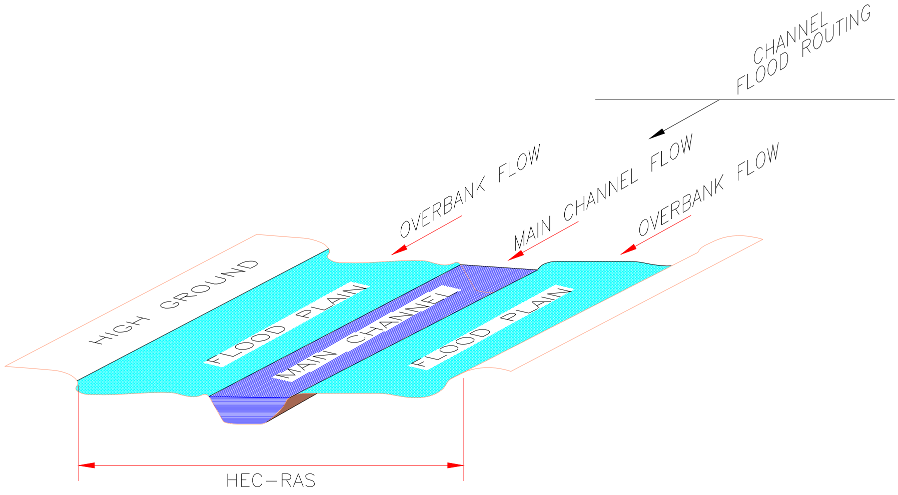


Figure R 5.2 Structure of HEC-RAS Model

(2) Methodology

The basic inputs to the HEC-RAS model are stream discharge, cross sections perpendicular to the flow direction along the river channel and flood plains, geometry of bridge or other cross channel structures, Manning's roughness coefficients (n values) as well as upstream and downstream channel boundary conditions.

Hydraulic calculations of flow in channels and overbank areas require an estimate of flow resistance, which is generally expressed by the Manning's roughness coefficient, n. The effect of channel roughness on water surface profiles is that as the n value is increased, the resistance to flow also increases, which results in higher water surface elevations. The assumed roughness, n, considered for the main channel and overbank areas under this study are 0.03 and 0.06, respectively.

Water surface profile calculations are computed from one cross-section to the next by solving the Energy equation by means of an iterative procedure called the standard step method. The Energy equation is written as follows:

$$Z_2 + Y_2 + \frac{a_2 V_2^2}{2g} = Z_1 + Y_1 + \frac{a_1 V_1^2}{2g} + he$$

Where:

Z1, Z2	= elevation of the main channel inverts at section 1 and 2
Y1, Y2	= depth of water at section 1 and 2
a1, a2	= velocity weighing coefficients at section 1 and 2
g	= gravitational acceleration

he = energy head loss

A diagram showing the terms of the Energy equation is shown in Figure 5.3.

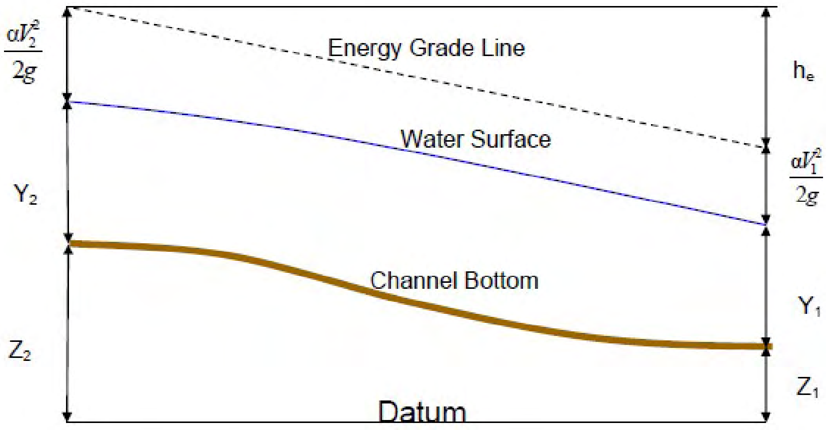


Figure R 5.3 Representations of Terms in the Energy Equation

The energy head loss (he) between the two sections is comprised of friction and contraction/expansion losses and is expressed as follows:

$$he = L\bar{S}_f + C\left|\frac{a_2 V_2^2}{2g} - \frac{a_1 V_1^2}{2g}\right|$$

Where:

L = Weighted reach length

$\bar{S}_f$ = Friction slope between two sections

C = Expansion/contraction loss coefficient

The weighted reach length is calculated as:

$$L = \frac{L_{lob}\bar{Q}_{lob} + L_{ch}\bar{Q}_{ch} + L_{rob}\bar{Q}_{rob}}{\bar{Q}_{lob} + \bar{Q}_{ch} + \bar{Q}_{rob}}$$

Where:

L_{lob}, L_{ch}, L_{rob} = Reach lengths for flow in the left overbank, main channel and right overbank, respectively.

$\bar{Q}_{lob}, \bar{Q}_{ch}, \bar{Q}_{rob}$ = Arithmetic average of the flow between sections for the left overbank, main channel and right overbank, respectively

The total conveyance and velocity coefficient for a cross section requires that the flow be subdivided into units for which the velocity is distributed uniformly. The approach is to subdivide the flow in the overbank areas using the cross section n-value breakpoints (i.e., where n values change) as the basis for subdivision as shown in **Figure R5.4**.

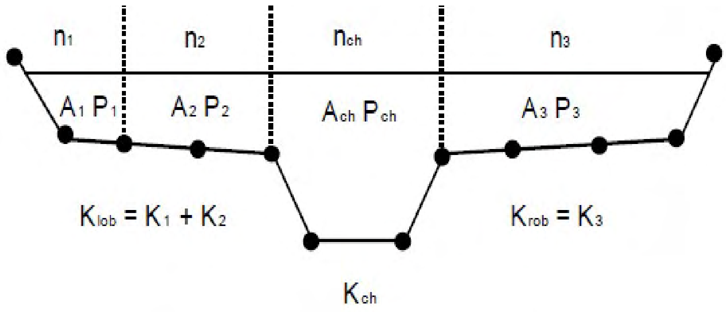


Figure R 5.4 Default Conveyance Method in HEC-RAS

Conveyance is calculated within each subdivision from the Manning's formula:

$$Q = K\sqrt{S_f}$$

$$K = \frac{1}{n}AR^{2/3}$$

Where:

K = conveyance for the subdivision

n = Manning's roughness coefficient for the subdivision

A = flow area for the subdivision

R = hydraulic radius (A/P) for the subdivision

P = wetted perimeter

HEC-RAS sums up all the incremental conveyances in the overbanks to obtain a conveyance for the left and right overbanks while the main channel is computed as a single conveyance element. The total conveyance for the cross section is obtained by summing the left, channel and right subdivision conveyances. Interpolation between cross-sections is applied when instability of simulation occurs.

Virtual rivers are integrated as new reach in the model to determine the flood inundation on the flood planes. The overflow calculation is determined by setting up lateral weirs at certain sections with poor capacity which serves as overflow links to the virtual rivers with this equation:

$$Q = CLH^{3/2}$$

Where:

C = Weir flow coefficient

L = Length of the crest.

H = Upstream energy head above the crest.

(3) Model Network

The model consists of a branched network of the Ilog River (23.5km), Hilabangan River (5km) and Consuelo River (6.6km) as shown schematically in Figure R5.5.

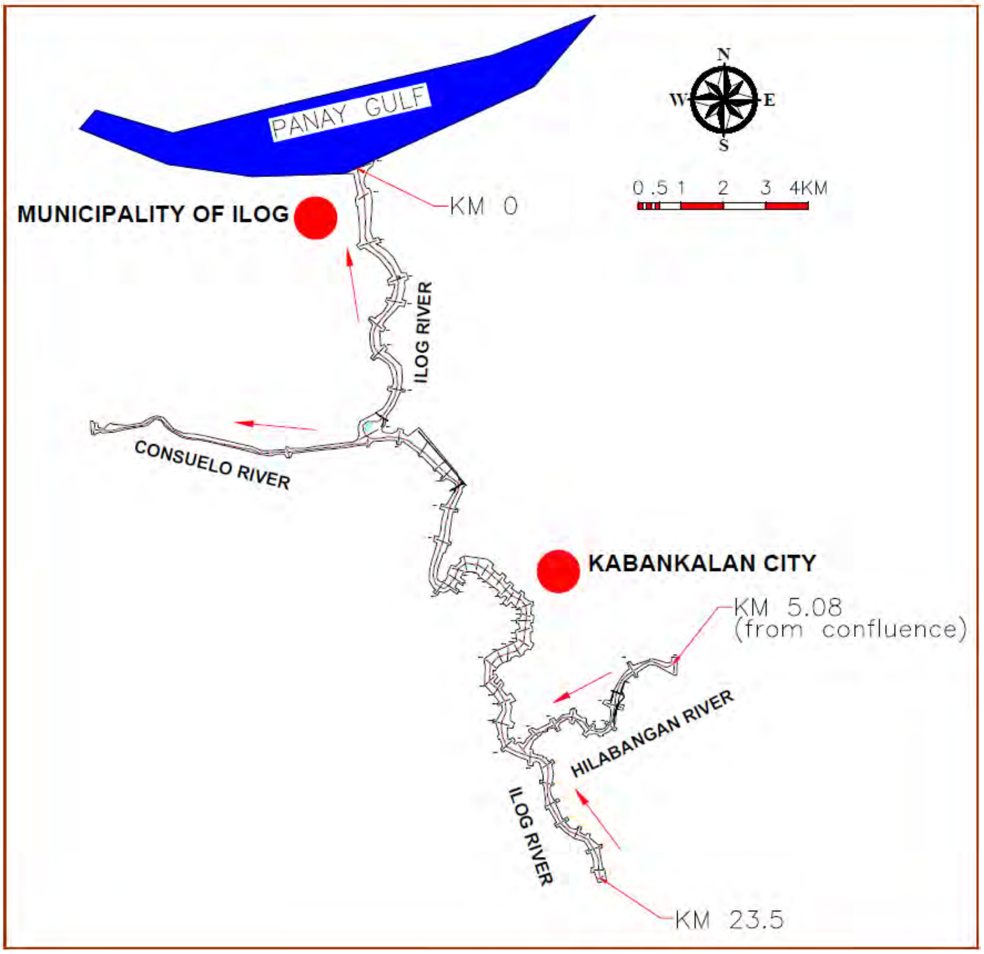


Figure R 5.5 River Model Network

CHAPTER 6 PLANNING FRAMEWORK

6.1 Basic Concepts on Planning Framework

6.1.1 Summary and Outline of Current M/P

As shown in Part-1 Report, The Master Plan on the Ilog-Hilabangan River Basin, which has been selected as a candidate river basin for the implementation of flood control project in the Sector Loan Project, was formulated in 1991 (1991 M/P) by Japan International Cooperation Agency (JICA) based on the mutual agreement between the Government of the Philippines (GOP) and the Government of Japan (GOJ). The following is a summary of the M/P Study Results:

(1) Study Area and Objective of 1991 M/P Study

The study area covers the Ilog-Hilabangan River Basin of 2,162 km^2. The objectives of the study were to formulate the master plan of flood control for the Ilog-Hilabangan River Basin and to identify priority projects.

(2) Background f the Projects

In 1990, regional development was one of the main strategies of the national development policy emphasized in the Medium-Term Philippine Development Plan for 1987-1992. It was proposed to solve the problem of hampering the desired favorable development.

Inhabitants of the Ilog-Hilabangan River Basin had been enjoying abundance in agricultural and fish production. Poverty and insurgency problems had, however increased due to scarcity of flood, which is brought about by flood damages resulting in low productivity and thus hampering development of the region. The maximum flood, recorded in November 1949, inundated the area for 4 days, causing 730 casualties and 5.1 million pesos of damages at 1954 prices. Another instance was the flood in September 1984, which inundated the municipalities of Kabankalan and Ilog as well as the surrounding flat land, resulting in 48 dead and 29 missing. Then, on November 13, 1990, typhoon Ruping hit the Visayas Region and caused flooding in the lower reaches of Ilog-Hilabangan River, which was more severe than the 1984 flood. DPWH has painstakingly made efforts to mitigate flood damage but this may be expected to increase in the future due to further agriculture development and population increase.

It is therefore essential to provide flood control works to mitigate flooding problems and improve the livelihood of the inhabitants. The necessity of providing more effective countermeasures has been recognized, and study was commenced to formulate a master plan of flood control for this river basin.

(3) Flood Inundation Condition in the Basin

Flood damage in the Ilog-Hilabangan River Basin is most conspicuous in the flat lands in the lower reaches, and this is caused mainly by river overbank flow. The flow capacity of the main river channel presently ranges from 500m^3/s to 2,000 m^3/s, while the probable discharge of a 2-year return period is 920 m^3/s. Discharge in excess of the river flow capacity widely spreads over the flat lands inundating an estimated area of 125 km^2 in the lower reaches.

In terms of area, sugarcane plantations are the most dominant in the flat lands, followed by fishponds, paddy fields, coconut/nipa grooves, and residential areas. Under this condition, flood causes widespread damages to agricultural/aqua-cultural products followed by residential properties.

(4) Basic Condition and Policy on Formulation of Master Plan

The Mater Plan has been studied on the basis of the following conditions:

(a) Project Scale

The project scale for the Master Plan was selected in consideration of those of other major rivers in the Philippines and the magnitude of recorded maximum flood in the basin. A 100-year return period was adopted.

(b) Target Year

Since the Master Plan was envisioned to provide an ideal flood control plan, the target year for completion could not be specified aside from its enormous fund requirement and work volume. To examine the economic viability, a tentative project completion year is required, and the year 2020 with implementation for 30years since 1991 was employed as the target year.

(c) Manner of Selection of Optimum Plan

In the 1991 M/P Study, comparative options were made among several alternative measures for flood control, which included river improvement plan along the river channel, and an optimum plan was selected from the economic and technical aspects.

(d) Implementation Schedule

Implementation of the Master Plan was assumed to span a long period of 30 years from 1991 to 2020, including the feasibility study stage.

Since the Master Plan was to be formulated on the condition that an Urgent Project would be included in the early stage, a Phased implementation schedule was studied accordingly. Eventually, flood control works for a 25-year return period flood was proposed for completion in the first phase, and it would be consecutively upgraded to the design scale of a 100-year return period until the target year 2020.

(e) Project Cost and Economic Evaluation

The construction cost of the Master Plan was estimated at 1,253 million pesos at the price level of November 1990 with the currency conversion rates of USD1.00 = ¥130.00 = Php28.00, Php1.00 = ¥4.64. This cost consists of main construction cost, engineering services and administration cost, physical contingency and compensation cost, excluding price contingency, as follows:

Table R 6.1 Summary of Project Cost and Economic Evaluation of 1991 M/P

Item	Project Cost
Construction	893
Administration	45
Engineering Services	143
Physical Contingency	108
Compensation	64
Total	1,253

The annual average benefit, which was calculated under the land use condition of the year 2020 is 126.6 million pesos (This includes direct and indirect benefits).

The economic viability of the Master Plan was assessed by means of EIRR, B/C and NPV. The EIRR was estimated at 12.6%.

In general, the EIRR borderline in this kind of infrastructure project is around 15% and therefore the economic viability of the Master Plan is not adequate. However, this project would bring about intangible benefits such as saving of invaluable human life that may possibly be lost by flooding, prevention of possible injuries and mitigation of occurrence of disease. In this connection, it was recommended that the Master Plan should then be put into implementation in the near future.

(f) Urgent Project

As explained above, the urgent project was selected within the framework of the Master Plan by narrowing down the area to be protected and/or by lowering the projects scale as follows:

Table R 6.2 Summary of Project Cost and Economic Evaluation of Urgent Projects

Project Name	Contents of the Project	Protection Scale
River Improvement	River channel improvement for the same river stretch	25-year return period

The economic viability of the Urgent Project was preliminarily calculated at EIRR=15.2%. The Urgent Project was thus acceptable enough from the economic viewpoint, although it would be necessary to confirm its viability in the feasibility study stage.

(g) Summary of Project Features in M/P

The project features in the M/P are summarized below:

Table R 6.3 Summary of Project Features in M/P

Main Item	Item	Contents	Remarks
Design Flood	Project Scale	100-year Return Period	
	Design Discharge	5,450m^3/s	
Target Year		Year 2020	
Flood Control Measures	River Channel Improvement	21.5km in total length	
Structures and Works	Embankment	966,700m^3	
	Excavation	6,701,800m^3	
	Dredging	2,723,700m^3	
	Slope Protection (Revetment)	153,150m2	
	Sodding	530,200m^2	
	Sluice (Type-A)	3 units	(One Barrel)
	Sluice (Type-B)	1 unit	(Three Barrels)
	Bridge Works	Talubangi Bridge	B:10m, L:290m
		Bungul Bridge	B:4m, L:360m
Compensation	Land Acquisition	Fishpond	38 has
		Sugarcane	178 has
		Residential Area	6 has
	House Relocation	354 units	

(h) Recommendation

Based on the results described aforementioned, the following considerations were recommended:

- Early Conduct of a Feasibility Study
- Considerations for the Feasibility Study
- Consideration in Case of Implementing River Improvement Works without the Feasibility Study
- Continuation of Hydrological Observation in the Study Area

6.1.2 Core Areas to be Protected by Structural Measures in the Sector Loan Project

Flood Control Projects as sub-projects in the Sector Loan Project on Disaster Risk Management aim to mitigate flood damages and alleviate other flooding problems in selected “core areas” in the major basin. From this standpoint, the core area refers to Kabankalan City, which is playing a role as one of the key cities contributing to provincial economic development for Negros Occidental (together with the provincial capital city of Bacolod), and the Municipality of Ilog which is the first Spanish settler’s land in the Negros Island as shown in the 1991 M/P Report.

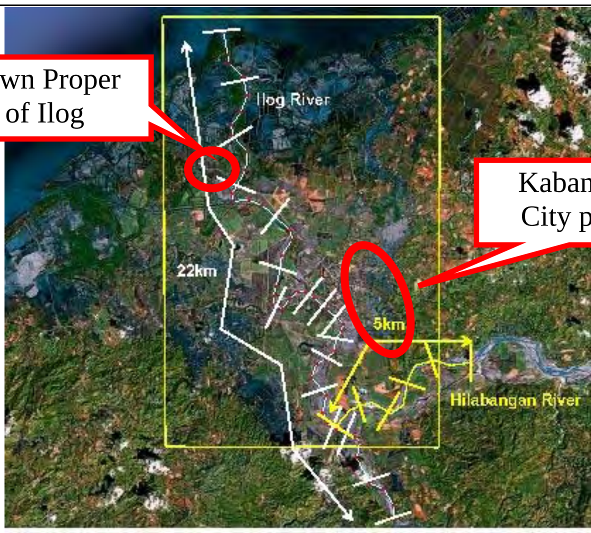


Figure R 6.1 Core Areas to be Protected in the Ilog-Hilabangan River Improvement Project

6.1.3 Basic Concept for Flood Control

As described above, the Study Area is one of the most significant areas for provincial economic development in Negros Occidental together with Bacolod City.

However, the Study Area suffers from frequent inundation by river overflow due to storm rainfall and high tide, which weakens the regional economy and worsens the daily living condition of the residents. Under these circumstances, the Study being conducted aims at solving the adverse effects caused by floods through the formulation of a flood mitigation plan.

The flood mitigation plan consists of structural and non-structural components with the proposed policy, contents and results outlined in the 1991 M/P. River improvement would be the main structural measure proposed in this Study, such as the construction of dike, widening of channel and dredging to increase the flood flow capacity of the waterway, based on the results of 1991 M/P.

On the other hand, the non-structural measures would have functions to control the flood runoff discharge from the upper reaches of the river basin such as improvement of vegetative cover through reforestation. Moreover, in order to minimize the damage caused by the flood when it exceeds the design capacity of the structural measures, the flood warning and evacuation system is highlighted as the eligible non-structural flood mitigation measure.

Table R6.4 shows the list of proposed structural and non-structural measures.

Table R 6.4 Functions of Conceived Structural and Non-structural Flood Mitigation Measures in the Study Areas

Item	Function	Structural Measures	Non-Structural Measures
Basic Concept	Areas to be Protected	Kabankalan City and Municipality of Ilog referring to the center of the Ilog-HIlabangan River as "Core Areas" is selected to firstly consider the flood mitigation plan in the Sector Loan project.	In addition to core areas for extraordinary flood, non-structural measures are considered to alleviate /minimize the flood damage basin-wide.
	Intention of Stakeholders	Flood mitigation structural and non-structural measures to be selected should be considered and subject to the consents from the stakeholders since their consents are absolutely imperative to construct smoothly and execute effectively for the implementation of river works and O&M Activities.	
Basic Policy	Basic Plan	This Project shall be considered based on the proposed Urgent Project to prevent flood damage from 25-year return period flood in 1991 M/P.	
Specific Flood Control Measures	Increment of Discharge Capacity in Waterways	• Construction of Dike and Revetment • Widening of River Channel • Dredging of River Channel (Measures to be proposed shall be designed not so as to affect flood condition to other areas.)	• Harmonization between CLUPs, Flood Control Plan and Solid Waste Management Plan • Prevention of encroachment to river area • Legal arrangement for construction of structural measures
	Flood control / retention capacity in the basins and the application in the project	In associated with Established Negros Island Integrated Water Resources Management Council, possible watershed conservation shall be considered.	
Mitigation measures in the extraordinary flood beyond design discharge		—	• Rainfall gauges with telemeter System have not installed in the Basin by PAGASA. Therefore, FFWS should be set in log-term plan. • Early Flood Forecasting and Evacuation system as community-base measures with easy devices.
Concept of Climate Change Adaptation	Increment of Rainfall intensity and design discharge	• Heightening of Dike • Dredging and widening of low-water channel	• Enhancement of measures proposed for other functions to minimize the damages • Enlightenment Activities to stakeholder for adverse effects of climate change.
	Sea Level Rising	• Heightening of Coastal Dike • Enhancement of Inland Drainage Capacity • Raising of Land Elevation	• Enlightenment Activities to stakeholder for adverse effects of climate change. • Revising of CLUPs • Set-up Legal and Organizational System for Smooth Implementation of Structural Measures

There are several distinct merits and demerits of the above structural and non-structural flood mitigation measures. The merit of structural measures is such that they could almost completely get rid of any damage of the flood, when the flood is less than the design scale. On the other hand, they hardly mitigate the damage when the flood exceeds the design scale, and they may cause negative environmental impacts such as a large number of house relocation and felling of mangrove forest. Moreover, it may take time and large cost to complete the construction of the structural measures.During the time of construction, the effect of the flood mitigation is hardly felt.

As for the non-structural measures, the merits are such that they could bring about an almost instant effect of flood mitigation, as for instance, early warning and flood zoning, with less cost of implementation as compared with the structural measures. At the same time, they could contribute to a certain range of flood mitigation effect for every scales of flood. On the other hand, the demerit of the non-structural measures is such that accurate quantitative estimation is rarely made.

The target design level for the structural measures is pre-determined in accordance with the previous M/P Study as well as from recommendations in relevant guidelines and/or the design levels applied in similar flood mitigation projects in the Philippines. In this regard, the targeted design level recommended in the 1991 M/P Study shall be applied for basic concept in the Sector Loan Project.

With due consideration to the particular physical, social and financial conditions of the Study Area, the plan for structural components would be examined assuming the various design level options. It is further noted that the plan for the structural component would be separately formulated for the following three locations:

(1) Flood Protection Plan for Kabankalan Areas (Right Bank) and Sugarcane Mill Factory (Left Bank) together with adverse effects of the Protection,

(2) Flood Protection Plan for Ilog Areas (Old Ilog River), and

(3) Consideration of non-protected Areas, such as sugarcane field and fishponds

The above concepts on the location to be protected and design level applied in the Study could bring out the minimum negative environmental impact and the most economical and affordable structural flood mitigation plan.This, however, may cause a regional gap in flood safety level and hence, regionally different allowable extents of flood inundation. Moreover, adaptation to climate change, of which there is a serious concern about its adverse effects worldwide, shall be taken into consideration.

Hence, the stakeholder meetings are indispensable in order to attain the adequate understandings of the stakeholders on the proposed flood mitigation plan and the unavoidable regional gap in the flood safety level. At the same time, the importance of the non-structural components is highlighted in order to minimize such regional gap inflicted by the structural components.

As described in Main Report (Part-A), the delay of the project implementation resulting in the decrease of the benefit of overall project's objectives might be induced due to the delay of the procedure of ROW acquisition and/or opposition from communities as before, unless the consensus of stakeholders is obtained. In addition, it is, by good right, desirable that the river works in downstream portion should precede works in middle or upper stretches in terms of river improvement works not so as to increase flood discharge in lower portions. Therefore, it is also concerned that the river works in the sector loan project aiming to improve flood conditions in Kabankalan and Ilog areas located in the stretch of 5~7km upstream from river mouth in the Ilog-Hilabangan River Basin should be carefully elaborated so as to affect neither opposite side (sugarcane field) nor estuary areas (fishpond area).

6.2 Planning Framework

Planning frameworks will be set up as the bases for plan formulation taking the results of the previous study, the baseline study and basic analysis into account. The objective planning frameworks will include: (1) the target project completion year; (2) the socio-economic framework; and (3) the design frameworks. The details of these items are as described in the following subsections.

6.2.1 Target Project Completion Year

The flood mitigation project contains both structural and non-structural measures. Based on the results of 1991 M/P, the Project is to be categorized into the urgent projects and long-term plan as shown in Sub-section 6.1. The urgent project consists of manly river channel improvement works urgently required as the priority project expected to protect vulnerable and the most densely populated areas in Kabankalan and Ilog against flood damage by flood control works for 25-year return period flood in the first phase.

The target completion years for the urgent projects will be finally determined through discussion with the counterpart agencies in accordance with the Implementation Schedule of Sector Loan Project. the structural flood mitigation measures in particular will involve a large volume of work, which will lead to difficulties in completing any priority project by several years. In addition, the schedule of the progress of the conditionality and status of Sector Loan Project should be considered. Based on the clarification, it is proposed that the target year for the priority structural and non-structural flood mitigation plan should be set in 2020.

6.2.2 Social Framework

Kabankalan City has prepared its own land use plans with 2014 as the target year. The Study Team has delineated the overall land use plan for the protected areas based on these plans, and further confirm the population as well as land use conditions of the areas to be protected for the target year 2020 based on the factors mentioned below.

(1) Zoning plans projected by the municipal governments;

(2) Past trend of regional economy and population;

(3) Existing land use and economic conditions; and

(4) Ongoing and projected large-scale land development plans.

The basin flood runoff conditions will be seriously influenced by the basin land use conditions. Moreover, the flood damage potential could increase as the population and assets in the core areas to be protected increase. From this point of view, the flood mitigation plan is formulated on the premise of social conditions in the years 2014 shown in CLUP of Kabankalan as in 2020 (See Chapter 3 and Chapter 4).

6.2.3 Design Framework

The design framework shall include the target design level and its corresponding standard discharge. Of these items, the target design level is expressed in terms of return period, and the standard discharge means probable peak discharge in natural basin runoff conditions without any control by basin flood mitigation measures proposed in 1991 M/P.

In this connection, the Study should adopt 25-year return period for basic design level to protected the targeted areas since the said protection level has been set in 1991 M/P as priority and urgent flood control plan.

However, the target design scale to be selected for the Sector Loan Project is finally determined taking the following alternatives into account throughout the Study:

(1) Basic Flood Peak Discharge of 25-year flood as targeted flood mitigation level;

(2) In case the scale of structural measures against the basic flood peak discharge is quite large attributing to the huge social and environmental issues and/or opposition of stakeholders, lower viable design scales shall be considered based on the status of regional economic, investment conditions, possible areas to be acquired and other restrictions for implementation of the project; and

(3) The conditions after climate change shall be considered for design of structural measures.

First of all, based on the concept (1) mentioned above, flood scale at 25-year return period flood will be selected, if there is no any concerns.

However, the existing structural flood mitigation capacity in the Study Area was evaluated to be extremely small and could hardly cope with even the probable flood discharge of less than 2-year return period, as described in the Chapter 5. Moreover, the area along the downstream river channel is densely packed with houses and the river channel improvement with the design scales set up under the above Item (1) would cause serious conflicts in house evacuation in particular. Due to these points of view, the above Item (2) might be applied as the base for determination of target design scale or structural flood mitigation measures in the Study. The flood over the design scale and under the condition of climate change described in (3) above would basically be dealt with by non-structural measures such as the flood warning and evacuation system and the dissemination of flood risk maps to the residents together with certain structural measures which have retarding functions.

Determined framework of Ilog-Hilabangan River improvement policy and the relevance with the Sector Loan Project are as follows:

Table R 6.5 Summary of Framework of the Mitigation Measures in the Study Areas

Target	Item	Achievement	Countermeasures	Relativeness to Sector Loan
River Flood	Urgent Plan	25-year return period flood	Structural Measures	For core areas, Sector Loan shall implement the suitable and viable scale flood control works (max. 25-year return period).
			Non-structural Measures	In/around core areas, suitable and viable mitigation measures shall be designed and assisted by Sector Loan.
		Together with climate change adaptation		
	Framework Plan	100-year return period flood	Structural Measures	No consideration (formulation of plan / approval of M/P）
			Non-structural Measures	No consideration (adoption of the concept of IWRM committee / approval of M/P）
Tidal Flood	Urgent Plan	Recorded Max. Highest Tidal Level w/o wave height	Structural Measures	No consideration for coastal protection (formulation of plan）
			Non-structural Measures	In/around core areas, suitable and viable mitigation measures shall be designed and assisted by Sector Loan.
	Framework Plan	w/ Climate Change Consideration	Structural Measures	Basic plan and measures are proposed in the study.
			Non-structural Measures	In/around core areas, suitable and viable mitigation measures shall be designed and assisted by Sector Loan.

CHAPTER 7 STRUCTURAL FLOOD MITIGATION PLAN

The structural flood mitigation plan would include components against river-overflow and inland floods caused by storm rainfall and high tide. These structural plan components against both types of floods are examined in this Chapter based on the results of the flood simulation analysis described in Section 4 of Chapter 5.

7.1 Structural Flood Mitigation Plan against River-Overflow Flood

7.1.1 Maximum Design Scale Examined in the Study

Most flood mitigation projects for large-scale river basins in the Philippines employ the design scale of 100-year return periods for structural measures against river-overflow floods in long-term or frame work plan. On the other hand, as described in Subsection 6.2.3 of Chapter 6, 25-year return period probable flood has been set for urgent projects in the Ilog-Hilabangan River Basin in the 1991 M/P. Considering these precedents, the design scale of 25-year return period is provisionally assumed as the maximum design scale to be examined in the Study.

The potential flood mitigation measures and the alternative flood mitigation plans consisting of combinations of potential measures are firstly examined within the scope of the above maximum design scale. Then, the optimum design scale as well as the optimum combination of flood mitigation measures will be selected based on the synthetic evaluation of socio-economic impacts, natural environmental impacts, financial affordability and technical viability (See Chapter 11).

7.1.2 Potential Measures

River-overflow flood is herein defined as the flood runoff from a large catchment area that spills over the inland due to the overflow over the riverbanks and inflicts significant damage over a wide area. On the other hand, the objective river is the Ilog-Hilabangan River which has a catchment area of more than 2,100 km2, which is one of the major river basins in the Philippines. The existing channel of the Ilog-Hilabangan River in targeted areas has been proven through the hydraulic simulation that it possesses a channel flow capacity of less than 5-year return period.

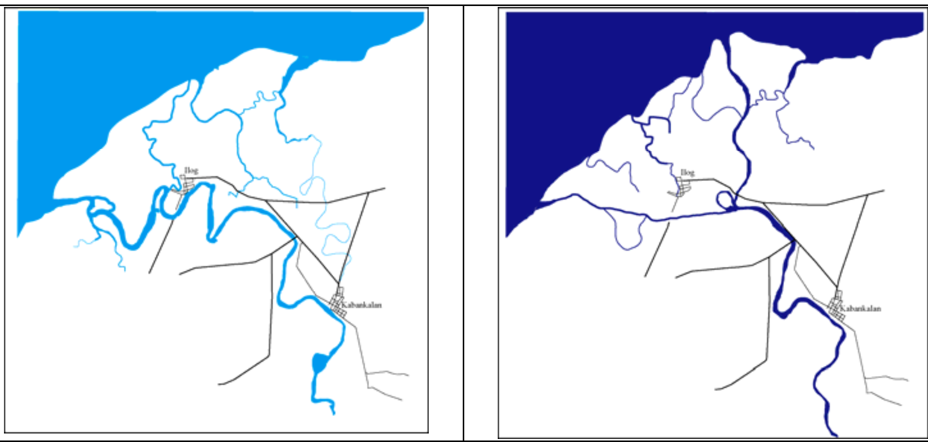
According to the field reconnaissance and the interview survey with the residents, the flood overflow of the Ilog-Hilabangan River has the following particular characteristics:

(1) Flooding inundated in low-lying areas annually occurred together with typhoons passing through the region. During a Typhoon in 2009, river water almost reached at the top of revetment located in Kabankalan City along the river course.

(2) Flood conditions of Ilog Municipality are perennial throughout rainy season. Thus part of the residents living in the municipality tends to be sick and tired with the clammy conditions and actual damages.

(3) A Sugarcane Mill Factory located at right bank of the river course is a key and important facility in the region and plagued by flood damage. In the second stakeholders’ meeting, the protection works against flood for this facility is strongly required.

(4) Old Ilog River (Consuelo) as mainstream course in the lowest stretch of Ilog-Hilabangan River before 1950’s has narrowed despite due efforts of cut-off and dredging by DPWH. However, the recent flood flows have eroded the land and its main course has changed again toward Old Ilog River.



River Course in 1950's	River Course in 2005

Figure R 7.1 Comparison of River Flow in Estuary of Ilog-Hilaban River

Taking the above items into consideration, the following three (3) measures are contemplated as the eligible potential measures against river-overflow flood for the targeted core areas in the Study Area: (1) River Improvement Works along Kabankalan City; (2) Construction of Ring Dike to protect Ilog Area; and (3) Dredging Works around Estuary Area. The details of these potential measures are as described below.

(1) River Improvement Works along Kabankalan City (Construction of Flood Protection Dike and Widening of River Channel)

At first, flood protection dike on the city proper side (right bank) along the river course to protect the 25-year flood shall be considered.

Secondary, widening of existing river channel shall be considered. Basically, the width of new channel will be secured to confine 25-year flood in the river channel. The width of new channel to be excavated in sector loan project depends on the consensus of the stakeholders and allowance of the budget. In this connection, the maximum width fir widening of the river channel shall be restricted in accordance with the proposed width as standard cross section in 1991 M/P. Remaining width and sections of which the works will have been included in the sector loan project shall be controlled under revised land use plan as a part of non-structural measures.

In addition, flood protection dike and widening of river channel shall be considered as certain combined measures in the alternative studies taking into consideration suitable hydraulic, appropriate social and affordable financial conditions.

(2) Construction of Ring Dike to protect Ilog Area

The construction of Ring Dike around municipal proper area of Ilog shall be considered as first recommended alternatives. However, another alternative in which the ring dike around proper area of Ilog is not constructed has been studied since the community of Ilog is anxious to decouple the close community into two, namely protected and unprotected areas.

(3) Dredging Works around Estuary Area of Ilog-Hilabangan River and Old Ilog River

Judging from river longitudinal and cross sectional survey, sedimentation has proceeded in estuary areas of Ilog-Hilabagan River. The dredging works shall be considered to sustain the riverbed and increase the flow capacity of river system. The dredging works will contribute to flood damage mitigation for not only core areas but also other low-lying areas.

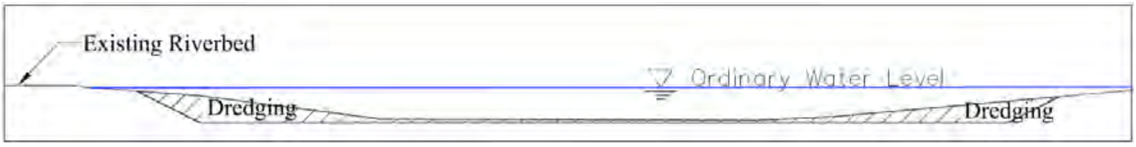


Figure R 7.2 Typical Cross Section of Dredging Works

7.1.3 Alternative Flood Mitigation Plans against River-overflow

The combination of potential flood mitigation measures is proposed as alternative flood mitigation measures against river-overflow flood, as described in the preceding Subsection 7.1.2. The alternative measures thus proposed are as listed below.

Table R 7.1 Alternative Flood Mitigation Plans against River-Overflow

Alternatives	Widening of River Channel	Kabankalan Dike (Right Side) and Sugarcane Mill Dike (Left Side)	Ring Dike for Ilog Municipal Proper	Dredging Works in Estuary
Alt-I1	●	●	●	●
Alt-I2		●	●	●
Alt-I3		●	●	
Alt-I4		●		●

Note: ● : Adoption in the Alternative

The location and extent of each alternative are shown in Figure 7.1 to 7.4.

7.1.4 Flood Simulation Analysis

(1) Purpose of Analysis

The flood inundation analysis was carried out on several scales of flood, aiming mainly as follows:

(a) To define the probable flood inundation extent, inundation area, inundation depth and inundation duration that could be used as essential information for evaluation of the effect of alternative flood mitigation plans for river overflow.

(b) To estimate flood damage based on the results of hydraulic and land use analyses.

(2) Simulation Results

As the result of flood inundation analysis, the maximum extent and depth of inundation under the without and with-protection situations are as summarized in the table below. Simulation results are shown in Table 7.1 and Figure 7.5 to 7.8 attached.

Table R 7.2 Flood Inundation Area

	Extent of Inundation Area (km2)					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Without Project	27.87	33.02	54.87	60.13	63.63	66.84
Alt-I2 (W/ Dike&Ring Dike)	27.04	30.01	38.93	44.14	63.63	66.84
Alt-I3 (W/ Dike & Ring Dike & Dredging)	26.71	29.68	37.29	42.14	63.63	66.84
Alt-I4 (W/ Dike & Dredging)	27.18	31.14	39.23	44.56	63.63	66.84

Alt-I2 is proposed to protect only Kabankalan City area and Municipality of Ilog area as a core area. However, these core area protection cause adverse effect on the other river side and downstream of Kabankalana City as shown in Figure 7.6.

Alt-I3, which has measures of Alt-I2 and river dredging, is proposed to avert the said negative impact. Figure 7.7 shows that the extent of inundation area and depth is mitigated to the current condition in non-protected area.

Ring dike is proposed as an optimum counter measure to protect Municipality of Ilog from flood which has various causes such as over flow of Ilog River and Old Ilog River, flood water from upstream of Ilog River and inland flood in and around Ilog Area. However, the ring dike was not accepted in the Stakeholder’s meeting held in Kabankalan City (refer to IEE Report).

Further river dredging is studied instead of ring dike to avert negative impact of diking system along Kabankalan city. Ilog main channel dredging and/or Old Ilog River dredging are examined and then the latter which has less dredging amount is adopted as Alt-I4. Simulation result of alt-I4 is shown in Figure 7.8.

7.1.5 Optimum Structural Mitigation Plan (Summary of Simulation Analysis)

The optimum flood mitigation plan was determined through comparison of the alternative schemes not only to control the 25-year return period probable flood in the core area but also not to affect other areas based on the flood simulation analysis described in sub-section 7.1.4. In addition to flood simulation analysis, other items should also be considered and the summary of comparisons is shown in the table below:

Table R 7.3 Summary of Comparative Study on Alternative Flood Mitigation Plan for the Low-lying Area in Ilog-Hilabangan River Basin

<table>
<tr><td>Item</td><td>Without Project</td><td>Alternative I-1</td><td>Alternative I-2</td><td>Alternative I-3</td><td>Alternative I-4</td></tr>
<tr><td>Target Flood</td><td>-</td><td>25~100-year</td><td>25-year</td><td>25-year</td><td>25-year</td></tr>
<tr><td>Concept</td><td>No Improvement</td><td>Floods can be controlled for whole low-lying area</td><td>The project protects the core areas K.K & Ilog</td><td>The project protects the core areas K.K & Ilog so as not to affect other areas.</td><td>The project protects the core areas K.K so as not to affect other areas.</td></tr>
<tr><td>Const. Cost</td><td>-</td><td>4.0 billion</td><td>1.8 billion</td><td>2.2 billion</td><td>2.0 billion</td></tr>
<tr><td>Land Acquisition</td><td>-</td><td>Approx.200</td><td>Approx. 60ha</td><td>Approx. 60ha</td><td>Appprox.43has</td></tr>
<tr><td>House Relocation</td><td>-</td><td>Approx. 500</td><td>Approx. 60</td><td>Approx. 60</td><td>Approx. 60</td></tr>
<tr><td>Advantage</td><td>No. L/A H/R</td><td>Whole area will be protected.</td><td>Core Areas will be protected.
Minimum cost.</td><td>Core Areas will be protected.</td><td>K.K will be protected</td></tr>
<tr><td rowspan="2">Disadvantage</td><td rowspan="2">No improve</td><td rowspan="2">Huge Cost
Huge Social Issues due to project.</td><td>Flood condition in unprotected area slightly might get worse.</td><td>It is necessary to secure disposal site for surplus soil</td><td rowspan="2">Ilog area will not improved largely
It is necessary to secure disposal site for surplus soil</td></tr>
<tr><td colspan="2">Ilog community might be segmentalized by ring dike.</td></tr>
<tr><td rowspan="2">Evaluation</td><td>Not recommend</td><td>Not recommend</td><td>Not recommend</td><td>the most Recommended</td><td>Recommended</td></tr>
<tr><td colspan="5">Alternative I-4 is selected as the most suitable Alternative.</td></tr>
</table>

Note : K.K: Kabankalan L/A: Land Acquisition H/R: House Relocation

As the results, the following detail description for the facilities to be executed in the Sector Loan was made:

(1) Alignment of Flood Protection Dike

In accordance with the relation between the results of flood simulation and the existing land use condition as well as the CLUP, the alignments of flood protection dike for each core area or facilities, such as built-up area of Kabankalan and Ilog and Sugarcane Mill Factory, are determined. Figure 7.4 shows the appropriate alignments of flood protection diking system and Table R 7.3 indicates the summary of features of proposed diking system as shown below:

Table R 7.4 Summary of Alignment of Flood Protection Dike Proposed

River	Side	Location	Quantity
Ilog-Hilabangan River			
	Right Bank		
		Kabankalan	L= 5,600 m
	Left Bank		
		Sugarcane Mill Factory	L= 2,750 m
	Road Construction		
		Ilog	L= 3,300 m
Hilabangan River			
	Right Bank		
		Kabankalan	L= 1,000 m
Total			L= 12,650 m

(2) Dredging

In addition to the construction of flood protection dike for core areas, lower stretch(es) of main channel or old Ilog channel shall be dredged so as not to get worse the flood condition in unprotected area by dike system.

There are two options for dredging works to sustain flood condition in unprotected area, one is to dredge main stretch with 100 meter in width and another is to dredge old Ilog riverbed instead of main stretch. As shown in Sub-section 7.1.4 Flood Simulation, the effects of two options are equivalent each other. In this connection, the Project will/may dredge in either of two options.

Table R 7.5 Summary of Proposed Dredging Work

Option	Dredged Section	Required Length to be Dredged	Assumed Volume of Required Dredging Works
Option-1	Main River Course	L= 10.0 km	V= 2.4 m^3
Option-2	Old Ilog Course	L= 6.7 km	V= 0.5 + 1.3 = 1.8 m^3
	Main River Course	L= 3.0 km	

(3) Other Consideration

(a) Drainage Outlet

At the locations where original drainage channels outflow on the alignment of new dikes, Drainage Sluices shall be installed to prevent floodwater in main stream from intruding into protected areas.

(b) Widening of River Channel

To smoothen the original flow alignment and decline the flood water level, critical meandering sections shall be widened as shown in Figure 7.4. In this connection, approximately 28 has of the farmland shall be acquired by the Project.

(4) Summary of Project Component

Based on the optimum measures for the structural measures to mitigate flood in the core areas under the Sector Loan Project are summarized in table below.

Table R 7.6 Summary of Proposed Work

Component	Length (m)	Height/ Depth (m)	Width (m)	Volume (m3)
Dike(1)_Right Bank at Kabankalan	5,600	1~3m	Crown: 6m	265 thousands
Dike(2)_Left Bank at Sugarcane Mill	2,750	2~4m	Crown: 6m	275 thousands
Dike(3)_Right Bank at Hilabangan	1,000	1~2m	Crown: 6m	60 thousands
Excavation (1)	-	-	-	200 thousands
Excavation (2)	-	-	-	150 thousands
Excavation (3)	-	-	-	150 thousands
Raising of Road (Existing/New)	3,300	1~4m	Crown: 6m	250 thousands
Dredging (1)	6.5km	0~2m	Bed 50~100	1,300 thousands
Total (Embankment)	12,650	1~4m	Crown: 6m	850 thousands
(Excavation/Dredging)	-			1,800 thousands
Drainage Sluice	1 at the Kabankalan (BxH=3.0x3.0mx2)			

K.City: Kabankalan City, M.I: Municipality of Ilog

7.1.6 Preliminary Design of River Facilities

(1) Flood Protection Dike

(a) Dimension of Dike

The dimension of dike has been set to pass the design discharge safely and the elevation of top of the dike has been obtained by adding a freeboard to the H.W.L. The material of flood protection of dike is basically embankment type to adapt the condition such as climate change and utilization of the crown of the dike as service road except for the lowest downstream section of Kabankalan Stretch since original river channel is narrower compared with other river sections.

The standard design section of river dike is shown in Figure 7.9. Basically, the elevation of top of embankment set the elevation of proposed design dike level in 1990 M/P. In case the calculated high water level (H.W.L.) of the 25-year return period flood is higher than original (H.W.L.), the elevation of dike is raised by the parapet wall on the crown of embankment. The dike height is determined by adding 1.2m of a freeboard to the design high water level which is reckoned on the design flood discharge. The freeboard, which is the margin of height to guard against overtopping and wave wash, is given by the design flood discharge.

Top width complying with DPWH Standard should be planned in consideration of dike stabilities and function of road during maintenance operations. Top width is also given by the design flood discharge in accordance with DPWH Standards.

The side slopes on both land side and river side of the dike are designed as 1:2.0 (V:H) from the aspect of dike stability. Berms are provided along the slopes of high dikes surpassing 5~10m in height in terms of the improvement of stability of dikes-self against slope failure as shown in Figure 7.9.

(b) Slope Protection on Dike

For the protection of dike against slope erosion or scouring, the revetment structure is applied on the designated slopes of river side. The proposed/designated alignments of revetment to be installed are illustrated in Figure 7.10.

Revetment is designed with the use of wet stone masonry (grouted riprap type) (0.25~0.3m of thickness). The standard design section of revetment is shown in Figure 7.10. The base concrete of revetment should be set to prevent sliding failure of wet stone masonry and shall be constructed in the dry condition.

(2) Drainage Sluice

As explained above, drainage sluices are placed at original outlets of drainage channel from protected areas. In this regard, the drainage sluice passing under the dike shall also be designed to prevent flood of the Ilog-Hilabangan River water from intruding into protected areas by flood protection dike.

The standard design of sluice gate(s), classified into two types (Type A and Type B) in accordance with the dimension, are shown in Figure 7.11 respectively. Type A, which placed for the outlet of small drainage channels, has one box culvert of 1.5m by 1.5m. Type B, which is placed for natural drainage channel originally flowing into the Ilog-Hilabangan River on right bank, has two barrels of 3.0m by 3.0m.

7.1.7 Construction Plan

(1) Basic Policy of Construction Plan

(a) Scope of Works for Construction of Proposed Structural Plan

Proposed structural component is manly composed of the construction of flood protection dike with appurtenant facilities, such as revetment on embankment dike and drainage sluices as well as dredging works in lowest reaches. Their works aims to safely flow the design discharge toward sea downstream.

The work items consists of six (6) major facilities; namely dredging work in the lowest channel(s), embankment work for construction of flood protection dike, masonry work for revetment, concrete work for revetment, drainage facilities and fabrication/installation of sluice gate and driving work of Steel Sheet Pile (SSP) for retrofitting of existing slope in the lowest section of Kabankalan Dike System.

These works will ideally be undertaken during 2011-2013 as shown in Table R7.11.

(b) Major Features of Facilities and Construction Procedure/Method

Major requirements for the works are as follows.

- The type of dike proposed is mainly embankment type with masonry protection on river side slope.
- The dredging works in the lowest reach(es) are one of main works with to secure flow area.
- Drainage sluice is a box culvert passing under dike with installation of slide gates.

Major part of construction work will be earthwork. Construction procedure/method of earthwork shall be as follows.

- As for embankment works, it is necessary to make sure that the compaction retains the required consistency. Earth fill work should be implemented in accordance with the compaction regulations to maintain such strength against settlement, shearing force and piping.
- In this connection, excavated materials in the towhead area will be used for filling material.
- Earthwork equipments are bulldozers and backhoes for excavation, dump trucks or barges for transport, and tamping rollers for compaction.
- Volume of excavated materials is estimated approximately 1.8 millionm^3. 0.85 million m^3 of that is reused for constructing the dike and appurtenant facilities, etc. The remaining is transported to the dumping site, graded and compacted.

(c) Disposal and Dumping Sites

According to the discussion about disposal/dumping site/method with LGUs, following issues have been developed.

- Land developments for the industrialization projects are expected carried out in the City of Kabankalan in near future.
- It is expected that surplus soil of construction work due to the excavation and dredging works would be welcomed by those land development. If excavated soil is offered to land developers without any charge, they would utilize it as their embankment/filling material, and then disposal cost of surplus soil would be considered within hauling and spreading works in the project cost.
- According to the land use plan established by the Kabankalan City government, the areas around project sites are categorized into industrial area, in particular on right bank of Ilog-Hilabangan River.

Taking conditions described above into consideration, disposal plan of surplus excavated soil in this project shall be as follows.

- Some amount of excavated soil shall be carried into the construction of embankment dike, since the construction of flood protection dike will be carried out at the same time. Average hailing distance shall be about 2km in this case.
- On condition that surplus excavated soil would be utilized as embankment/filling material for land development, disposal cost consists of loading, hauling (average distance = 5km), unloading and spreading works in this cost estimation.

Location map of expected disposal and dumping sites in accordance with the city development is shown in Figure 7.12 attached.

(2) Basic Condition of Construction Schedule

The construction schedules to be prepared are based on the scope of works defined above with the working quantities for the each work item through the feasibility study. Each of the scheduled activities contains labor to be assigned and equipment resources considered with the most appropriate method to the particular site conditions and requirement of the work.

In F/S study, unit construction schedules for each work item has been analyzed and fixed in this section hereinafter.

(a) Work Quantity of Major Construction Work Items

The major construction work items are divided into following five (5) main work items: (1) Earth Works (i.e. Dredging, Excavation and Embankment), (2) Construction of Drainage Ditch (i.e. concrete work), (3) Construction of drainage sluices (i.e. concrete work and gate installation), (4) Revetment Works (i.e. masonry and concrete works), and (5) SSP Revetment Works. The work items and their work volumes are as listed below:

Table R 7.7 Major Construction Works

Ilog-Hilabangan Project *Major* Work Description		Quantity	Unit
Earth Work			
	Clearing and Grubbing	756,566	m^2
	Removal and Stripping of Topsoil	446,566	m^2
	Excavation, Open Cut -1	22,247	m^3
	Excavation and Loading by Backhoe	1,756,072	m^3
	Spreading	1,018,574	m^3
	Dike Embankment	849,059	m^3
	Grass Sodding	251,232	m^2
Drainage Ditch (BxH=0.3m x 0.3m)			
	Concrete Work for Small Structure-2	2,390	m^3
	Concrete Work for Leveling Concrete-2	1,062	m^3
Drainage Sluice			
	Concrete Work for Reinforced Concrete-1	594	m^3
	Concrete Work for Leveling Concrete-2	21	m^3
	Formwork F1 (for Large Sized Structure)	1,095	m^2
	Installation of 3.0x3.0m Slide Gate	2	nos
	Steel Sheet Pile Type II	219	m^2
	Reinforcing Bar (Grade 60)	59	ton
Revetment Works			
	Demolition & Removal of Existing Revetment	36,769	m^2
	Stone Masonry/Wet Stone Masonry-1	76,896	m^2
	Gravel Bedding and Backfill	11,534	m^3
	Gabion Mattress, w/ Filter Cloth Bedding	7,811	m^3
	Rock Fill, Type A & B (Cobble Stone)	53,964	m^3
	Steel Sheet Pile Type IIIA, Furnishing and Driving	5,000	m^2
	Concrete Work for Small Structure-2	1,885	m^3
	Formwork F2 (for Small Sized Structure)	9,163	m^2
	Reinforcing Bar (Grade 60)	151	ton

(b) Climate Condition

The characteristic of climate at the project area is dominated by the rainy season from May to October and dry season for the rest of the months. The total rainfall from May to October accounts for about 80% of the annual rainfall.

(c) Available Working Time

In determining the number of working days available for construction activities, the following factors are considered:

- Working day per week, Working hours per day
- Public Holiday
- Rainfall
- Type of Construction Activity

(i) Working Day per Week, Working Hours per Day

The normal workweek consisting of six (6) working days is adopted for developing all calendars in the sure track program. All construction schedules are based on an 8-hour per a working day.

(ii) Public Holiday

The following days are excluded from the working calendars as public holidays:

Holiday	Date
New Year's Day	January 1
Maundy Thursday	On day in March / April
Good Friday	On day in March / April
Labor Day	May 1
Independence Day	June 12
National Heroes Day	August 30
All Souls Day	November 1
Bonifasio Day	November 30
Christmas Day	December 25
Rizal Day	December 30
Special Holiday	December 31
Sub-total of Public Holiday	11 days

In addition, an allowance is made for four (4) extra days that may be declared non-working by government on account of special events. Thus, total number of non-working days accounts for 15 days in this study.

(iii) Daily Rainfall and Annual Working Day

The time lost due to rainfall was based from the rainfall data and the number of rainy days. It is recognized that the effect of rain on different types of construction activities will vary.

Based on the previous construction plans under JICA or JBIC projects, the total number of working days available annually for different activities is established by incorporating all assessed time losses into the eight (8) items shown in the following table:

Table R 7.8 Annual Working Day for Major Work Items

Work Item	Sunday	Public Holiday	Rainy at Weekday	Suspension Day	Annual Working day
Structural Excavation	52	15	51	12	235
Gabion Works	52	15	51	12	235
Embankment /Backfill	52	15	51	12	235
Concrete Work	52	15	51	-	247
Revetment Work	52	15	51	-	247
Grading Works	52	15	51	-	247
Canal Facility Work	52	15	51	12	235
Road Work	52	15	51	12	235

(d) Works Productivity

Major equipment items were selected based on the equipment capacity quoted from the publication of the Association of Construction and Equipment Lessors, Inc. (Equipment Guidebook 2001, edition 22, ACEL). Labor requirement were assessed using a mix of productivity rates provided through the current practice and the rates recorded on similar overseas projects.

(i) Earth Works

The performance of the construction machine is assumed as listed in the flowing table taking the most suitable machine combination and the reuse of the excavation soil.

Based on the performance of the construction machine, the construction period of earthwork was estimated. Due to huge volume of earth work, critical paths are attributed to the construction schedule of earth work for each retarding basin.

Table R 7.9 Performance of Construction Machines in Earth Work

Item of Earth Work	Major Equipment	Performance Capacity	Remarks
Common Excavation	Bulldozer (32t)	146 m^3/hr	
Loading	Backhoe (1.0m^3)	104 m^3/hr	
Hauling	Dump Track (10t)	30.8 m^3/hr	Distance: 0.5 km.
	Dump Track (10t)	8.0 m^3/hr	Distance: 8 km.
	Dump Track (10t)	6.7 m^3/hr	Distance: 12 km.
Grading & Compaction	Bulldozer (21ft)	100 m^3/hr	Disposal site, Road work
Compaction of Embankment	Tamping Roller	55 m^3/hr	Road Work

(ii) Concrete Work and Revetment Work

Concrete works and revetment (masonry) works are also main construction works other than earth work. The construction period of concrete of the small structure and placing work of masonry are estimated on the basis of the following assumptions:

Table R 7.10 Performance of Main Construction Work

Item of Work	Daily Capacity	Remarks
Concrete Work	60 m^3/day/party	Depending on Concrete Pump
Gabion Work	75 m^3/day/party	t=500 mm, Equivalent to 37 m^3/day/party
Revetment Work (1:2.0)	38 m^3/day/party	Wet Stone Masonry
Revetment Work (1:2.0)	13 m^3/day/party	Concrete Block

(3) Construction Schedule

In accordance with the program and strategy mentioned above, the entire construction period for the major work components of the optimum structural plan was assumed as shown in the following table.

Table R 7.11 Entire Construction Schedule for Ilog-Hilabangan River Improvement Project

Working Item	Unit	Q'ty	Year : 1												Year : 2												Year : 3											
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Mobilization & Preparatory Work	L.S.	1																																				
Earth Work																																						
Clearing & Grubbing / Stripping of Top Soil	m^2	756,566																																				
Excavation / Dredging	m^3	1,778,320																																				
Embankment	m^3	849,059																																				
Disposal of Soil	m^3	1,018,574																																				
Drainage Ditch (BxH=0.3m x 0.3m)																																						
Concrete (for Small Structure)	m^3	2,390																																				
Leveling Concrete	m^3	1,062																																				
Form Work for Concrete	m^2	19,920																																				
Form Work for Leveling Concrete	m^2	2,656																																				
Drainage Sluice																																						
Reinforced Concrete, Staging, Supporting	m^3	594																																				
Leveling Concrete	m^3	21																																				
Formwork for Concrete	m^2	1,095																																				
Formwork for Leveling Concrete	m^2	11																																				
Supporting	m^3	982																																				
Gate Installation	pcs	2																																				
SSP	m^2	219																																				
Re-Bar	ton	59																																				
Revetment (1:3.0 – 1:2.0)																																						
Wet Stone Masonry (t=200mm)	m^2	76,896																																				
Gravel Bedding	m^3	11,534																																				
Concrete (Small Structure)	m^3	1,885																																				
FormWork for Concrete	m^2	9,163																																				
Re-Bar	ton	151																																				
SSP Revetment																																						
SSP Furnishing and Driving	m^2	5,000																																				
Gabion Mattress																																						
Gabion Mattress	m^3	7,811																																				
Others																																						
Grass Sodding	m^2	251,232																																				
Other Ancillary Works	L.S.	1																																				
Site Clearance / Cleaning	L.S.	1																																				
Demoblization	L.S.	1																																				
Commpletion																																						☆

7.1.8 Cost Estimation

(1) Constitution and Conditions of Project Cost

Project cost has been estimated under the following conditions:

(a) Construction Base Cost

Construction base cost is composed of direct cost estimated based on the work quantities multiplied by unit cost, and indirect cost which is estimated in percentage.

(b) Price Level

Price level is as of August 2009.

(c) Contingencies

Price escalation and physical contingencies are assumed as follows:

Annual Price Escalation: 5.20% for Local Currency Portion;
2.10% for Foreign Currency Portion

Physical Contingency : 10% of the sum of construction base cost, compensation cost and engineering service cost

(d) Currency Conversion Rate

Currency conversion rates are assumed at USD1.00 = JPY93.67 = PHP49.70 as of the end of August 2009.

(e) Compensation Cost

Compensation cost consists of the costs of house evacuation and land acquisition. These costs are estimated on the basis of actual market value obtained from the Interview Survey in Kabankalan City and Ilog Municipality of land and properties assessed for taxation purposes in the locality and the actual cost of past or ongoing house evacuation activities, as well as the ongoing projects of similar nature under JBIC and DPWH such as the Iloilo Flood Control Project and the Pasig-Marikina River Channel Improvement Project (River-Overflow Flood Mitigation Projects).

The compensation unit costs are enumerated below.

Table R 7.12 Adopted Compensation Cost for F/S Study

Item of Cost	Site/Condition	Unit Cost Php/m2 for Land , Php/(house/family) for House		
		Zonal Value	Market Price *2	Adopted Price
Land Acquisition	Right Bank (Kabankalan)	300	500	500
	Left Bank (Kabankalan)	50~100	100	100
	Ilog	50~100	100	100
House Relocation	Formal Residents	-	-	350,000
	Informal Dwellers	-	-	50,000
Support Activities	All Concerned Families	-	-	50,000

Note *1 : Results of hearing survey with Officers concerned based on in-real land sale.

(f) Administration Cost

Administration Cost (Project Owner’s Expense for management) of the Project is estimated at 5% of the total sum of construction cost and compensation cost.

(g) Engineering Service Cost

Engineering service cost is prepared for the detailed engineering design and construction supervision services at 6% and 10% respectively of construction base cost.

(h) Tax, etc.

12% of the sum of construction base cost and engineering service cost is added to project cost for VAT, etc.

(i) Constitution of Project Cost

Based on conditions described above, the constitution of the project cost is given a below:

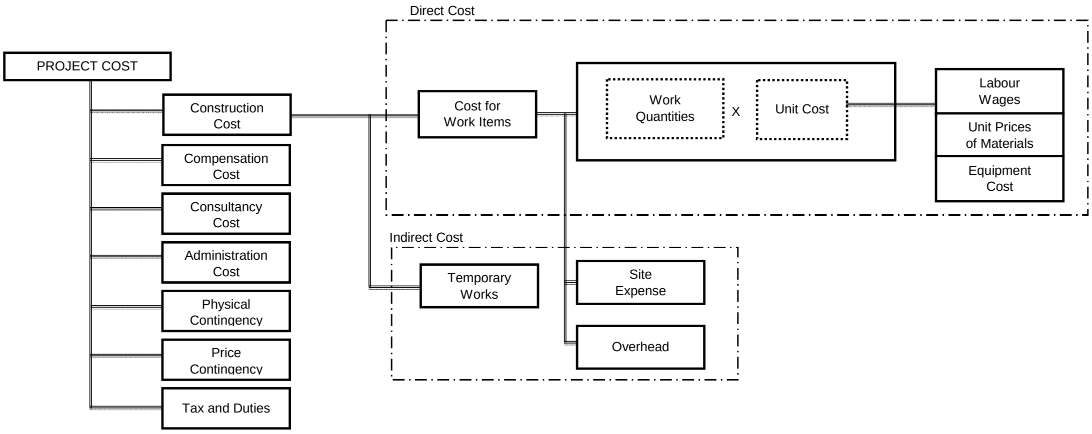


Figure R 7.3 Constitution of Project Cost

(2) Construction Base Cost

The construction base cost is estimated as the sum of the direct cost and the indirect cost.

(a) Direct Cost

The estimate for direct costs is performed based on the quantities of all construction tasks shown on figures and described in the project requirements. The direct cost includes all of countable element due to the type, size, design, construction procedures and quality of the intended structure, which are taken into account when deriving the cost for each work item. The costs are estimated on the unit cost basis as shown below:

Direct Cost = Sigma (Unit Cost for a Payment Item x Work Quantity for a Payment Item). The unit cost can be estimated based on the basic costs such as labor wage, unit prices of materials and equipment cost.

In direct cost, “Overhead & Profit” shall be included. “Overhead” is the expense for the main and branch office support of the Contractor composed of director’s remuneration, retirement allowances, communication fee, advertising, research activities, social expense, profit and insurance. “Profit” is the profit of the contractor. 16 % of the sum of the direct cost, “Overhead & Profit” is adopted.

(b) Indirect Cost

The indirect cost on the project is an integral part of each estimate. “Temporary works”, “Site expense” and “Mobilization & Demobilization” are considered as the indirect cost.

"Temporary works" includes items such as temporary buildings, electrical facilities, water supply system, access road construction and maintenance, and temporary utilities. 10 % of the sum of the direct cost is adopted.

"Site expense" includes the cost items such as salary and allowance of the Contractor's employee, job office expenses, consumables, small tools and insurance at site. 10 % of the cost for the direct cost and "Temporary works" is adopted.

"Mobilization & Demobilization" includes the costs such as the movement of the contractor's equipment, facilities and man powers at the commencement and retreat of the Project. 1 % of the cost for the direct cost and "Temporary works" is adopted.

(3) Project Cost

Based on the above assumptions, the project cost estimated for the optimum structural flood mitigation plan is estimated at Php. 2,744 million in total, which is divided into (1) Php. 1,611 million for the construction base cost, (2) Php. 16 million for the compensation cost and (3) Php. 258 million for the consultancy service, (4) Php. 81 million for the administration cost, (5) Php. 397 million for the contingencies and (6) Php. 281 million for the value added tax, etc. The breakdown of the project cost is given in Tables 7.2 to 7.4, and as tabulated below:

Table R 7.13 Project Cost for the Proposed Structural Flood Mitigation Measures

Objective	Item	Description	Cost (mil. P)
Ilog-Hilabangan River Improvement Project			
	Construction Base Cost	Civil	1,611
	Compensation Cost	House/Support	6
		Land	10
	Consultancy Services	D/D & S/V	258
	Administration	5% of Civil& Compensation	81
	Subtotal		1,966
	Contingencies	Physical for Civil, D/D & S/V	187
		Physical for Compensation	2
		Price for Civil, D/D & S/V	288
		Price for Comp. & Admin.	20
	Value Added Tax, etc	12% of Civil & Consultancy	281
Grand Total			2,744

(4) Operation and Maintenance Cost

The operation and maintenance cost mainly consist of costs for Patrol/Inspection Work, Maintenance Work and Operation Work. These costs include facility maintenance cost, cost for the administrative and logistic support, cost for operation cost in case of flooding, cost for repair of the structures, and other miscellaneous expenses but exclusive for heavy damage due to calamities, such as seismic forces and huge flood.

The annual operation and maintenance cost is estimated at Php 5.69 million upon completion of the three retarding basin as listed in the table below.

Table R 7.14 O&M Cost for the Proposed Structural Flood Mitigation Measures

Work Item	Annual Cost (mil. P)	Remarks
Patrol/Inspection	0.01	Inspection & Preventive
Maintenance	5.44	Annual Repair
Operation	0.24	During Flood (Mean Annual Amount)
Total	5.69	

Details of operation and maintenance cost for the structural plan are given in Table 7.5. The necessary annual budget proposed should be assured from both budgets of DPWH, Province and LGU with approval and concurrence of FMC or similar mandatory committee for flood mitigation activities.

7.2 Economic Evaluation of Project

7.2.1 Methodology

Taking NEDA policy into consideration, economic evaluation is made according to the following steps in this kind of project:

1) Identify the most likely damage item.
2) Estimate the basic unit value per unit and/or unit area (amount/unit, or amount/ha) for each damage item.
3) Evaluate the damages of existing floods to be the basis of evaluation.
4) Estimate the annual average flood damages by means of probability analysis for each return period under the “With-” and “Without-Project” concept.
5) Identify the economic benefit as differences of damages in the “With-” and “Without-Project” conditions.
6) Compare the economic benefit with the economic cost of project, and evaluate project feasibility by means of some indices such as the economic internal rate of return (EIRR), the net present value (B – C), and the B/C Ratio.

The Economic Internal Rate of Return (EIRR) is calculated using the cash flow of economic cost and economic benefit during the project life. This EIRR is defined by the following formula:

$$\sum_{t=1}^{t=T} \frac{C_t}{(1+R_e)^t} = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_e)^t}$$

Where, T = the last year of the project life;

Ct = an annual economic cost flow of the project under study in year t;

Bt = annual benefit flow derived from the project in year t; and

Re = the EIRR (a discount rate to be used for costs resulting in the same amount of benefit in terms of present value).

When the resulting EIRR is of the same rate as or higher than the discount rate applied for the calculation of present value of both the benefit and cost, the project has the feasibility for execution.

The NPV is expressed as "B-C" and defined by the following formula:

$$NPV = B - C = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_e)^t} - \sum_{t=1}^{t=T} \frac{C_t}{(1+R_e)^t}$$

If "B-C" (subtract present value of cost from present value of the benefit) would become positive, it means that the project under the Study will have a reliability to execute.

The B/C Ratio is defined by the following formula:

$$B/C = \sum_{t=1}^{t=T} \frac{B_t}{(1+R_e)^t} \Bigg/ \sum_{t=1}^{t=T} \frac{C_t}{(1+R_e)^t}$$

It means that, if the rate of the present value of the benefit divided by the present value of the cost would become more than "1.00", then the project under study will have a reliability to execute.

Project life is assumed at 50 years after completion of river channel improvement works and 30 years after completion of inland drainage works for the Project. Cash flow of the economic cost and economic benefit should be made from the first year of the construction works to the end of each project life.

In this case, annual operation and maintenance cost (O&M Cost) should be taken into account, and some amount of replacement cost, if any, should also be taken into consideration since some parts of the initial works for the facilities may not be durable during the project life.

7.2.2 Basic Unit for Estimation of Economic Benefit

(1) Damages to Buildings, Household Effects, Durable Assets and Inventory Stocks in Built-Up Area

First of all, the number of buildings is counted by City Profile according to the type of building, i.e., (1) Residential/Housing units; (2) Manufacturing; (3) Wholesale and Retail Trade (Shops); (4) Hotels and Restaurants; (5) Real Estate and Business Activities (Offices); (6) Education Facilities; and (7) Buildings for Health and Social Works, because property values vary according to the type of building. In this case, the share rate of each type of building to the total number of buildings is assumed in the Study.

The following table shows the share rates of each type of building per unit area:

Table R 7.15 Share Rate of Buildings by Type

Kind of Building	Share Rate
Total	100.00%
1. Housing Units	94.03%
2. Manufacturing	0.60%
3. Wholesale & Retail Trade	2.66%
4. Hotels & Restaurants	0.60%
5. Real Estate & Offices	0.78%
6. Education Facilities	0.45%
7. Health/Medical Facilities	0.90%

Source: Kabankalan City

As basic units for the estimation of damages, the figures shown in the following table are to be applied. These figures are based on the said similar projects in the Philippines modified by the magnitude of buildings, the ratio of gross regional domestic product (GRDP), results of site investigation and interview with the officials concerned city/municipality of Kabankalan and Ilog.

Table R 7.16 Economic Basic Units for the Estimation of Flood Damage

(Unit: Pesos/unit)

Assets	Building (*1) (Pesos/ unit)	Durable Assets (Pesos/unit)	H. Effects/ Inv. Stock (Pesos/unit)	Value Added (*2) (Pesos/day)	Damageable Value (Pesos/ha)	Daily Amount (*3) (Pesos/day)
1. Residence						
a. Residential Unit	198,886		133,603			1,280
2. Industrial, Educational and Medical Facilities						
a. Manufacturing	1,473,300	5,052,097	5,591,143	17,087		
b. Wholesale & Retail Trade	389,700	950,321	6,767,517	10,132		
c. Hotels & Restaurants	1,406,100	852	63,185	7,824		
d. Real Estate & Business Activities	886,950	603	275,480	38,681		
e. Education	1,611,900	386,856	28,207	0		
f. Health & Social Work	996,000	257,032	87,457	0		
3. Crop Production						
a. Palay						
b. Corn						
c. Sugarcane					122,578	

Note: *1: Per square meter cost is derived using 1st quarter 2009 index of construction cost of NSO, formula used based on NEDA guidelines

*2: VA is calculated based on not actual business days of 250 days but 365 calendar days.

*3: In residence, the daily amount for cleaning damaged house is equivalent to daily income of an average family because they should stop working for cleaning.

Furthermore, the following table shows the damage rates for the estimation of damages according to inundation depth. In this case, inundation duration is already taken into consideration assuming it to be 2 days on average for agricultural crops.

Table R 7.17 Damage Rate by Inundation Depth

Item		Inundation Depth					
		Below Floor/Ground Level	Over Floor/Ground Level				
			Less than 0.5m	0.5-0.9m	1.0-1.9m	2.0-2.9m	More than 3.0m
1	Building						
a	Building*[1]	0.000	0.092	0.119	0.266	0.380	0.834
2	Residence						
a.	Household Effects	0.000	0.145	0.326	0.508	0.928	0.991
3	Industrial, Educational and Medical Facilities						
a.	Depreciable Assets	-	0.232	0.453	0.789	0.966	0.995
b.	Inventory Stock	-	0.128	0.267	0.586	0.897	0.982
4	Crop Production *[2]						
a.	Lowland Crop	-	0.210	0.240	0.370	0.370	0.370
b.	Upland Crop	-	0.200	0.310	0.440	0.440	0.440

Note: *1 In case of all buildings, floor level is 15cm higher than the ground level, because t almost all buildings have the threshold of around 15cm in height in front of their entrances according to the field investigation.
*2 Assuming that inundation duration is 2 days on average.

(2) Income Losses due to Cleaning of Building and/or Houses and Business Suspension

Once flood occurs and houses are inundated, several days will be needed for cleaning the houses. In case of business activities, they should be suspended for several days. During these days, people's income is decreased because they stop working or businesses are suspended.

Average daily income per household (HH) is estimated at 1,280 pesos/day as of 2009 (estimated based on CPI) in Region II (CAGAYAN Region) according to the "Philippine Yearbook 2008" and as shown in Table R 7.15 above together with the average daily amount of value added tax for business activities. The average number of days needed for cleaning and business suspension are estimated, as shown in the following table.

Table R 7.18 Estimated Days for Cleaning and Business Suspension by Inundation Depth

Item		Inundation Depth					
		Below Floor Level	Above Floor Level				
			Less than 0.5m	0.5-0.99m	1.0-1.99m	2.0-2.99m	More than 3.0m
1.	Residence						
	Cleaning (days)	-	7.5	13.3	26.1	42.4	50.1
2.	Business Facilities						
	Suspension of Business (days)	-	4.4	6.3	10.3	16.8	22.6
	Stagnant Days of Business after Suspension*[1]		2.2	3.2	5.2	8.4	11.3
	Total		6.6	9.5	15.5	25.2	33.9

Note: *1 Businesses shall be suspended during the stagnant days.

(3) Damage to Industrial Estates

There are several large industries besides a small and medium-sized manufacturing. Damages due to floods also extend over these industrial areas. The damages are estimated as the statistical decrease in "value added" corporate income and the amount of value added income which is estimated for small scale and micro scale industries in the built-up areas. The following table gives a summary of the basic unit for estimation of damages. In this case, the industrial area is estimated by means of GIS.

Table R 7.19 Basic Unit for the Estimation of Damages to Industrial Estates

Unit Value Added of All Commercial Sectors in Built-Up Area (Pesos/ha./day)	Unit Value Added in Large-Scale Industries in Industrial Estate (Pesos/ha./day)
3,410 Pesos/ha./day (*1)	627,457 Pesos/ha./day (*2)

Remarks: (*1) [Unit value added of all commercial sectors in built-up area]
= [73,724 Pesos/day/unit (total of "value added" of all commercial sectors, 2.a~d in Table R 7.16)]
x [0.0302 unit/ha (total number of unit of all commercial sectors per area, b~e in Table R 7.15)]

(*2) [Unit value added in large-scale industries in industrial estate]
= [3,410 Pesos/ha./day (Unit value added of all commercial sectors in built-up area)]
x [184 = (value added of industries in industrial estate) / (value added of small/micro scale industries in built-up area)] (*3)

Source: (*3) 2008 Annual Survey of Philippine Business and Industry (by NCSO)

(4) Damage to Agricultural Crops

It is assumed that the damaged agricultural crops in irrigated areas are mainly "sugarcane" based on statistical records and the results of field investigation, while the damaged upland crops are mainly corn.

Farm gate prices of sugarcane are mentioned in Table R 7.14 as 122,578 pesos/ha estimated in the table below, and their damage rates are already indicated according to inundation depth in Table R 7.15.

Table R 7.20 Damageable unit price of Agriculture

	Crop Production (metric tons)	Area Harvested (ha)	Crop Yield (kg/ha)	Farmgate Prices (Pesos/kg)	Farmgate Prices (Pesos/ha)
Irrigated Palay	320,479	83,548	3,836		
Rainfed Palay	112,048	32,055	3,495		
Corn	51,949	50,205	1,035		
Sugarcane	11,487,560	157,735	72,828	1.68	122,578
Coconut	117,445	34,599	3,394		
Banana	83,729	9,503	8,811		

Source: Bureau of Agricultural statistics website, (www.bas.gov.ph)
*: Total in Negros Occidental Province

(5) Damage to Social Infrastructures (Roads, Bridges, Drainage Ditches)

Once flood occurs, social infrastructures such as roads, bridges, drainages sustain heavy damages. This is the other kind of damage to be checked. According to some previous flood control projects in the Philippines, the damage of social infrastructures is approximately 10% of direct damage. Therefore, the damage is assumed to be 10% of total amount of item (1) to (4) above in this Study.

(6) Damage to Fishery

It is assumed that once a flood occurs, the whole fishpond production will be damaged. Fishpond area is located at the downstream and the damage will not change between under without project condition and with project condition. Moreover, the benefit for project evaluation is estimated from the assumption of the damage with project and without project. Therefore, the fishery damage is not estimated in this study.

(7) Other Indirect Damages

Following items can be considered as indirect damage.

- Losses due to interruption of transport service and/or detour losses,
- Saving of expenses for the support of evacuees,
- Losses due to interference of supply from lifeline facility such as water, gas and electricity,
- Medical expenses (medical cost and/or fees for some of waterborne diseases may be people's burden), and
- etc.

However, further basic data such as traffic volume, estimation of evacuees including food, water, medicines, tents, blankets, dishes, etc are required for the estimation of above indirect damage requires.

In a previous flood control project report in the Philippines, indirect damage is approximately 10% to 30% of direct damage. Then, it is assumed to be 20% of the above total amount of item (1) to (4) as indirect damages in this Study.

7.2.3 Identification of Economic Benefit

The economic benefit is given as the difference between annual average damages in cases of "with project" and "without project," i.e., the economic benefit is to be the value of "average expected damage to be mitigated". For this purpose, annual average damages "with project" and "without project" should be estimated and the target year is set at the year 2020. In this connection, therefore, the said annual average damage is estimated in both cases of "2009 Land Use Status" (hereinafter referred to as "Present") and "2020 Land Use Status" (hereinafter referred to as "Future").

(1) Estimation of Flood Damage

The following table shows a summary of the total damage caused by each probable flood on each damage item mentioned above Section 7.2.2. Detail estimation sheet is tabulated in Table 7.6.

Table R 7.21 Estimated Damage

(Million Pesos)	Without Project		With Project (Alt-I4)	
Return Period	Present	Future	Present	Future
2-year	233	346	204	267
5-year	507	758	361	482
10-year	1,662	2,950	548	740
25-year	2,023	3,549	760	1,061
50-year	2,189	3,928	2,189	3,928
100-year	2,456	4,474	2,456	4,474

(2) Estimation of Annual Average Expected Damage to be mitigated

The annual damage caused by each scale of flood and the annual damage to be mitigated by the river channel improvement at each scale of flood are estimated as shown in Table

7.7. The following table gives a summary of the results of estimation for annual average expected damages to be mitigated due to execution of measures in each flood scale.

Table R 7.22 Annual Average Expected Damage to be mitigated

(Million Pesos)

Return Period	Present	Future
2-year	7	20
5-year	33	73
10-year	96	197
25-year	168	338
50-year	180	363
100-year	180	363

If the project is executed, these figures will be the economic benefit in each project scale corresponding to flood return period.

In the future, namely in 2020, the land use status will have changed as projected by the CLUP, and urbanization will have increased. In case none of the measures for the mitigation of flood damage as indicated in the above table has been executed, flood damage will greatly exceed the damage under the present land use status. In this connection, the flood control measures should be executed to keep with the changes under the future land use status.

7.2.4 Estimation of Economic Cost

(1) Standard Conversion Factor (SCF)

The Standard Conversion Factor (SCF) has been estimated as 0.97166 based on the international trade statistics, as shown in the table below.

Here, SCF is calculated by the following formula.

$$SCF = \frac{\sum I + \sum E}{(\sum I + \sum I_{customs}) + (\sum E - \sum E_{tax} + \sum E_{subsidy})}$$

Where,

SCF	=	Standard Conversion Factor
I	=	Import Amount
E	=	Export Amount
Icustoms	=	Import Duties (Custom Duties)
Etax	=	Export Tax
Esubsidy	=	Export Subsidy

The following table shows the calculation of the Standard Conversion Factor (SCF).

Table R 7.23 Calculation of Standard Conversion Factor

(million Pesos)

Year	Export in Mil Pesos	Import in Mil Pesos	Import Duties (Customs Duties)	Export Tax	Export Subsidies
2002	1,803,362	2,045,007	96,835	0	0
2003	1,948,514	2,214,951	100,694	0	0
2004	2,215,363	2,501,868	122,715	0	0
2005	2,255,393	2,637,873	151,474	0	0
2006	2,414,597	2,680,841	190,797	0	0
Total	10,637,231	12,080,540	662,515	0	0
				SCF =	0.97166

Source: Philippine Year Book 2008 and NSO website

(2) Personal Income Tax

Usually, project cost consists of cost for equipment and materials, and cost for manpower as personnel expenses and labor cost. For the cost of manpower, personal income tax is one of the transfer items. Therefore, the amount of personal income tax should be deducted from the project cost. Of course, personal income tax may consist of several levels in percentage. In this Project, the rate of 5% is applied for labor and 12% for consulting (engineering) services as the minimum rates according to the Tax Code of the Philippines.

(3) Shadow Wage Rate

Based on similar projects in the Philippines, the shadow wage rate of 0.60 is applied to unskilled labor employed for the Project.

(4) Shadow Price of Land

Also based on the said similar project in the Philippines, the rate of 0.50 is applied as the conversion factor for making clear the shadow price of land needed to be acquired for the Project.

(5) Taxes

All kinds of taxes are transfer items. Therefore, the taxes, if any, should be deducted from the financial cost for the conversion into economic cost. In the Project, the value added tax (VAT) of 12% is applied according to the said Tax Code of the Philippines.

(6) Corporate Profit Tax

In the Philippines, the net profit of corporations as contractors is estimated as 10% to 20% or more of the contract price. In this Project, the net profit is assumed at 15% as the reasonable level.

Corporate income tax is levied against the said net profit, and this corporate income tax is also one of the transfer items. Therefore, this tax should be deducted from the financial cost of the Project. There should be several levels of rates of the corporate income tax, but for the Project, 32% is applied based on the said Tax Code of the Philippines.

(7) Economic Cost

Under the conditions and assumptions, the economic cost is converted from the financial cost, as shown in Table R7.22 below. Details of the Financial Cost are as described in the preceding subsection.

Table R 7.24 Economic Cost for the Proposed Structural Measures

Item	Financial Cost (million Pesos)	Economic Cost (million Pesos)
Construction Base Cost with Physical Contingency	1,772	1,549
Compensation Cost with Physical Contingency	17	16
Administration Cost	81	77
Engineering Service Cost with Physical Contingency	284	258
Price Contingencies for All	308	-
Value Added Tax, etc	281	-
Total	2,744	1,899
O&M Cost	6	5

7.2.5 Results of Economic Evaluation for the Project and Conclusion

(1) Estimation of NPV, EIRR and B/S

The economic evaluation for the Project has been made by using a cash stream as indicated in Table 7.8 taking certain conditions and assumption into account. In this case, project life is set at 50 years after completion of the works for river channel improvement. The evaluation process is shown in the attached Table 7.9. The following table shows the results of the economic evaluation.

Table R 7.25 Economic Evaluation Results

Indices	
NPV (million Pesos)	55
EIRR	15.65%
B/C	1.05

As indicated in the above-said table, the Ilog-Hilabangan River Flood Control Project is viable for execution without any problem based on the Economic Internal Rate of Return (EIRR).

(2) Sensitivity Analysis

According to NEDA guidelines, sensitivity analysis shall be carried out using the following scenarios:

Case I : Increase in projected costs by 10% or 20%
Case II : Decrease in revenues by 10% and 20%
Case III : Combination of Cases I and II

From the point of views, the sensitivity analysis was made. The results of the analysis are as summarized below:

Table R 7.26 Result of Sensitivity Aalysis

	Case I		Case II		Case III			
Cost	+10%	+20%			+10%		+20%	
Benefit			-10%	-20%	-10%	-20%	-10%	-20%
NPV	-57	-168	-62	-179	-173	-290	-284	-401
EIRR	14.38%	13.31%	14.26%	12.83%	13.09%	11.77%	12.10%	10.86%
B/C	0.95	0.87	0.94	0.84	0.86	0.76	0.79	0.70

As listed above, EIRR fell below 15% in all cases. In another words, the economic viability of the project could not be verified in all cases.

CHAPTER 8 NON-STRUCTURAL FLOOD MITIGATION PLAN

8.1 Overview of Eligible Measures

In 1976, PD 1566 was enforced to pursue pre-disaster planning, community disaster preparedness and positive, precise disaster control action for rescue evacuation, relief and rehabilitation against natural disaster including floods. In 1988, National Disaster and Calamity Preparedness Plan (NDCPP) was prepared to ensure effective and efficient implementation of civil protection program thru an integrated, multi-sectoral and community based approach and strategies for the protection and preservation of life, property and environment. Based on PD 1566, Disaster Coordination Councils (DCCs) have been organized from the national level to LGU level. In the core areas of three (3) target river basins for the Feasibility Study, namely, Cagayan, Ilog-Hilabangan and Tagoloan river basins, CDCC (city) or MDCC (municipality) is undertaking several flood preparedness activities such as designation of evacuation centers, implementation of evacuation and rescue and relief.

In the Philippines, PAGASA is an agency in charge of flood forecasting and warning activities. In 1973, PAGASA commenced operation of the first Flood Forecasting and Warning System (FFWS) in the Pampanga River and at present operates four (4) FFWS in Luzon including the Cagayan River Basin. At present, the PAGASA plans, designs and assists the operation of the Community-based Flood Early Warning Systems (CBFEWSs). By the end of 2011, CBFEWSs assisted by the PAGASA will commence operation in 27 provinces. However, the Core Areas in the Ilog-Hilabangan and the Tagoloan river basins are not covered by the CBFEWSs.

In the Feasibility Study, inundation conditions analyzed for floods with several probabilities in Core Areas. Flood preparedness activities in these Core Areas are conducted based on experienced floods and thus, they will encounter surely floods with much wider in area and much deeper in depth, exceeding their preparedness. Therefore, it is necessary to make Flood Preparedness Plan in consideration of the probable floods analyzed in the Study. The flood warning under FFWSs by the PAGASA at present aims to disseminate occurrence of flooding and information does not cover magnitude and/or degree of flooding. CBFEWSs operated by cities/municipalities intend to disseminate simpler information to inhabitants.

Under these circumstances, a project using the results of the Feasibility Study for the Core Areas is proposed; composing of 1) preparation of flood preparedness plan for the Core Areas against estimated probable floods, and 2) establishment of CBFEWSs for the Core Areas to provide necessary information for the flood preparedness plan to be implemented.

8.2 Practice of Non-structural Measures in The Philippines

8.2.1 Preparedness Plan

In the Philippines, flood preparedness plans are prepared by Disaster Coordinating Councils (DCCs) organized from the national level to LGUs. Hereunder, DCCs and National Disaster and Calamities Preparedness Plan (NDCPP) is first explained. Then, two (2) projects to assist preparedness planning are explained so as to understand/evaluate the existing organization and activities in the Core Areas of the Feasibility Study.

(1) DCCs and National Disaster and Calamities Preparedness Plan (NDCPP)

On October 19, 1970, after the wrath of Typhoon “Sening” which affected most specially the Bicol Region and caused flooding for almost three (3) months in Metro Manila, President Ferdinand E. Marcos approved the Disaster and Calamities Plan prepared by an Inter-Departmental Planning Group on Disasters and Calamities. This plan includes among others, the creation of the National Disaster Control Center.

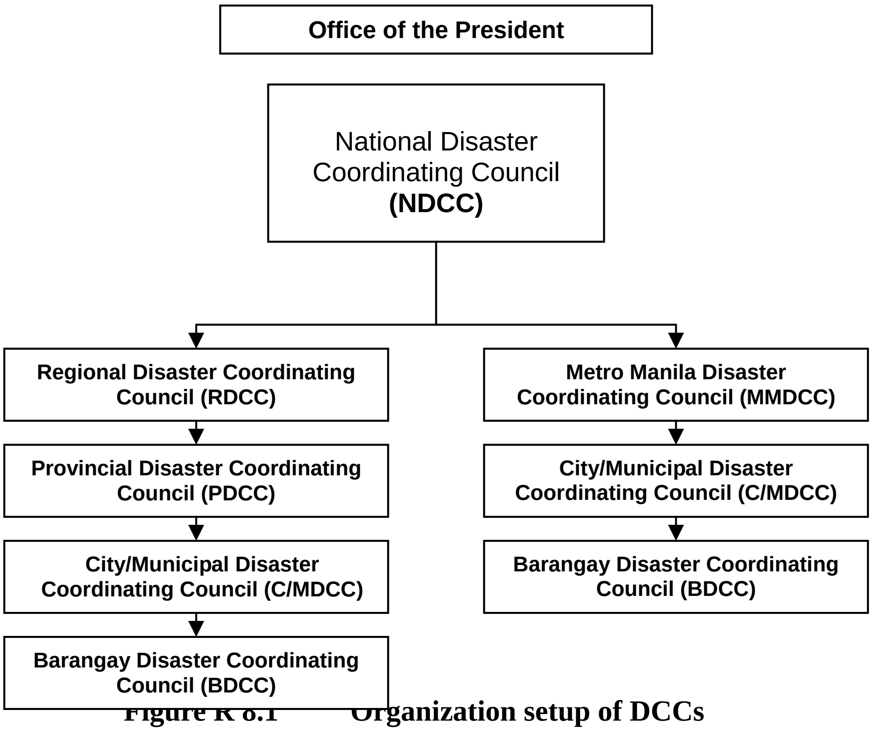


Figure R 8.1 Organization setup of DCCs

On June 11, 1978 through Presidential Decree (P.D. 1566), the National Disaster Coordinating Council (NDCC) replaced the National Disaster Control Center. In accordance with P.D. 1566, the Office of Civil Defense (OCD) prepared a National Disaster and Calamities Preparedness Plan (NDCPP) in 1988 and implementing plans by NDCC member-agencies. The primary objective of NDCPP is to ensure effective and efficient implementation of civil protection program thru an integrated, multi-sectoral and community based approach and strategies for the protection and preservation of life, property and environment.

To ensure the activities, organizations of national level, regional level and local government level (Figure R8.1) was established. The establishment of the National Disaster Coordinating Council (NDCC) embodies PD 1566. The Secretary of National Defense heads the NDCC with the heads of 18 departments/ agencies as members including Executive Secretary and the Administrator, Office of Civil Defense (OCD) who is the Executive Officer of the Council. The OCD functions as the operating arm or secretariat of the NDCC. The Members of DCCs of Regional and LGU levels are as follows.

(a) Regional Disaster Coordinating Council (RDCC)

- Regional PNP Director - Chairman;
- Heads of Regional Offices and Field Stations – Member;
- National Agencies and Selected Non-Government Organizations (NGOs) – Member

(b) Provincial Disaster Coordinating Council (PDCC)

- Provincial Governor – Chairman;
- Provincial Director of the PNP – Vice Chairman;
- All Organic Provincial Officials – Member; and
- National Officials – Member

(c) City/Municipal Coordinating Council (C/MDCC)

- City/Municipal Mayor – Chairman;
- City/Municipal Director of PNP – Vice Chairman;
- All Organic City Officials – Member; and
- National Officials – Members

(d) Barangay Disaster Coordinating Council (BDCC)

- Barangay Captain – Chairman; and
- Leading Persons in the community - Members

Each Council shall have the following staff elements:

- Damage Assessment and Needs Analysis Unit;
- Emergency Management Information Service Unit;
- Vulnerability Risk Reduction Management Unit;
- Plans and Operations Unit;
- Resource Unit
- Communication Transportation Service and Early Warning Service; and
- Relief and Rehabilitation Service;

(2) Hazard Mapping and Assessment for Effective Community-Based Disaster Risk Management (READY Project)

(a) Outline

The project, supported by the UNDP, AusAID and ADB, aims to address the problems of Disaster Risk Management (DRM) at the local level. At the national level, it aims to institutionalize and standardize DRM measures and processes. At the community level, the project aims to empower the most vulnerable municipalities and cities in the country and enable them to prepare disaster risk management plans. Target areas of the Project are 27 provinces vulnerable to national hazards. The project will be implemented from 2006 to 2011. Responsible agencies are; PHIVOLCS (DOST), PAGASA (DOST), MGB (DENR) and NAMRIA (DENR).

(b) Main Project Components

(i) Multihazard Identification and Disaster Risk Management

MGB made floods and flashfloods hazard maps with 1: 50,000 scale based on geomorphologic analysis. Figure R8.2 shows those for Negros Island. PAGASA will make past flood inundation maps for the flood prone areas covered by the existing 10,000 maps made by the NAMRIA.

(ii) Community-based Disaster Preparedness

- Development of Community-based early warning system for floods/flashfloods by the PAGASA and for Tsunami by PHIVOLCS
- Conduct of Information and Education Campaign (IEC) and distribution of related pamphlets, flyers and posters

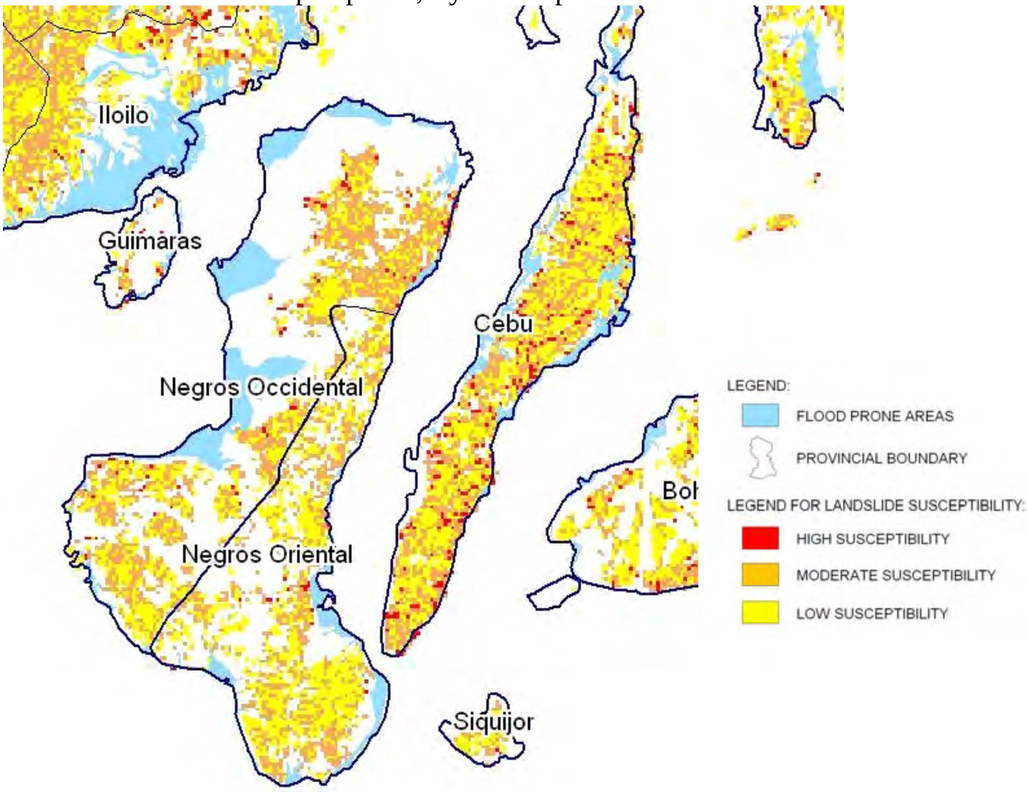


Figure R 8.2 Floods and Landslide Hazard Map for Negros Island

(3) GTZ – Dipecho Disaster Preparedness Project

(a) Outline

Target river basin is the Pagsangaan River Basin, which is located in Ormoc City, Kanamanga Municipality and Matag-ob Municipality of Leyte Province. Catchment area of this river basin is 551.84 km^2. Flooding occurs 2-3 times a year and lasts between 1-3 days. Population affected by flooding totals 17,400, equivalent to 62 % of the total population in the basin. In two (2) barangays, barangay hall could be used as evacuation sites/centers, but in most cases inhabitants stayed in their houses or moved to elevated areas, if there are.

As part of the engagement of the project, Participatory Disaster Risk Assessments (PRDA) was done in eleven (11) barangays within the Ormoc part of the Pagsangaan River Basin. Five (5) of these (11) barangays were PAGASA-identified monitoring area for the Flood Early Warning System that the Project will install in 2007 in partnership with the City Government and PAGASA.

(b) Barangay Disaster Preparedness Plan

In addition to the EFW, Barangay Disaster Preparedness Plan (BDPP) was formulated as the results of the PRDA for the Barangay Lao of Ormoc City, which was identified as Resettlement Area for those affected by 1991 flash flood in Ormoc City. The total population is 3,746. Estimated land area is 750.3 ha. with rice fields comprised of 61.2 ha. as its major land use. Major source of income of its residents is farming.

Following is contents of the BDPP for the Barangay Lao for CY 2008 - 2012. Chapter 1 describes the Barangay Profile and members of the Barangay Disaster Coordinating Council (BDCC) as shown below

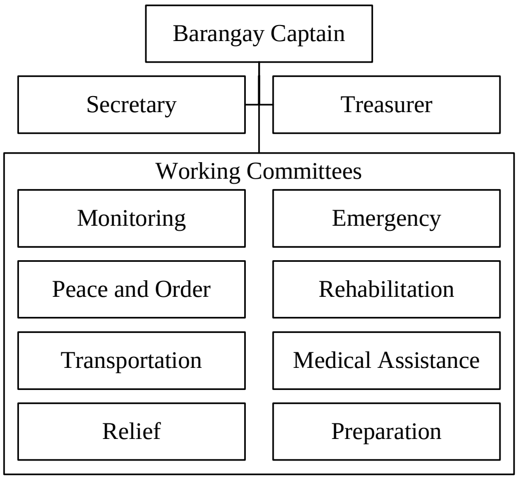


Figure R 8.3 Organization of BDCC

Chapter 2 of the BDPP contains the Profile of hazard flooding. This includes the historical background of the barangay on major/worst flooding that had happened in the barangay over the years. Hazard Profile includes the following information:

(i) A table containing the year, the catastrophe, disasters, and casualties affected;

(ii) Historical Transect provides and recalls information on records and occurrences of flooding that had happened years ago. Including reasons and suggestions;

(iii) Quantitative Description of Flooding Hazards; describes the path or direction and height of floodwater in the event of flooding; and

(iv) Worst Case Scenario illustrates what will happen in worst case including natural and social impacts, if flooding problems do not be resolved

Chapter 3 contains the Profile of Vulnerable Sectors. This chapter comprises the list and number of disabled persons, infants/children who are prone to sickness/illness, farmers whose major income is from crops and households who have continuously experienced flooding. Statistics on the types of materials used for housing, sources of drinking water and types of comfort rooms in the community, details and summary of coping mechanisms are also included.

The last Chapter (Chapter 4) contains the Disaster Preparedness Programs, Projects and Annual Investment Programs for flood mitigation in the Barangay. The Community Disaster Preparedness Action Plan contains the following information:

(i) A five-year Disaster Preparedness Plan involving the following sectors:

Social Sector

This includes purchase of medicines to insure good health and prevent sickness of the barangay people particularly the children.

Economic Sector

This provides other sources of income such as livelihood programs, training/seminars on farming technologies, marketing support and tree planting.

Infrastructure Sector

Development of a safe infrastructure in the barangay to provide evacuation and security to the community against flooding including dike construction (3 kms) and desilting of drainage channel (more or less 3 kms).

In addition, the technical materials for construction and other support needed for the project such as agencies or organizations will be included.

(ii) Five-year Annual Investment Programs (AIP)

This comprises the annual budget and sources of fund for flood mitigation projects.

8.2.2 Flood Early Warning System

Flood early warning is conducted by the PAGASA as the mandate. The System can be classified into three (3) systems, namely, PABC FFWS, FFWSDO and Community-based FEW System.

(1) PABC FFW System

(a) Outline of System and Warning

The PAGASA is conducting the flood forecasting and warning operation in the four (4) major rivers in the Luzon, Pampanga, the Agno, the Bicol and the Cagayan rivers. These are called as PABC Flood Forecasting and Warning (FFW) Systems. Pampanga FFWS commenced in 1973, while the other three (3) FFWSs started in 1982. Field Flood Forecasting and Warning Center (FFWC) is located at San Fernando City for Pampanga FFWS, at Rosales City for Agno FFWS, at Naga City for Bicol FFWS and at Tuguegarao City for Cagayan FFWS.

PAGASA analyzes the runoff characteristic of the respective rivers using the storage function model. FFWCs forecast WLs after 24 hours using present WLs and rainfall with forecasted rainfall. When the forecasted WL exceeds the warning WL, the warning are issued and transmitted as the Flood Bulletin.

Table R 8.1 Flood Warning Level and Definition

Flood Warning Level	Discharge Criteria	Definitions	Suggested Actions
Flood Outlook	40 % of flow capacity	There is possibility of flooding within the next 24 hours	Awareness
Flood Alert	60 % of flow capacity	There is threat of flooding with the next 12 hours	Preparedness
Flood Warning	100 % of flow capacity	Flooding is expected within the next 12 hours, or flooding has occurred	Response

The PAGASA issues Flood Bulletin two (2) times a day at 4:00 am and 4:00 pm. Intermediate flood bulletin is issued at 11:00 am and 11:00 pm, if necessary. Furthermore, auxiliary bulletin is issued when sudden flood is expected. Draft Bulletin made by the FFWC is sent to the Hydro-Meteorological Division (HMD) of Data Information Center (DIC) at Manila through the facsimile. The chief of HMD signs the Bulletin and sends back to FFWC. The HMD sends the Bulletin to the OCD. FFWC also sends the Bulletin to the RDCC and the PDCC. The flow of the Flood Bulletin dissemination is shown in Figure R8.4. Figure R8.5 shows the Flood Bulletin for Cagayan River Basin (At present, Flood Forecasting Branch, FFB is reorganized to Hydro-Meteorology Division, HMD).

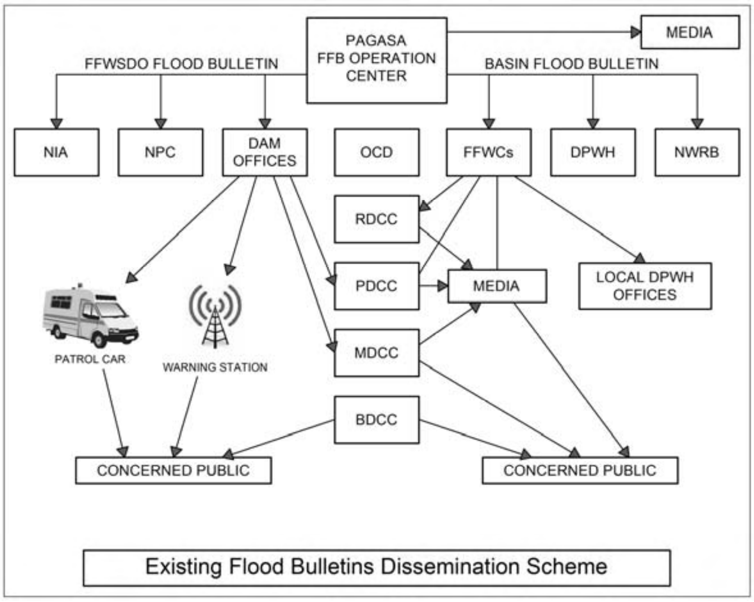


Figure R 8.4 Flood Bulletins Dissemination Scheme

(b) Upgrading of Pampanga and Agno FFWS

Since it took 25 to 30 years after completion, the PABC FFWSs encountered difficulties to keep their functions due to deterioration and shortage of spare parts, particularly for the Pampanga and Agno FFWSs, which were seriously damaged by volcanic mudflows caused by the eruption of Mount Pinatubo and Baguio Earthquake.

Under these circumstances, the Project for Upgrading of Flood Forecasting and Warning System in The Pampanga and Agno River Basins commenced on January 2008 through the JICA grant aid scheme. The items to be upgraded are as follows:

(i) Installation of Additional Gauging Stations

Existing stations are removed due to the present river conditions and new stations are added in consideration of the social and technical needs as well as the development situation in the cities in the basins. Table 8.2 shows number of stations before and after the upgrading.

REPUBLIC OF THE PHILIPPINES
Department of Science and Technology
Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)
Tuguegarao PAGASA Complex, Tuguegarao City

DOST@ 50 1958-2008 Making Science Work for You

FLOOD BULLETIN NO.5
ISSUED AT 4:00 AM, 19 AUGUST 2000
(VALID UNITL THE NEXT ISSUEANCE AT 4:00 PM TODAY)

AVERAGE BASIN RAINFALL(mm):
PAST 48 HOURS ENDING AT 2:00 AM TODAY = 200 mm
FORECAST FOR THE NEXT 24 HOURS = LESS THAN 60 mm

EXPECTED HYDROLOGICAL RESPONSE:

1. FURTHER RISE OF THE FLOODWATERS FROM UPPER CAGAYAN RIVER AND TRIBUTARIES DIADI AND ILUT RIVERS.
   FLOODING IS EXPECTED TO PERSIST: IN THE LOW LYING AREAS OF CAUAYAN, BANQUERO, ECHAGUE AND ALICIA UNTIL TOMORROW MORNING.

2. RAPID RISE AND OVERFLOWING OF MIDDLE CAGAYAN RIVER AND TRIBUTARY MAGAT RIVER.
   FLOODING IS EXPECTED TO OCCUR: IN THE LOW LYING AREAS OF AURORA, LUNA, NAGUILIAN, GAMU, ILAGAN, SARAGAN, SAN PABLO AND TUMAUINI BEGINNING THIS AFTERNOON.

3. GRADUAL RISE OF LOWER CAGAYAN RIVER AND TRIBUTARIES PARET, PINACANAUAN, AND CHICI RIVERS.
   FLOODING IS THREATENING: IN THE LOW LYING AREAS OF SOLANA, IGUIG, AMULUNG, ALCALA, MINANGA NORTE, TUGUEGARAO, GATTARAN, LAL-LO AND APARRI BEGINNING LATE THIS MORNING.

THE RESIDENTS IN THE LOW LYING AREAS AND THE DISASTER COORDINATING COUNCILS CONCERNED ARE STILL ADVISED TO TAKE APPROPRIATE ACTION.

PREPARED BY: NOTED BY:

LLB/ ACP/AEB A LAN L. PINEDA
Chief , FFB

Figure R 8.5 Flood Bulletin for Cagayan River Basin

Table R 8.2 Number of Stations

Type	River basin	No. of station	
Rainfall gauging station	Pampanga	6 (4)	8 (4)
	Agno	2 (0)	
WL and rainfall gauging station	Pampanga	10 (8)	18 (15)
	Agno	8 (7)	
Repeater station with rainfall gauge	Pampanga	1 (1)	2 (2)
	Agno	1 (1)	

Figures in parentheses is those before upgrading

(ii) Improvement of Multiplex Radio Network

Existing multiplex radio network with 2 GHz, which is developed for the communication between Science Garden with FFWCs and also with the relevant agencies, has fatal interference due to the mobile phones. New multiplex radio network will be established with 7.5 GHz and 18 GHz. 7.5 GHz is used between Science Garden to Pampanga FFWCs and Agno FFWCs, while 18 GHz is applied to NIA and ODC, which are near to the Science Garden.

(iii) Upgrading of Equipment for Flood Forecasting and Warning Operation

- Equipment at DIC, Pampanga FFWC, Agno FFWC and monitoring stations such as OCD, NPC, NIA and DPWH are upgraded or newly installed.
- Present runoff model used by DIC is improved and inundation model will be applied to accurately estimate areas to be flooded.

(2) FFWSDO

Flood Forecasting and Warning System for Dam Operation (FFWSDO) aims to: 1) effectively utilize the six (6) dams located in the Luzon Island by the NPC or the NIA which operates the dam; 2) issue dam discharge warning by the NPC or the NIA to the related agencies and inhabitants along the river reaches which has sudden water rise due to dam water release; and 3) undertake flood warning by the PAGASA obtaining the released discharge data from the NPC or the NIA.

Originally, dams included in the FFWSDO System are Angat Dam and Pantabangan Dam in Pampanga River, Binga/Ambuklao Dam in Agno River and Magat Dam in Cagayan River. In August 2002, San Roque Dam was completed in the Agno River and included in the FFWSDO System.

Through the FFWSDO Project, Data Information Center (DIC), Dam Offices and Multiplex Network connecting DIC and Dam Offices have been completed. Following table summarizes number of stations under the FFWSDO.

The NPC has responsibility for the operation and maintenance of the FFWSDO system and gate operation for the Angat, Binga, Ambuklao and San Roque Dams, while the NIA has responsibility for the Pantabangan and the Magat Dams.

Dam offices forecast inflow discharge to the reservoir using the installed rainfall gauges and decide the operation of the gates and issue dam discharge warning, when gates are opened. PAGASA disseminates flood warning to the downstream areas using the discharge data released from the dam with the storage function runoff model. Table 8.3 tabulates number of stations and facilities under the FFWSDO.

Table R 8.3 Number of Stations and Facilities under FFWSDO

Nos.	Angat	Pantabangan	Binga/Ambuklao	San Roque	Magat
Dam Office	1	1	1	1	1
Rainfall Sta.	4	4	4	8	5
WL Sta.	2	1	1	4	1
Combined Rain/WL Sta.			1	1	1
Warning Sta. (A)	7	6	7	7	9
Warning Sta.(B)	10	13	11	11	6
Patrol Car	6	6	6	6	6
Walkie-talkie	21	18	21	21	27

(3) Community-based Flood Early Warning System (CBFEWS)

In READY Project, PAGASA will install CBFEWS in total 27 Provinces. Based on the experience of the PABC FFWS and FFWSDO, PAGASA designs and install observation and communication network while the LGUs operate the network and disseminate flood warning with assistance of PAGASA. Following explains to establish a CBFEWS.

(a) Consultation with LGUs

The consultation meeting aims to bring together the stakeholders to discuss the feasibility of implementing a CBFEWS and to assess the existing facilities for the CBFEWS. The consultation meeting shall be conducted in coordination with the Governor or City/Municipal Mayor and invite the key persons in the target area.

(b) Design of Rain Gauges, WL Gauges and Communication

Type of gauges is selected in consideration of: 1) technical capability of the community to operate and maintain the installed equipment; 2) economic capability of the community to purchase or acquire the equipment and spare parts to ensure the continuous operation of the system; and 3) availability of volunteer or LGUs from the community to operate the instrument. The communication system to transmit observed data to the operation center is selected among ; 1) existing communication system (SMS), 2) radio; or 3) walkie-talkie. For warning purposes, bells can be used in addition to the warning equipment being utilized by the community.

(c) Ocular Survey of Proposed Sites

After establishing the network density, the proposed sites are verified through actual survey in coordination with LGUs. There are criteria that are considered in choosing the sites of the proposed monitoring stations such as the presence or availability of an observer, access to the site and the availability of communication facilities.

(d) Installation and Hydrologic Survey

(i) Installation of Observation Instruments

The rain gauges and WL (staff) gauges are installed by PAGASA personnel and the LGUs based on the Installation guidelines made by the PAGASA.

(ii) Hydrologic Survey

The hydrologic survey consists of discharge measurement and cross sectioning of the river channel by PAGASA to determine the carrying capacity of rivers and to derive the assessment levels at the particular cross-section.

The assessment levels are divided into Level 1, Level 2 and Level 3. These levels are the basis in issuing flood advisories/warnings as shown in Table below.

Table R 8.4 Meaning of Flood Advisory

Assessment Level	Discharge at WL Observation Point	Flood Advisory/ Warning	Meaning of Message
Level 1	40 % of flow capacity	READY	**"Awareness** " that flooding is possible within the next 24 hours
Level 2	60 % of flow capacity	GET SET	**"Preparedness**" that flooding is threatening with 12 hours
Level 3	100 % full	GO	**"Response"** that flooding is expected to occur/or will persist within the next 12 hours

For rainfall gauges, initial threshold values for "Ready", "Get Set" and "Go" are set.

(e) Training of Observers

The LGUs are requested to identify two (2) observers for each installed station to be trained in the observation, recording and transmission of data to the DOC. Formal lectures and on-the-job training are conducted by PAGASA and the necessary forms and operation manuals will be provided to the observers.

The deputized Civil Defense Coordinator (DCDC) in the municipality and his staff will also be trained on the protocols on data interpretation and issuance of flood warning/advisory

(f) Pilot Testing/Dry Run on the Operation of the CBFEWS

A dry run is conducted to test the observation and transmission of data by observers, analysis of data and formulation of flood warning/advisories and the dissemination of warnings to the threatened communities. A sample flow chart of the communication flow for the CBFEWS is shown in Figure R8.6.

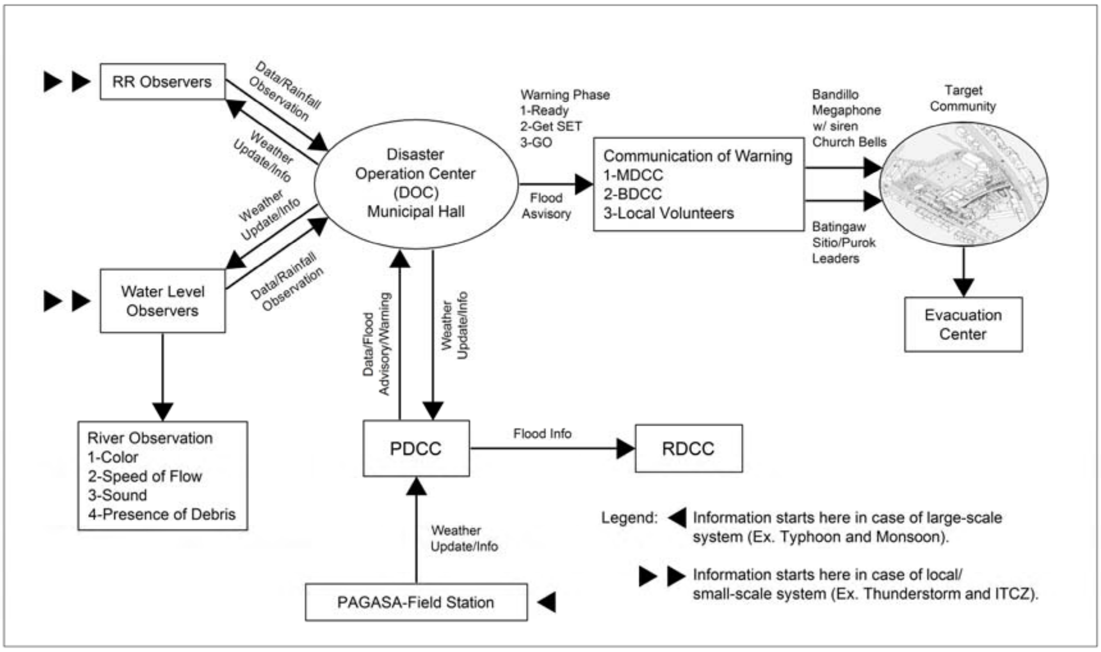


Figure R 8.6 Communication Scheme of a CBFEWS

(g) Other Activities

(i) Signing of a Memorandum of Agreement

Activities to be undertaken, the cost sharing scheme and roles of the community and institutions shall be stipulated in a Memorandum of Agreement (MOA).

(ii) Enactment of a Local Ordinance for the Operation and Maintenance of the CBFEWS

Local ordinance shall be enacted by the Provincial Council and City/Municipal Council to allocate continuously a reasonable amount of money for the operation and maintenance of the CBFEWS.

8.3 Present Activities related to Non-structural Measures in the Ilog-Hilabangan River Basin

8.3.1 Disaster Coordinating Council

(1) Ilog Municipality

Organization and function of the MDCC of the Ilog Municipality is explained in the Disaster Preparedness Plan of Ilog Municipality.

(a) Organization

Ilog MDCC is composed of; Chairman and Executive Office (Municipal Mayer), Vice chairman/Action Officer and management staff. Management staff is classified as follows; 1) Intelligence & Disaster Analysis Unit, 2) Plan and Operations Unit, 3) Resources Unit, 4) Task Service Unit, 5) Relief Service Unit, 6) Welfare and Rehabilitation Unit, 7) Evacuation Unit, 8) Rescue and Engineering

Service Unit, 9) Public Information Service Unit, 10) Communication and Warning Service Unit.

(b) Function Related to the Flood Preparedness Activities

Intelligence and Disaster Analysis Unit

- Evaluate disaster situations, determines courses of action to follow in time of emergency and formulate guidelines in evaluating disaster situation;
- Evaluate and advises the member agencies of the Municipal DCC of impounding disasters;
- Prepare recommendations on how to prevent disaster, if possible, and/or suggests precautionary measures to minimize effects of disasters; and
- Submit recommendations for allocation of needed resources.

Plans and Operation Unit

- Determine courses of action based on recommendations of the Intelligence and Disaster Unit;
- Determine the type of service units to be utilized in the disaster area;
- Recommend implementation of existing plans;
- Maintain and supervises progress operations and determines the necessity of utilizing additional units;
- Prepare appropriate reports upon termination of operations;
- Formulate Disaster Management Program based on the integrated Plan of every office;
- Prepare hazard, risk and vulnerability maps;
- Prepare incident command post system; and
- Spearhead and support the disaster response operation

Evacuation Service Unit

- Determine ideal site for evacuation in coordination with next higher authority;
- Prepare plans for means of transportation, number of person/persons to be evacuated by priority and points of evacuation;
- Keep current with the situation and advises the mayor and the populace thru channels;
- Anticipate evacuation needs of the service and the populace; and
- Escort evacuees by groups either on food or any means of transportation, to designate evacuation centers on order by an appropriate authority and in coordination with the concerned Purok or Barangay Evacuation Unit.

Communication and Warning Service Unit

- To provide, operate and maintain continuous and reliable communications and adequate warning system throughout the period of impounding and/or existing disaster and calamities; and
- The Municipal Mayor shall be responsible for giving the orders to his warning units to sound alarms.

(2) Kabankalan City CDCC

(a) Organization

Figure R8.7 shows organization of Kabankalan CDCC.

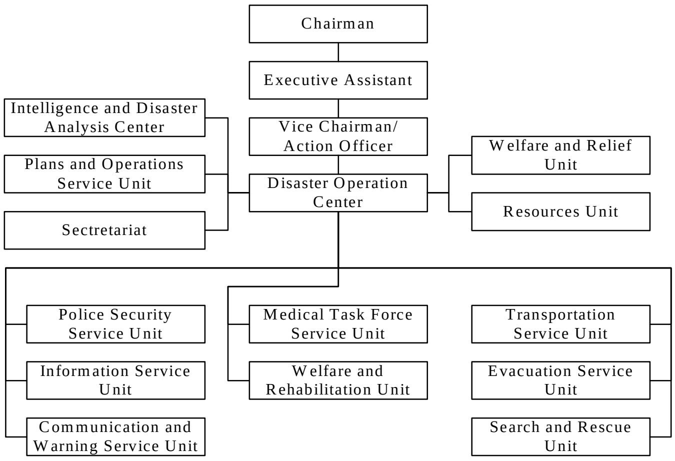


Figure R 8.7 Organization of Kabangkalan CDCC

(b) Functions

Activities related to Flood disaster and sediment disaster are done by the following units.

<u>Intelligence and Disaster Analysis Unit</u>

- Shall evaluate reports and information and advices the CDCC members of any impending recommendations on how to prevent disaster and/or suggest precautionary measures to minimize the effect of disaster;
- Submits recommendations for allocation of needed supplies and resources;
- Prepare supplies and resources;
- Prepare appropriate recommendation to proper authorities of possible declaration of the existence of a calamity in affected areas;
- Conducts Hazard Assessment, Risks Vulnerability Analysis and Capability Inventor; and
- Validate Damage Assessment and Needs Analysis Report and recommend appropriate action.

<u>Plans and Operations Service Unit</u>

- Determine courses of action to be taken based on recommendation of the Intelligence and Disaster Analysis Unit;
- Determine the type of service unit to be utilized in the disaster area;
- Recommend implementation of existing plans, maintains and/or supervise progress of operations;
- Determine the necessity of utilizing additional services units and prepare appropriate report upon termination of operations;
- Formulate Disaster Management Program (DMP) based on the integrated plans of every unit;
- Prepare Hazard and Vulnerability Maps; and

- Establish Incident Command Post System.

Resources Unit

- Shall act as custodian of all cash and resources of the Council; and
- Shall make inventory and documentation of available facilities and resources in the area.

Communication and Warning Service Unit

- Receive warning information from the local civil defense authorities or other sources and dissemination the same to the Warning Service Leader;
- Evaluate reports/information and advise CDCC members and the public of any impending disaster at appropriate measures;
- Maintenance of appropriate communication line of the city;
- Keeping of records of all warning and communication message;
- Provide, operate and maintain continuous and reliable communication and warning system through the period of impending and/or existing disasters and calamities; and
- Inform the CDCC via (Disaster Operation Center) DOC the status if disaster relief activities.

Evacuation Service Unit

- Responsible for supervising and executing the plans and control of all residents in times of disaster or emergency;
- Plan routes and establish movement procedures to give effect to the Evacuation Plan;
- Divide the area into convenient zones/blocks or puroks and assign leaders;
- Direct and supervise evacuation activities during drills and actual emergency/disaster;
- Shall be responsible of the repair and maintenance of the facilities of the evacuation center;
- Assess and make inventory of possible evacuation center;
- Manage the evacuation centers and recommend appropriate actions;
- Document evacuees; and
- Render Post Disaster Evacuation Management Report.

Information Service Unit

- To provide accurate information and instruction to the civilian population arising from natural or man-made causes; and
- Conduct massive propaganda campaign.

8.4 Non-Structural Measures and Implementation Plans

8.4.1 Hydrological Hazard Mapping and Flood Preparedness Plan

(1) Objectives

The CDCC or MDCC in the core areas is conducting the evacuation operation based on the experience of the past floods. The magnitude of these past floods is normally not so large and thus there are high possibility that unexpected flood exceeding the preparedness might occur even in the areas, which are normally not flooded.

Criteria of PAGASA's flood warning, both for the PABC FFWSs and for CBFEWS, is flow capacity of the existing river channels, which is normally small. Therefore, the flood warning informs the discharge will exceed the flow capacity of the river channel but does not explain the magnitude of flooding.

In the Feasibility Study for the Core Areas, after review of the runoff model established in the previous study, their probable discharge is used for river channel design and inundation analysis for benefit computation for the Ilog-Hilabangan River.

The results of runoff and inundation analysis can be used for establishment of more effective flood preparedness plan and early flood warning system covering floods exceeding the normal flood, though it is necessary to review for the models to use these objectives. Under these circumstances, this project aims to assist that; 1) inundation maps for the probable floods containing description of hazard impacts are prepared by the related agencies, 2) flood preparedness plan including the hazard maps is prepared by the LGUs in the Core Areas, 3) early warning system necessary for the flood preparedness plan, and 4) leading land development to suitable one in the flood-prone areas will be established.

(2) Related Agencies

(a) OCD: Executive Agency

(b) NAMRIA: Provision of base maps

(c) FCSEC: Runoff model/analysis and Inundation modeling/analysis

(d) PAGASA: Runoff model/analysis, Inundation modeling/analysis and establishment of community based early warning system

(e) LGUs (CDCCs, MDCCs, BDCCs): Preparation of flood preparedness plan

(f) LGUs (CPDOs, MPDOs): Land use and development planning

(3) Activities

Activities will be done with the JICA experts to be dispatched for the Project.

(a) Identification of Necessary Preparedness Plan and FEWS

Consulting meeting will be held in coordination with Regional Director, Governor(s), mayors of City/municipalities located in the river basin and invite key staffs of the related RDCC, PDCC and CDCC/MDCC.

(i) Disaster profile in target core area;

(ii) Necessity of preparedness plan and FEWS; and

(iii) Identification of preparedness plan and FEWS

For the Ilog-Hilabangan River basin, community–based flood early warning system will be installed.

The most crucial for CBFEW is the Project could install robust information network from hydrologic warning transmission stations up to the end communities at an impending flood disaster, in terms of institutional capacity for data transmission and receiving as well as technical aspects.

(b) Establishment of CBFEWS

Design and installation of CBFEWS will be done for the Ilog-Hilabangan River basins in the following manner.

There are two major rivers joining in the lower reaches in the Ilog-Hilabangan River system, namely Ilog and Hilabangan. Considering the extent of both basins, location of villages and easy accessibility, it could be recommended to install three rain gauges and one water level gauge in the Hilabangan River basin, five rain gauges and one water level in the Ilog River basin, and one rain gauge and one water level gauge in the lower reaches.

Type of gauges and data transmission system to the Disaster Operation Center (DOC) shall be determined as a unit. The following combinations shall be compared in the succeeding study/design stage.

- manual type of gauge and VHF radio communication system,
- automatic recorder with data logger and GSM telecommunication system, and
- automatic recorder with data logger and telecommunication system using communication satellites, for instance Iridium.

After installation of the observation network, training activities shall be made to observers for proper observation, recording and data transmission, and to operators in the DOC for proper data management and dissemination of disaster information to the communities concerned.

Overall flood early warning system, including information from PAGASA, is illustrated below.

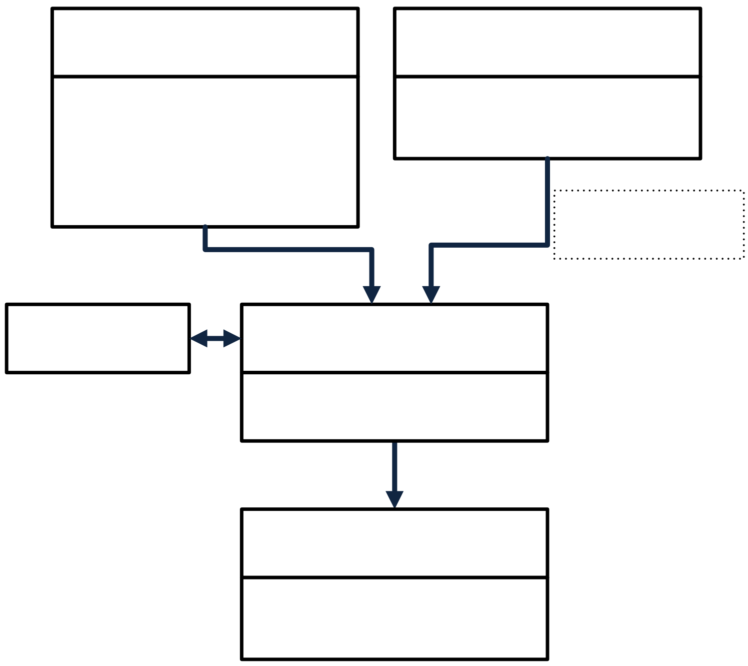


Figure R 8.8 Overall Flood Early Warning System in

the Ilog-Hilabangan River Basin

(c) Establishment of Hazard Map and Preparedness Plan

(i) Detailed Inundation Maps

Probable runoff discharge and inundation conditions used during the Feasibility Study are reviewed and revised. Using the NAMRIA data (land use, land elevation, etc), runoff model and inundation model will be established.

- Data collection
- Establishment of runoff and inundation model
- Detailed flood inundation analysis for the core area corresponding to the probable discharge

(ii) Establishment of Warning WLs and Threshold Rainfalls

- Grouping of barangays in core areas in consideration of inundation characteristics
- Establishment of warning WLs and threshold rainfalls (if appropriate) corresponding to the grouped barangays

(iii) Establishment of Flood Preparedness Plan

- Flood Preparedness Plan is formulated in respective barangays to be affected by flood including evacuation centers, route and method
- Flood Preparedness Plan is formulated for the City or Municipality

(iv) Implementation of Dry Run

- Field Reconnaissance
- Preparation of seminar and dry run
- Implementation of dry run
- Modification of Flood Preparedness Plan

(v) Revision of Flood Preparedness Plan

- Review of flood preparedness plan after major flood events using the runoff model and the inundation model
- Revision of flood preparedness plan and flood warning WL and threshold rainfall

(d) Revision/Modification of Land Use/Development Plan

Urban/industrial developments in the flood-prone areas always increase the flood damages. Thus future land development should be led to distribute suitable land use in future in the flood prone areas. Evaluation on the land use and development plan should be made overlaying the City/Municipality development plan onto the flood hazard map. If such land use modification/control could be successfully pursued, it might be advantageous for future river improvement to acquire a necessary land, upgrading the design level or adopting the adaptive measures against effects of global warming.

Reference

PAGASA: Improvement of the Flood Forecasting and Warning System for Magat Dam and Downstream Communities Project, February 2009

Nippon Koei Co., LTD.: The Project for Improvement of Flood Forecasting and Warning System in the Pampanga and Agno River Basins (Tender Documents Volume I), January 2008

Susan Espinueva, Establishment of Community Based Flood Early Warning System (CBFEWS) in the Province of Surigao del Sur, December 2007

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Nippon Koei: Basic Design Report on The Project for Upgrading of Flood Forecasting and Warning System in The Pampanga and Agno River Basins in Republic of The Philippines, March 2007

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CTI Engineering Co., LTD., (CTIE), Association of Electrical Engineering (AEE), Basic Technology and Management Corporation: Interim Report of Detailed Design for The Flood Forecasting and Warning System in the Cagayan, Agno and Bicol River Basins, 1978

Office of Civil Defense, Project Management Office: Hazards Mapping and Assessment for Effective Community-Based Disaster Risk Management (READY Project)

Homepage of the following Philippine Government Agencies:

- National Disaster and Coordinating Council (NDCC)
- Office of Civil Defense (OCD)
- Philippine Atmospheric, Geophysical & Astronomical Services Administration (PAGASA)

CHAPTER 9 ENVIRONMENTAL SOCIAL CONSIDERATIONS

9.1 Introduction

9.1.1 Necessity of environmental and social considerations

In accordance with DENR (Department of Environment and Natural Resources) Administrative Order NO.37 in 1996 (DAO 37-1996), any projects in Philippines are required to obtain Environmental Compliance Certificate (ECC). If a project has no significant impact and has no necessity of ECC, the project proponent shall obtain the Certificate of Non-Coverage (CNC).

The Environmental Management Bureau (EMB) of the DENR published the Revised Procedural Manual (August 2008) (hereinafter referred to as RPM). The relation between the project cycle and EIA process is described in Chapter 1.0 of the RPM. In accordance with the RPM, the EIA study for preparation of ECC application would be carried out during the F/S study. Meanwhile, this study can be termed as a preparatory study for the detail EIA/RAP study in the next stage as shown as Figure R 9.1

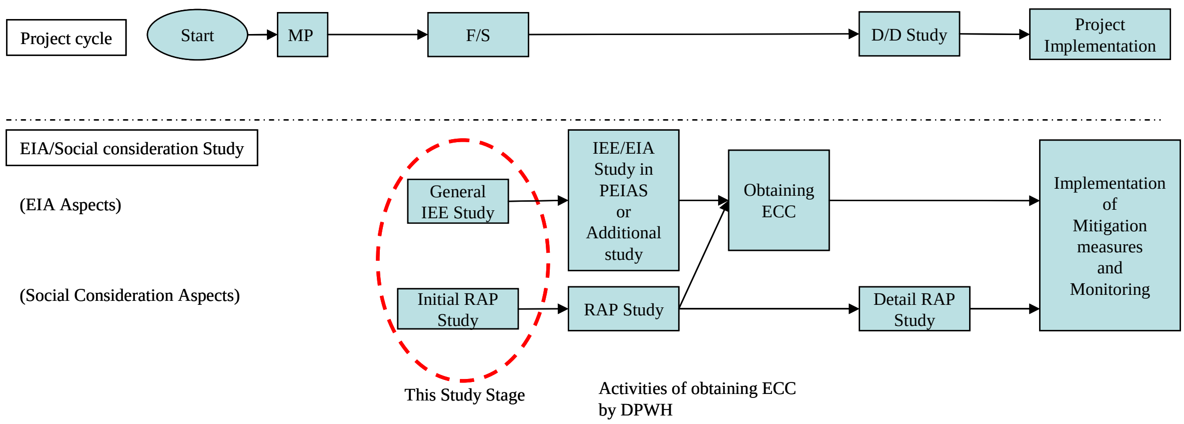


Figure R 9.1 Project cycle and EIA/Social Consideration Study of the Project

9.1.2 Scope of IEE study

The scope of this IEE study is described as below:

<u>Study Area</u>: The areas directly and indirectly affected by the Project. The Project Area is shown in Chapter 1 and 2.

<u>Baseline data collection</u>: The baseline data of natural and social environments on the project threshold.

<u>IEE study</u>: The study follows the requirements of the RPM. The outline of IEE report is described in the RPM.

<u>Recommendation of the necessary mitigation measures</u>: The mitigation measures for the results of scoping on the project threshold will be considered.

<u>Recommendation of the monitoring plan</u>: The monitoring plan will be recommended.

9.1.3 Baseline data of natural condition

(1) Data of natural condition

The RPM describes three specific modules of natural conditions as below:

(a) The land (Land Use/classification, associated Terrestrial Biology (flora and fauna), Relevant aspects of Geology (i.e. land forms/topography/slope/ terrain), and Pedology (main soil type and quality). In this report, the land use/classification is described in Sub-section 9.1.4. (2) as part of the social environment conditions.

(b) The water (Hydrology and Hydrogeology, Water quality, and Freshwater Biology.

(c) The air (Meteorology and Air Quality)

(2) Biological Environment

The existing vegetation and wildlife survey in the Project site was not conducted. Assessment of the vegetation and wildlife in the Project site were conducted from July to August 2009. Three survey routes were selected along the river banks within a 500m wide strip on both sides of the river. The survey routes are shown as Annex PIIB_9-1. The survey routes were established and all plants and animals encountered were noted and recorded. Some animal species not observed were yielded by interviewing local farmers and residents in the area.

The site was noted to consist predominantly of residential, and commercial built up areas. Areas along the river banks were found to have secondary growth of plant cover composed of grasses, shrubs, trees, with some areas being planted out with backyard vegetables. In accordance with the results of field surveys, rare species listed on the Philippines Red Data Book were not found in the Project area.

(3) Topography/Geology

(Geographical features): The Ilog-Hilabangan River Basin, with a catchment area of 2,162 km2, is situated in the central and southern portions of Negros Island. The basin is enclosed by Negros Central Mountains to the North, Negros Cordillera to the East, Negros Mountains to the Southwest, and It faces Panay Gulf to the Northwest direction.

(Topography): The Ilog-Hilabangan Plain is situated in the middle part of the basin. It is characterized by an alluvial flat land and gently sloping hills. The highland of this plain has an elevation of less than 300 meters above mean sea level. In the northwestern part of the plain, the delta along the Ilog-Hilabangan River has a very gentle slope as it comes to the seashore. The area of Ilog-Hilabangan river basin is 2,162km^2. According to the terrain slope classification, the area classified as more than 15% slope has a share of 37%. The land suitable for cultivation of crops and people residing in the lower reaches has a share of only 27% and most of them are located in the lower part of the basin where floods occur at high level. In the upper reaches of the river, dominantly situated are forests, pasture/grassland and upland grain crops.

(Geological condition): Negros Island is an upfield igneous sedimentary basin, named as the Negros-Siquijor basin, believed to have originated during Cretaceous. The region is dominated by old volcanic rocks with the basement complex of metamorphosed igneous and sedimentary rocks. Ilog-Hilabangan plain is formed of young and old sedimentary rocks, volcanic rocks and limestone.

The details of topographical/geological condition were described in Chapter 2.1.1 and 2.1.2 in this report.

(4) Soil/Sediments

Sediments were collected from the sampling sites to test for heavy metal contamination in the areas. The results were as follows:

Table R 9.1 Results of Sedimentation Quality Measurement

(Unit: ppm)

Analysis	Sample 1	Sample 2	Standard Value in Dutch
Total mercury	Not Detected	Not Detected	0.3
Arsenic	4.1	4.5	29.0
Cadmium	Not detected	Not Detected	0.8
Chromium	13	16	100.0
Lead	Not detected	Not detected	85.0
Cyanide	Not detected	Not detected	5.0

Source: JICA Study Team

The Philippines does not have any standards for soil or sediment quality. The Dutch standard for sediments is generally used. The standard values are shown in the Table R 9.1. The survey results show that the sediments in the project site are not contaminated by heavy metals.

(5) Hydrology (River System)

The Ilog-Hilabangan river system is composed mainly of two major rivers; namely, Ilog River with the length of about 120 km, the principal drainage-way of this basin, and the Hilabangan River, one of the main tributaries of the basin, with the length of 35 km, The riverbed gradient of the Ilog River, ranging from 1/140 to 1/3,100. The width and depth of the Ilog River, which are related to the flow capacity, are variable in the upper reaches. In the lower reaches, the river width ranges between 100 m and 200 m and the river depth, between 5 m and 15 m. The monthly average discharge of Ilog River is around 1,400 mm. Changes in the Ilog River course at the delta area have been identified the following points: (a) The change of the Ilog River at the diversion point to Bungul Diversion Channel is remarkable and the shift in its course is continuing, (b) In the Old Ilog River Basin where the river course had once changed, the river width and depth have decreased after the Bungul Diversion Channel, and cut-off channels have been constructed. Since then, the change of river course has not been severe due to the reduced water discharge.

The details of river system were described in Chapter 2.2.2 in this report.

(6) Surface Water

(a) General

Surface water is used primarily for irrigation and subsistence fishing in the Ilog Hilabangan basin.

According to DENR Administrative Order (DAO) No. 34 (Revised Water Usage and Classification 1990), water bodies are classified into five (5) classes (i.e AA, A, B, C and D) for fresh surface waters, and four (4) for marine and estuarine waters (i.e SA, SB, SC and SD). The criteria of classification of the water quality are shown below:

Class	Definition
Class AA	Public Water Sully Class I. This class is tended primarily for waters having watershed which are inhabited and otherwise protected and which require only approved disinfection order to meet the National Standards for Drinking Water (NSDW) of the Philippines.
Class A	Public Water Supply Class II – Intended as sources of water supply requiring conventional treatment to meet the PNSDW
Class B	Recreational Water Class I – Intended for primary contact recreation (e.g., bathing, swimming, skin diving, etc.)
Class C	Fishery Water, Recreational Water Class II, or Water Supply Class I – Intended for propagation and growth of fish & other aquatic resources, boating, manufacturing processes after treatment
Class D	Industrial Water Supply Class I – Intended for agriculture, irrigation, livestock watering, etc.

(Source: DAO NO.34, 1990)

DAO 34-1990 establishes the water quality standard (water quality criteria for conventional and other pollutants contributing to aesthetics and oxygen demand for fresh waters). The table below shows some parameters of the standard.

Table R 9.2 Water Quality Criteria for Conventional and Other Pollutants Contributing to Aesthetics and Oxygen Demand for Fresh Waters (abridgment)

Parameter	Unit	Class AA	Class A	Class B	Class C	Class D
BOD (Max)	mg/L	1.0	5.0	5.0	7.0 (10.0)	10.0 (15.0)
DO (Min)	mg/L	5.0	5.0	5.0	5.0	3.0
TDS (Max)	mg/L	500.0	1,000.0	--	--	1,000.0
TSS (Max)	mg/L	25.0	50.0	(b)	(c)	(d)

Notes: BOD: Biochemical Oxygen Demand, DO: Dissolved Oxygen, TDS: Total Dissolved Solids, TSS: Total Suspended Solid
(a) -The numerical limits are yearly average values. Values enclosed in parentheses are maximum values., (b) -Not more than 30% increase, (c) -Not more than 30 mg/L increase, (d) -Not more than 60 mg/L increase
Source: DENR Administrative Order 34-1990

The DAO establishes water quality standards for toxic and other deleterious substances for fresh waters as Table R 9.3.

Table R 9.3 Water Quality Criteria for Toxic and Other Deleterious Substances for Fresh Waters (For the Protection of Public Health)

Parameters	Class AA	Class A	Class B	Class C	Class D
Arsenic	0.05	0.05	0.05	0.05	0.01
Cadmium	0.01	0.01	0.01	0.01	0.05
Chromium (hexavalent)	0.05	0.05	0.05	0.05	-----
Cyanide	0.05	0.05	0.05	0.05	-----
Lead	0.05	0.05	0.05	0.05	-----
Total Mercury	0.002	0.002	0.002	0.002	0.002
Organophosphate	nil				
Aldrin	0.001	0.001	-----	-----	-----
DDT	0.05	0.05	-----	-----	-----
Dieldrin	0.001	0.001	-----	-----	-----
Heptachlor	nil		-----	-----	-----
Lindane	0.004	0.004	-----	-----	-----
Toxaphane	0.005	0.005	-----	-----	-----
Methoxychlor	0.10	0.10	-----	-----	-----
Chlordane	0.003	0.003	-----	-----	-----
Endrin	nil		-----	-----	-----
PCB	0.001	0.01	-----	-----	-----

nil: Extremely low concentration and not detectable by existing equipments
(Source: DENR Administrative Order 34-1990)

(b) Water quality of river in the Project site

The present water usage in the Project site is mainly for fish breeding and irrigation. It is classified as Class C in the table above. There was no problem with the quality of the river water in the project site in accordance with information received from officials and residents.

The classification of the river water quality by the EMB-DENR in 2004 shows the class of upper stream of Ilog River as A and lower stream (the Project site is located) as C[1].

The water quality checks on the major rivers in the Region VI were taken in the Region VI from 2001 to 2005. The results were compiled in the Region 6 Water Quality Status Report. However, the sampling was not conducted in the Project site. Therefore there is no direct data available on the water quality in the Project site.

Most of the water usage in the Project site is for irrigation and fish breading. In this study a heavy metals test was done in the water and in the sedimentation. It was confirmed that there is no contamination by any heavy metals in the river water. The water sampling survey (for heavy metals testing) was conducted on July 16, 2009. Annex PIIB_9-2 shows the details of the sampling survey. Table R 9.4 shows the results of the laboratory analyses for each station.

Table R 9.4 Water Quality Sampling Results

(Unit: mg/L)

Analysis	Sample 1 (ST.1)	Sample 2 (ST.2)	Standard for Class C waters
Total Mercury	<0.0001	<0.0001	0.002
Arsenic	<0.02	<0.02	0.05
Cadmium	<0.01	<0.01	0.01
Chromium	0.01	<0.005	0.05 (hexavalent)
Lead	<0.01	<0.01	0.05
Cyanide	<0.01	<0.01	0.05

Source: JICA Study Team

(7) Climatologic Features

The Ilog-Hilabangan River Basin falls in Type I and Type II of the modified Corona's climate classification. Type I where the southwest portion lies is characterized as two pronounced seasons, dry and wet; heavy rain period is from June to September during the prevalence of the southwest monsoon season.

Average monthly rainfall is 44mm in minimum (Mar.), 365mm in maximum (Oct.), and annual rainfall is 2,507mm in Kabankalan station.

Monthly variations of meteorological data such as temperature, relative humidity, pan-evaporation, cloudiness, etc., at Iloilo City are tabulated in Table 2.1. There is no significant variation in temperature and relative humidity; monthly average temperature varies from 25.9 degrees Centigrade in January to 28.8 degrees Centigrade in May. Relative humidity varies from 74% in April to 85% in August.

The details of climatologic features were described in Chapter 2.2.1 in this report.

(8) Air quality

(a) Air quality standard

The air quality standard in Philippines is shown in Table R 9.5. Note that there is no emission standard covering construction sites.

[1] http://www.emb.gov.ph/wqms/Classified%20Rivers%20as%20of%20Dec%202004.htm

Table R 9.5 National Ambient Air Quality Guideline Values

Pollutions	Short Term[a]			Long Term[b]		
	μg/NCM[d]	ppm	Averaging Time	μg/NCM	ppm	Averaging Time
Suspended Particulate Matter[c] TSP	230[d]		24 hours	90		1 year [e]
PM-10	150[f]		24 hours	60		1 year [e]
Sulfur Dioxide [c]	180	0.07	24 hours	80	0.03	1 year
Nitrogen Dioxide	150	0.08	24 hours			
Photochemical Oxidants as Ozone	140 60	0.07 0.03	1 hour 8 hours			
Carbon Monoxide	35mg/NCM 10mg/NCM	30 9	1 hour 8 hours			
Lead [g]	1.5		3 months [g]	1.0		1 year

[a] Maximum limits represented by ninety-eight percentile (98%) values not to exceed more than once a year.
[b] Arithmetic mean.
[c] SO2 and Suspended Particulate matter are sampled once every six days when using the manual methods. A minimum of twelve sampling days per quarter or forty-eight sampling days each year is required for these methods. Daily sampling may be done in the future once continuous analyzers are procured and become available.
[d] Limits for Total Suspended Particulate Matter with mass median diameter less than 25-50 μm.
[e] Annual Geometric Mean.
[f] Provisional limits for Suspended Particulate Matter with mass median diameter less than 10 μm and below until sufficient monitoring data are gathered to base a proper guideline.
[g] Evaluation of this guideline is carried out for 24-hour averaging time and averaged over three moving calendar months. The monitored average value for any three months shall not exceed the guideline value.

(Source: DENR DAO NO.2000-81 (2000))

(b) Air condition in the Project site

EMB-DENR announced a "2000 National Air Quality Status Report" in 2000. It monitored TSP, sulfur dioxide, nitrogen dioxide, ozone, and carbon monoxide. It also pointed out that the TSP constitutes one of the most serious problems. 7 places outside Metro Manila were selected as monitoring locations. Municipality Ilog and Kabankalan City and any locations near these areas were not selected for monitoring. The report says that the prevalent air pollution was due to the increasing the number of motor vehicles and industrializations.

EMB-DENR also undertook monitoring of TSP in the whole Philippines. The results can be accessed on the web site2, with Table R 9.6 showing extracted Regional data.

[2] http://www.emb.gov.ph/air/AQMN2.html

Table R 9.6 The Regional Monitoring Data of TSP

(Unit: µg/NCM)

Place	2001	2002	2003
NCR	151	147	156
CAR	238	145	-
Region I	64	93	130
Region II	213	339	198
Region III	-	113	120
Region IV-A	-	110	103
Region IV-B	-	246	-
Region V	76	109	109
Region VI	201	168	134
Region VII	66	89	94
Region VIII	98	98	100
Region IX	438	360	154
Region X	142	128	156
Region XI	74	92	96
Region XII	175	99	96
Region XIII	184	100	-

(Source: Extracting from web site of EMB-DENR
: The results of monitoring of Regional sampling of TSP)

Table R 9.6 shows the average value for a year. The values for Region VI are 201 in 2001, 168 in 1002, and 134 2003; they are inclined to decrease.

An air quality check in Municipality Ilog and Kabankalan City has not been taken. These areas are urbanized in the local area but the situation of the existing number of vehicles or industries is still small compared to conditions in Manila. There is a sugar cane factory in Kabankalan City. However there is no air pollution problem in the surrounding area in according to officials and residents. It was confirmed that there are no significant issues regarding air pollution in the Project site under the present circumstances.

(9) Noise

The environmental standards for noise in the Philippines are stipulated based on Presidential Decree (P.D.) No. 984 (1978) as Table R 9.7.

Table R 9.7 Environmental Quality Standards for Noise in General Areas

Category of Area	Daytime	Morning & Evening	Nighttime
AA	50 dB	45 dB	40 dB
A	55 dB	50 dB	45 dB
B	65 dB	60 dB	55 dB
C	70 dB	65 dB	60 dB
D	75 dB	70 dB	65 dB

Source: Official Gazette, 1978 Implementing Rules and Regulations of P.D. 984.

(Legend)

Category of Area is as follows:

AA: a section or contiguous area which require quietness such as area within 100 meters from school sites, nursery schools, hospitals, and special home for the aged

A: a section or contiguous area primarily used for residential purposes

B: a section or contiguous area primarily used as commercial area

C: a section primarily reserved as a light industrial area.

D: a section primarily reserved as a heavy industrial area

Division of 24-hour period is as follows:

Morning 5:00 AM to 9:00 AM Evening 6:00 PM to 10:00 PM
Daytime 9:00 AM to 6:00 PM Nighttime 10:00 PM to 5:00 AM

Noise level measurement was conducted at the three noise sampling locations on July 16, 2009. The noise sampling stations were positioned at the nearest residential community to determine the possible impact of noise during the construction period. The three sites were on the banks of the river along Barangay 9, along the center of Kabankalan City (Camugao) and the Ilog Municipal Hall. Measurements were conducted using a precision type digital sound level meter using the method prescribed in the implementing rules and regulations of PD 984. The instrument was also equipped with an integral calibrator which allows it to be calibrated up to 94dB.

The minimum and maximum of continuous readings were recorded in each station. The median values were then taken and compared with the DENR noise standards based on the 1978 Rules and Regulations of PD 984. Table R 9.8 shows the results of noise measurements in Barangay 9. Category AA applies to the area, because there is a kindergarten near the measurement location. The results of sampling show 7.9 – 17 dBA above the standard.

Table R 9.8 Results of Sampling of Noise along Batangay 9

Distance	Time	Min. (dBA)	Max. (dBA)	Median (dBA)	DENR Std. (dbA)	Categogy of Area	Remarks
(ST.1) Barangay 9, Kabankalan City							
10 meters from planed dike	Morning (6:40am)	45.5	70.3	57.9	50	Class AA	Exceeded
	Noon (3:00pm)	56	78.1	67.05	50	Class AA	Exceeded
	Evening (3:50pm)	57.3	76.3	66.8	50	Class AA	Exceeded

Source: JICA Study Team

The results of sampling in Camugao Kabankalan City (class A) show 1- 3 dBA below the standard, and Ilog Municipal Hall (class A) show 1 - 3 dBA below the standard in the morning and night, but 2 dBA above during the day. The details are shown in Annex PIIB_9-3.

(10) Sensitive areas

(a) Areas declared by law as protected areas: There are no nearest protected areas to the Project site, all declared areas by law are too far away for the Project site to be impacted upon..

(b) Areas set aside as aesthetic potential tourist spots: There are no potential tourist spots in the Project site as provided in the comprehensive land use plans

(c) Areas which constitute habitats for any endangered or threatened species of Philippine wildlife: The habitats for endangered or threatened species are located in the protected areas. Kabankalan and Ilog are cities; there are no endangered or threatened species habitats in the area since whatever habitats were available have been taken over by urban and agricultural activities

(d) Areas of unique historic, archeological, geological, or scientific interests: There are no unique historical, archaeological, geological, or scientific interests in the project site.

(e) Mangrove Areas: There are mangrove areas in the Project area. The Mangrove areas are along the side channel along Ilog municipality and along the banks of the mouth of the main channel of the Ilog River. However, they are not designated as protected mangrove forest areas in Philippines.

(f) Coral Reefs: Coral reefs can be seen near the river mouth of Ilog River, but they are not covered as protected areas in Philippines.

9.1.4 Baseline data of social condition

(1) Data collection methodology

The RPM describes necessary social baseline data as a) demography data, b) displacement of settlers and c) presence of Indigenous people. The land use condition is also required. In this study, demography data was described in Chapter 3 and 4, b) data of displacement of settlers were collected by the interview survey in the field. And there are no indigenous people in the Project site in accordance with the sourced data from the National Commission on Indigenous Peoples.

(2) Land-use

The Existing and Proposed Land Use in Kabankalan City is as Annex PIIB_9-4. The agricultural land is about 37,000 ha (about 53% of total area) followed by the area of integrated social forestry area which is about 18000 ha (about 25% of total City area). Even in the land use plan the agricultural area is still large at 36,000 ha (about 51% of total area).

The crop-wise land use is shown as Annex PIIB_9-4. The sugarcane land (with/without irrigation) is about 15000 ha as about 50% of 30 thousand ha as total crop land area. The area of rice fields (with/without irrigation) follows at about 8000 ha. They account for about 28% of the total crop lands.

(3) Indigenous People

There are no Indigenous groups in or around the Project site. All Indigenous people's groups were reported in the Accomplishment Report (National Commission on Indigenous Peoples). The relevant section of Region VI is shown in Table R 9.9. It shows that these 3 claimants are outside of the Project site.

Table R 9.9 Relevant section of Status Report of Accomplishment Report (CY 2004)

STATUS REPORT OF DELINEATION AND TITLING UNDER PDAP 2003-2004 As of December 2004					
REGION	PROVINCE	AD Location	Claimants Tribe	Area (Has)	Remarks
REG VI&VII	Iloilo	Calinog	Sulod-Bukidnon	4000.00	CADT awarded last Jan. 22, 2005; Registered to ROD
	Antique	Valderrama	Sulod-Bukidnon	4513.00	For deliberation
	Negros Occ.	Damutan, Hinobaan	Bukdinon-Magahat	2674.00	Social preparation just commenced
			Subtotal	11187.00	

Source: ACCOMPLISHMENT REPORT, CY 2004, NATIONAL COMMISSION ON INDIGENOUS PEOPLES (http://www.ncip.gov.ph/downloads/Annual%20Report%202004.pdf)

(4) Profile of people in/around the Project site

Census data covering demography on the Municipality level is available in the Philippines. However, data on education, employment, income, etc are compiled on a Region level only and therefore Municipality level data is not available. The JICA Study Team therefore carried out an interview survey of about 10 households who were going to be Project-Affected Persons (PAPs) at each planed facility. In total 53 households were interviewed. The interview survey was conducted in order to collect and collate - in brief – the residents' socio-economic conditions and opinions on the Project. The results of the survey were described in (a) to (d). The distribution of the interviewees and the details of the survey results are shown in Annex PIIB_9-5.

Table R 9.10 Number of Respondents in Ilog-Hilabangan

(Class-wise)			
Residents	Farmers	Fish Cultivators	Total
21 (40%)	29 (54%)	3 (%)	53 (100%)

Source : JICA Study Team

(a) Household (HH) heads and family

Gender and age of HH heads:

10 of the interviewed respondents' household heads are female and most of HH heads are male. The ratio of male is 81% of 53 HH heads. The ages of heads vary from 30 to 60t years old

Education of HH heads

A clear majority of the respondents did not reach college level. 38% of HH head are below elementary school level and 79% of them are below high-school level. Only 8% of 53 respondents were educated in college.

Family composition

42 HHs (79% of total respondents) were composed of single families and 11 HHs (21% of total respondents) have extended families in their households. This shows some level of independence in each household, and some independence in decision making.

Family sizes also tend to be smaller, with major family sizes ranging from 3 to 6 persons. The average of the total family members is 5.2 (persons/house) which is calculated by weighted average method.

(b) Economic condition

Income source of HH heads

29% of 52 respondents' source of income is farming, followed by employment (19%), fishermen (15%), and casual workers (15%).

Family income

The combined family income in the Project areas is generally low with about 77% of the respondents having family incomes of 8,000 Pesos and less. The average family income (calculated by the weighted average method) is about 7,000 Pesos per month.

(c) Life condition of HHs

House size and material, Electricity, Water supply and Toilet location

(House materials): The house materials for residents varied very much, with 29% (of 21) respondents using natural materials (wood, bamboo, etc.), 29% cement and natural materials and only 10% using concrete There are various lifestyles such as, urban, semi-urban, and rural. That is why the fabric materials of the houses are also of a mixed variety.

(Electricity): More respondents in Kabankalan City are connected to an electrical service. 18 respondents (86% of 21 respondents) have electricity connection.

(Drinking water): Most of the respondents (81%) use piped water and water of community wells (depth to about 18 to 20m) is used for other domestic water usage. The river water is used for agriculture.

(Toilet): Sanitation coverage within the respondents in all project areas is almost complete with no respondents using the river as toilet facilities.

(d) Property

House ownership and size

19 HH heads own the house and 2 of 21 residents do not have house ownership in accordance with the results of interviews with residents in Kabanakalan City. Their house size is not big, about 80 % of 21 HHs' houses area is between 20 to 50 m^2.

Land ownership and size

4 HH heads (about 19% of 21 respondents) own the land. 10 respondents (about 47 % of 21 HH heads) are informal settlers (referring to the Barangay Captains in Kabankalan City). The remaining 5 HH heads did not answer.

The size of homestead land (hereinafter referred to as "lot") is small (50m^2) to large (200$m^{2)}$ 9 HH heads did not answer.

(e) Opinion on the Project

Opinion on relocation

There is general agreement that flood control measures need to be in place in the area. In accordance with the interview result, there are no respondents who disagree on relocation if the Project will require them to do so. 15% of respondents agreed unconditionally and 47% of them agreed conditionally to be relocated or transferred. Others needed more information before deciding. Meanwhile, most would agree to the project proceeding, however they required more concrete information about the extent to which they would be affected, including the relocation site and the lawful payments for their land and crops.

Relocation site

The residents who agreed to be relocated were asked about their preferred relocation site and about 64% of them answered that - if possible - they wanted to be relocated within their neighborhood.

9.1.5 The Project

(1) Project Site

The Sector-Loan Project aims to protect the core areas which are Kabankalan City and Municipality of Ilog. The locations of core areas are shown in Figure R 6.1. in Chapter 6.

(2) Project Components

The components of the Project are i) dike construction, ii) excavation the river channel to expand the river area, and iii) dredging the river course. The distributions of the physical constructions are shown in attached Figure 7.4 in Chapter7. The summary of the project components is shown below:

Table R 9.11 Summary of the Project Components

Component	Length (m)	Height/ Depth (m)	Width (m)	Volume (m3)	Location
Dike(1)_Right Bank at Kabankalan	5,600	1~3m	Crown: 6m	265 thousand	K.City
Dike(2)_Left Bank at Sugarcane Mill	2,750	2~4m	Crown: 6m	275 thousand	K.City
Dike(3)_Right Bank at Hilabangan	1,000	1~2m	Crown: 6m	60 thousand	K.City
Excavation (1)	-	-	-	200 thousand	K.City
Excavation (2)	-	-	-	150 thousand	K.City
Excavation (3)	-	-	-	150 thousand	K.City
Raising of Road (Existing/New)	3,300	1~4m	Crown: 6m	250 thousand	M.I
Dredging (1) (Old Ilog River)	6.5km	0~2m	Bed 50~100	500 thousand	M.I
Dredging (2) (New River)	5.0km	0~2m	Bed 50~100	800 thousand	M.I
Total (Embankment)	12,650	1~4m	Crown: 6m	850 thousand	
(Excavation/Dredging)	-			1,800 thousand	

K.City: Kabankalan City, M.I: Municipality of Ilog
Source : JICA Study Team

(3) Alternatives and Evaluation from Environmental & Social Aspects

The alternatives were considered on several aspects, such as risk management, economic, construction, natural environment, and social environment. With regard to environmental and social consideration aspects, the scale of impact on people’s lives can be shown as the scale of land acquisition and resettlement.

(a) Considerations if no project

The damage done to the natural and social environment through flooding would not be mitigated in the case of the project not proceeding. Other impacts which would be caused by the project such as land acquisition, resettlement, salt water intrusion, etc., will not eventuate if the Project does not proceed. However, the risk of a flooding disaster would never be mitigated without the Project, and it would certainly have a negative impact on both natural and social environments. The negative impact without the project proceeding is considered much greater than the potential impacts by the project itself. Taking into consideration the entire evaluation of alternatives in Chapter 7- including the option of the project not proceeding- it is concluded that the Project is required and necessary for the Project site.

(b) Comparison of alternatives

There are 4 alternatives. The total evaluation of 4 alternatives is shown in Table R7.3 in Chapter 7. The considerations/evaluations/decisions of alternatives are carried out not only by environment & social aspects but also by economical, efficiency aspects and demand/requirements by the municipality/general people. The evaluation items on environment and social consideration aspects are scale of i) land acquisition, ii) resettlement, iii) impact by salted water running up, iv) scale of flood area after construction, and v) amount of soil disposal. The results of comparisons are shown in Table R 9.12. In accordance with the Table, alternative I4 can be evaluated as the smallest impact alternative on environmental and social consideration aspects.

Alternative I1: The area of land acquisition and number of resettlements would be the largest among the alternatives. The large scale of river dredging would lead to salt water intrusion, and the amount of disposal soil by dredging is expected to be large. Total evaluation is (-A).

Alternative I2: The total impact is evaluated as almost identical to alternative I3 or marginally smaller. However, an expansion of flood areas outside the center of Kabankalan City would be expected, because the dike (1) aims to limit the river flooding into Kabankalan City and the same amount of water would flood other areas such as upper/lower stream areas. From this angle this alternative is evaluated as lower than alternative I3. Total evaluation is (-B).

Alternative I3: The total impact is evaluated as bigger than alternative I4. The differences between I3 and I4 are impact on land acquisition and resettlement because I3 includes the ring dike at Ilog. Total evaluation is (-B).

Alternative I4: The total impact is evaluated as the smallest among the alternatives. This includes dredging the old Ilog River instead of the ring dike. Therefore, the impact on environmental and social aspects is small. Total evaluation is (-C).

Table R 9.12 Comparison of Impacts on Environmental and Social Conditions

	I1	I2	I3	I4
L.A	(-A) Along the river and ring dike (M.I), dikes (K.C)	(-B) Along ring dike (M.I), dikes and excavations (K.C)	(-B) Along ring dike (M.I), dikes and excavations (K.C)	(-C) Along dikes and excavations (K.C)
R.	(-A) Along the river and ring dike (M.I), dike (1) (K.C)	(-B) Along ring dike (M.I), dike (1) (K.C)	(-B) Along ring dike (M.I), dike (1) (K.C)	(-C) Along dike (1) (K.C)
S.W.I	(-A) Whole main river course	(x) Non	(-B) Until lower stream of Kabankalan	(-C) Until lower stream of Kabankalan
F.A.E	(x) Not expand	(-B) Lower/upper side of central Ilog	(x) Not expand	(x) Not expand
D.S	(-A) Surplus soil is about 3mil m^3	(-C) No surplus soil	(-B) Surplus soil is about 1.2 mil m^3	(-B) Surplus soil is about 1.0 mil m^3
C.E.	(-A)	(-B)	(-B)	(-C)

L.A.: Land Acquisition, R: Relocation, S.W.I.: Salty Water Intrusion, F.A.E.: Flood Area Expanding
D.S.: Disposal Soil amount, C.E.: Comparative Evaluation
M.I: Municipality Ilog, K.C: Kabankalan City
(-A): much significant, (-B): significant, (-C): small impact, (x): no impact
Source: JICA Study Team

9.2 EIA system in Philippines and ECC for the Project

9.2.1 Outline of Philippine EIA System (PEIAS)

(1) Regal Framework of Environmental and Social Considerations in Philippines

The powers and functions of executive agencies other than the Local Government Units (LGUs) are provided in the Administrative Code. Under this law, the Department of Environment and Natural Resources (DENR) is the primary agency responsible for environmental management as well as the use and management of all natural resources.6 The EMB is the unit within DENR that is primarily responsible for pollution issues and environmental impact assessment. A quasi-judicial body, the Pollution Adjudication Board (PAB), is composed of top DENR officials and representatives from the private sector. The PAB is authorized to decide pollution cases and impose fines.

Presidential Decree 1586 required certain projects to submit an environmental impact statement (EIS: detailing the environmental consequences of construction and operation) prior to the development activity. The DAO 37-1996 lists the types of "Environmentally-Critical Projects (ECP)" covered by the requirement (usually heavy industries). All ECPs are required to conduct an environmental study even if the scale of the project impacts would be small. The DAO 30-2003 has added a list of "Environmentally-Critical Areas (ECA)" where even minor projects are required to conduct some impact assessment. It requires detailed EIA for ECPs and relatively simpler studies (called Initial Environmental Examinations (IEEs) or checklists for minor projects or activities in ECAs) based on the level or degree of potential environmental impacts. For projects without any significant impacts, the project proponent shall obtain a Certificate of Non-Coverage (CNC). The EMB-DENR is the primary implementer of the law. The ECC of major projects needs to be approved by the Secretary of the DENR. For minor projects, the Regional Director of the DENR in the region where the project is situated approves the ECC.

PEIAS is a set of laws, regulations, administrative orders and guidelines concerned Environmental Impact Assessment (EIA). Among them some of the most important laws and guidelines are bellows:

(Environment)

- Environmental Impact Statement System, Presidential Decree No. 1586 (1978)

  An act establishing and centralizing the Environmental Impact Statement (EIS) System under the National Environmental Protection Council (NEPC), which merged with the National Pollution Control Commission (NPCC) in June 1987 to become the Environmental Management Bureau(EMB).

- Presidential Proclamation No. 2146 (1981) and No. 803(1996)

  It proclaims Environmentally Critical Projects (ECPs) to have significant impacts on the quality of the environment and Environmentally Critical Areas (ECAs) as environmentally fragile areas within the scope of the EIS System.

- DENR Administrative Order No. 30 Series of 2003 (DAO 03-30), Revised Procedural Manual (2007)

  It provides implementing rules and regulations of Presidential Decree No. 1586, establishing the Philippine Environmental Impact Statement System (PEISS). Also, detailed information in definitions of technical terms, procedures, related laws and regulations are described.

(Social Consideration)

- Guidelines for the Acquisition of Certain Parcels of Private Land Intended for Public Use Including the Right-of-Way Easement of Several Public Infrastructure Projects, Administrative Order No. 50 (1999)

The order is an amendment of the procedures for acquisition of property, declared by Presidential Decree No. 1533 mentioned in the latter section.

With respect to the conditions to be complied with during the negotiated sale, the order states that all the government agencies which are engaged in public infrastructure projects shall first negotiate with the owner for the acquisition of parcels of private land intended for public use including the right-of-way easement of such projects, by offering in writing a purchase price of an amount equivalent to 10% higher than the zonal value of the said property. During the negotiation, the landowner shall be given 15 days within which to accept the amount offered by the concerned government agency as payment for the land.

After the abovementioned period and no acceptance is made by the landowner, the concerned agency, in coordination with the Solicitor General, shall initiate expropriation proceedings in the proper court, depositing 10% of the offered amount.

Besides, the order prescribes the standards for the assessment of the value of the land subject of expropriation proceeding.

- An Act to Facilitate the Acquisition of Right-of-Way, Site or Location for National Government Infrastructure Projects and for other Purposes, Republic Act 8974 (2000)

It declares that private property shall not be taken for public use without just compensation. Towards this end, the State shall ensure that owners of real property acquired for national government infrastructure projects are promptly paid just compensation. The Act also provides Guidelines for Expropriation Proceedings including compensation of the property which shall be appraised by determining the market values of lands and improvements. The Sec. 8 states that the implementing agency shall take into account the ecological and environmental impact of the project.

- The Agricultural Land Reform Code, Republic Act 6389 (1971)

The Act amended the agricultural land reform code. The agricultural lessee shall be entitled to disturbance compensation equivalent to five times the average of the gross harvests on his landholding during the last five preceding calendar years.

- Executive Order 1035 (1985)

The order provides the procedures and guidelines for the acquisition of private properties or rights for development projects by the government, including government-owned or controlled corporations and state colleges and universities.

Acquisition shall be done either through negotiated sale or expropriation. The order gives authority to the government implementing agency/instrumentality concerned to immediately institute expropriation proceedings if the parties fail to agree in negotiation of the sale. The just compensation to be paid for the property acquired through expropriation shall be in accordance with the provisions of P.D. No. 1533 under-mentioned.

- Presidential Decree No. 1533 (1978)

  It establishes a uniform basis for determining just compensation and the amount of deposit for immediate possession of the property involved in eminent domain proceedings.

- Urban Development and Housing Act, Republic Act 7279 (1992)

  This Act provides policy to undertake, in cooperation with the private sector, a comprehensive and continuing Urban Development and Housing Program. The program is aimed to uplift the conditions of the underprivileged and homeless citizens in urban areas and in resettlement areas by making available to them decent housing at affordable cost, basic services, and employment opportunities. The Program covers lands in urban and urbanizable areas, including existing areas for priority development, zonal improvement sites, slum improvement and resettlement sites. Under this Act, eviction and demolition are allowed in danger areas such as railroad tracks, garbage dumps, riverbanks, shorelines, waterways, and other public places such as sidewalks, roads, parks, and playgrounds.

- Instituting the National Drive to Suppress and eradicate Professional Squatters and Squatting Syndicates, Executive Order No.153 (1999)

  The Act states that the Housing and Urban Development Coordinating Council (HUDCC) and the Department of Justice (DOJ) shall have authority to call on the relevant government agencies to give their assistance and cooperation to intensify the national drive against the professional squatters and squatting syndicates.

  Also, the Act prescribes that the National Police Task Force shall be strengthened as the operational arm of the HUDCC in the implementation of the provisions of the order.

- Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy (LARRIPP) (2007)

  This is the guideline of DPWH for land acquisition and resettlement. This policy was established based on Philippines national laws, regulations and it includes the guidelines of WB, ADB, and JBIC. This policy is applicable for the projects under DPWH.

- Relevant Guidelines

  Some of the guidelines prepared to put the above-mentioned laws into effect are listed below.

  - Implementing Rules and Regulations Governing the Registration of Socialized housing Beneficiaries (1993)
  - Implementing Guidelines for the Acquisition, Validation, Disposition and Utilization of Lands for Social Housing (1993)
  - Implementing Rules and Regulations to Ensure the Observance of Proper and Hmane Relocation and Resettlement Procedures Mandated by the Urban Development and Housing Act (1992)
  - Guidelines for Land Validation for Socialized Housing, Local Financial Circular 3-92 (1992)
  - Guidelines of Executive Order No.153

(Laws and Regulations Concerning the Environmental Standards)

- Environment Code, Presidential Decree No. 1152

  Known as the Philippine Environment Code, it launches a comprehensive program on environmental protection and management. It also provides for air, water quality, land use, natural resources and waste management for fisheries and aquatic resources; wildlife; forestry and soil conservation; flood control and natural calamities; energy development; conservation and utilization of surface and ground water and mineral resources.

- Water Code, Presidential Decree No. 1067

  A decree instituting a water code which revises and consolidates the laws governing the ownership, appropriation, utilization, exploitation, development, conservation and protection of water resources.

- Clean Water Act, Republic Act 9275

  An Act which aims to protect the country's water bodies from pollution of all possible sources (industrial, commercial, agriculture and household activities). It provides for a comprehensive and integrated strategy to prevent and minimize pollution through a multi-sectoral and participatory approach involving all the stakeholders.

- Clean Air Act of 1999, Republic Act No. 8749

  An Act which lays down policies to prevent and control air pollution. The act sets standards of exhaust gas from vehicles, manufacturing plants and so on to follow. All potential sources of air pollution must comply with the provisions of the Act. As such, all emissions must be with in the air quality standards set under the law. It also imposes the appropriate punishments for violators of the law.

- Ecological Solid Waste Management Act, Republic Act No. 9003 (2000)

  An Act providing for an ecological solid waste management program, creating the necessary institutional mechanisms and incentives, declaring certain acts prohibited and providing penalties, appropriating funds therefore, and for other purposes.

- Pollution Control Law, Presidential Decree No. 984

  An Act that serves as the foundation for managing industrial activities impacting air and water quality. It empowers the DENR to impose ex-parte cease and desist orders (CDO) on the grounds of immediate threat to life, public health, safety or welfare, or to animal or plant life when wastes or discharges exceed the normal.

- Forestry Reform Code, Presidential Decree No. 705

  The Forestry Reform Code of the Philippines recognizes that there is an urgent need for proper classification; management and utilization of the lands of the public domain to maximize their productivity to meet the demands of the increasing population of the Philippines. It surmises that to achieve the above purpose, it is necessary to reassess the multiple uses of forest lands and resources before allowing any utilization to optimize the benefits that can be derived. It also emphasizes not only the utilization but more so on the protection, rehabilitation and development of forest lands to ensure the continuity of their productive condition.

- National Integrated Protected Areas System (NIPAS), Republic Act No. 7586

  An Act that aims to protect and maintain the natural biological and physical diversities of the environment notably on areas with biologically unique features to sustain human life and development as well as plant and animal life. It establishes a comprehensive system of integrated protected areas within the classification of national park as provided for in the Constitution to secure for the Filipino people of present and future generations the perpetual existence of all native plants and animals. It encompasses outstandingly remarkable areas and biologically important public lands that are habitants of rare and endangered species of plants and animals, bio-geographic zones and related ecosystems, whether terrestrial, wetland or marine.

(2) Category of project

In accordance with DENR Administrative Order No.37, series of 1996 (DAO 37), any projects in Philippines are required to obtain ECC or CNC. The projects which are required CNC are defined in Section 2.0 of DAO 37. The other projects are categorized as EIA-covered projects which are classified into Group I to V as below.

Table R 9.13 Project type in PEIAS

Group	Description
I	Single ECP (Environmentally Critical Project) in ECA (Environmentally Critical Area) or NECA (non-ECA)
II	Single NECP (non-ECP) in ECA
III	Single NECP in NECA
IV	Co-located Projects in either ECA or NECA
V	Unclassified Projects

Source: Table 1-3 of RPM

There are 4 EPCs and 12 ECAs, they are described as Table R 9.14.

Table R 9.14 ECPs and ECAs in PEIAS

A. List of ECPs	
1	Heavy Industries – Non-ferrous Metal Industries, Iron and Steel Mills, Petroleum and Petro-chemical Industries including Oil and Gas, Smelting Plants
2	Resource Extractive Industries – Major Mining and Quarrying Projects, Forestry Projects (logging, major wood processing projects, introduction of fauna (exotic animals) in public and private forests, forest occupancy, extraction of mangrove products, grazing), Fishery Projects (dikes for/ and fishpond development projects)
3	Infrastructure Projects – Major Dams, Major Power Plants (fossil-fueled, nuclear fueled, hydroelectric or geothermal), Major Reclamation Projects, Major Roads and Bridges
4	All golf course projects
B. List of ECA Categories	
1	All areas declared by law as national parks, watershed reserves, wildlife preserves, sanctuaries
2	Areas set aside as aesthetic potential tourist spots
3	Areas which constitute the habitat of any endangered or threatened species of Philippine wildlife (flora and fauna)
4	Areas of unique historic, archaeological, or scientific interests
5	Areas which are traditionally occupied by cultural communities or tribes
6	Areas frequently visited and/or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.)
7	Areas with critical slopes
8	Areas classified as prime agricultural lands
9	Recharged areas of aquifers
10	Water bodies characterized by one or any combination of the following conditions: tapped for domestic purposes; within the controlled and/or protected areas declared by appropriate authorities; which support wildlife and fishery activities
11	Mangrove areas characterized by one or any combination of the following conditions: with primary pristine and dense young growth; adjoining mouth of major river systems; near or adjacent to traditional productive fry or fishing grounds; areas which act as natural buffers against shore erosion, strong winds and storm floods; areas on which people are dependent for their livelihood.
12	Coral reefs characterized by one or any combination of the following conditions: With 50% and above live coralline cover; Spawning and nursery grounds for fish; Act as natural breakwater of coastlines

The groups mentioned in Table R 9.13 are classified into several project types, and project types are classified into sub-types. Table R 9.15 shows number of project type and sub-type. The details are described in the Annex 2-1b of the RPM.

Table R 9.15 Number of project types in PEIAS

Group	Number. of types	Number. of sub-types
Group I	4 types	37 sub-types
Group II	20 types	121 sub-types
Group III:	no type	no sub-type
Group IV	1 type	1 sub-type
Group V: ,	1 type	2 sub-types
Total	26 types	161 sub-types

Source: Annex 1-2b of RPM

(3) Required report

There are seven (7) major EIA Report types as: (1)Environmental Impact Statement (EIS), (2) Programmatic EIS (PEIS), (3) Initial Environmental Examination Report

(IEER), (4) IEE Checklist (IEEC), (5) Project Description Report (PDR) (6) Environmental Performance Report and Management Plan (EPRMP), (7) Programmatic EPRMP (PEPRMP) for co-located project applications. (1) to (4) are prepared for Group I and II, (5) is for non-covered project (to obtain CNC), (6) and (7) are for the revised projects or co-related projects. The necessary type of EIA report is decided by EMB-DENR.

Table R 9.16 Summary of Project Groups, EIA Report Types, Decision Documents, Deciding Authorities and Processing Duration

Project Groups	Documents Required For ECC/CNC Application	Decision Document	Deciding Authority	Max Processing Duration
I: Environmentally Critical Projects (ECPs) in either Environmentally Critical Area (ECA) or Non-Environmentally Critical Area (NECA)	Environmental Impact Statement (EIS)	ECC	EMB Director / DENR Secretary	120 days (Working Days)
II: Non-Environmentally Critical Projects NECPs) in Environmentally Critical Area (ECA)	Environmental Impact Statement (EIS) / Initial Environmental Examination Report (IEER) / Initial Environmental Examination Checklist (IEEC) /Project Description Report (PDR)	ECC/CNC	EMB RO Director	15-60 days (Working Days)
III: Non-Environmentally Critical Projects (NECPs) in Non-Environmentally Critical Area (NECA)	Project Description Report (PDR)	CNC	EMB Director / EMB RO Director	15 days (Working Days)
IV: Co-located Projects	Programmatic Environmental Impact Statement (PEIS)	ECC	DENR Secretary	180 days (Working Days)
V: Unclassified Projects	Project Description Report (PDR)	CNC or Recommendation on Final Grouping and EIA Report Type	EMB Director / DENR Secretary / EMB RO Director	15 days (Working Days)

Source: Revised Procedural Manual for DENR Administrative Order No. 30 Series of 2003 (DAO 03-30) (2007)

After decision of type of required report, the EIA system in Philippines is going on as follows.

(4) Procedure of ECC obtaining

The following comprise the major steps of the environmental compliance certificate application process for projects requiring an environmental impact study:

1. Project Screening - The first step in the EIS process is determining which projects are covered or not by which requirements. The law pre-categorizes projects based on the level or degree of potential environmental impacts and each category has a prescribed environmental assessment instrument of commensurate scale or level of complexity. Projects that fall under environmentally critical projects in both environmentally critical areas and non-environmentally critical areas are classified as Group I projects. Those that are non-environmentally critical but located within environmentally critical areas are classified as Group II projects. Projects that are neither environmentally critical nor located in environmentally critical areas fall under Group III projects. Co-located projects fall under Type IV while unclassified projects are under Group V. Environmental enhancement projects are included under Group II projects and are required only a simple Project Description except for those with

environmentally critical components which will be required IEEs or EIAs. The initial screening is usually done by the proponent with the help and concurrence of DENR staff.

(While the projects in the three rivers are meant to help alleviate the flooding impacts in the core development areas, the projects have been screened as environmental enhancement projects under Group II but since they do have some critical components such as dredging and land excavation they have been required to have an IEE report. This was done with the help of EMB staff and the DPWH-ESSO)

2. Scoping – Scoping is where the key issues and concerns are identified and the scope of the study is agreed upon by the proponent, the EIA consultants, DENR-EMB, EIA Review Committee (EIARC), local residents and other project stakeholders. Here the proponent is required to submit a Project Description for Scoping (PD-S) which will be the basis for the determination by the EIARC of the pertinent technical issues. It is during scoping that the EIARC for the project is formed and project stakeholders are identified. The review committee is a body of independent technical experts and professionals of various fields organized by the DENR-EMB to evaluate the EIS Report and to make appropriate recommendations regarding the issuance or non-issuance of an environmental compliance certificate. It is also during scoping when requirements for specific studies such as environmental risk assessment and environmental health impact assessment are determined. The major activities include presentation of project to the EIA Review Committee, on-site scoping with project stakeholders, and a technical scoping session with the review committee. These activities result in the production of the scoping report and the scoping checklist.

A new memorandum issued only last October 1, 2009 has made such a scoping session optional although the necessary scoping guidelines have not yet been issued. This means that scoping may be done wholly by the project proponent without intervention by the EMB or the EIARC. The hiring of outside consultants for the EIARC has also been discouraged. This means that the EMB has to review the submitted report with its in-house personnel.

3. Environmental Impact Assessment Study - The conduct of the EIA study commences after the scoping checklist is finalized. The assessment for Category B projects typically includes characterization and analysis of the biophysical, chemical, social, economic and cultural environment although on a much smaller and specific scale than that of a full-blown EIA. However, the new memorandum issued on October 1, 2009 has focused the EIA study to include only the environmental impacts of the proposed project. The socio-economic impacts and impact mitigation have been transferred to other agencies such as the LGUs. Public participation has also been removed from the EIA process with public scoping, socio-economic and perception surveys, and public hearings and consultations not required anymore . Since the memorandum is rather new, the impact of this on the EIA guidelines is rather obscure and a new set of guidelines will be expected from the DENR. Other important parts of the EIA study include the following

a. baseline data gathering, where the environmental conditions within the main impact areas before the project commences are gathered. This includes air quality, water quality, soil quality, flora and fauna studies, and other environmental data that is identified during scoping. Primary data may be collected but for IEE reports, data may be sourced from secondary sources

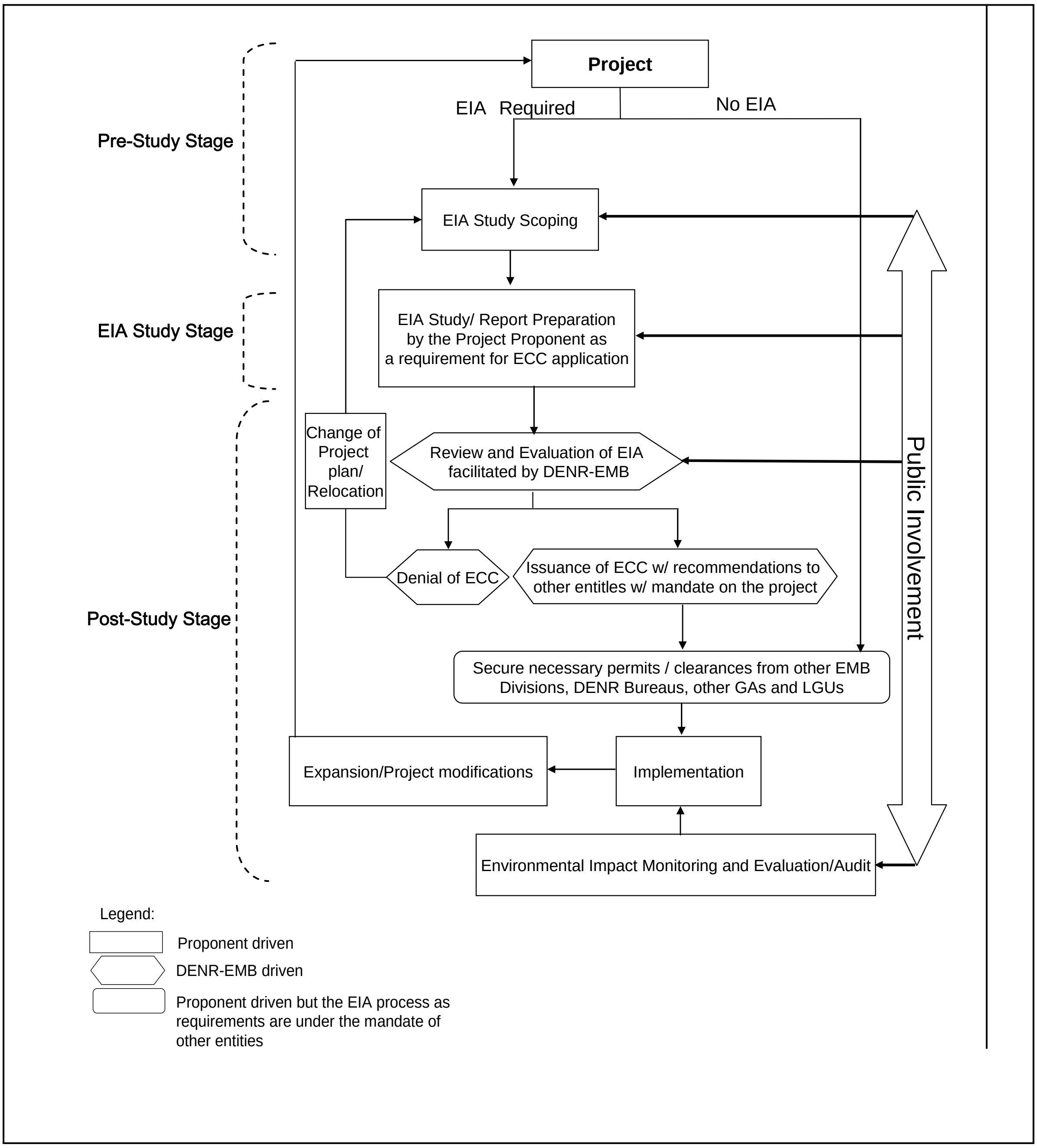
b. impact identification, prediction and evaluation, which involves a description of the project to be developed and its activities and the characterization of the possible impacts of project activities

c. environmental planning, which involves the creation of an environmental management plan and an environmental monitoring plan. The environmental management plan focuses on the key impacts and the manner by which these impacts are mitigated. This will also include a maintenance plan and an abandonment plan if the project is abandoned.

4. Environmental Impact Assessment Review - The results of the EIA study together with other required documents are packaged into an EIS or an IEE Report, which is submitted to DENR-EMB office for review. If a full-blown EIA is required, the document is submitted to the EMB central office. If an IEE or a CNC document is provided, the document is submitted to the EMB regional office where the project is located The review process consists of two stages. The first stage is a "procedural review" to be conducted by a DENR-EMB staff whose primary job is to check for completeness and ensure that submitted documents are clear and legible. Once the document is complete, the IEE or EIA shall be deemed accepted by the EMB. The second stage is the "substantive review" by the EIA Review Committee, which is now supposed to be chiefly composed of EMB and DENR personnel. At this stage, the review committee may conduct field visits or site inspections. The EIARC may not require any additional information anymore according to the new memorandum. ECC process application is now 20 working days.

5. Post-ECC requirements – After the environmental compliance certificate is issued, the proponent is expected to implement the environmental management plan and meet the conditions stipulated in the environmental compliance certificate. Post-environmental compliance certificate requirements may include the conduct of additional specialized studies such as biodiversity. With the shorter processing times and the optional attendance of the EMB and the EIARC during scoping, it is expected that the ECC conditions may become longer and more stringent. Since there is no limit on the number and types of conditions that can be included in the environmental compliance certificate, the DENR has used the environmental compliance certificate to include conditions or requirements that were not yet mandated by law but which the DENR felt necessary.

The summarize EIA process in Philippines is shown in Figure R 9.2.



Source: Revised Procedural Manual for DENR Administrative Order No. 30 Series of 2003 (DAO 03-30)(2007)

Figure R 9.2 Summary Flowchart of EIA Process

9.2.2 ECC obtaining process for the Sector-Loan Project

(1) Category of the Project in PEIAS

The JICA Study Team prepared the checklist as self-screening and discussed the category of the Project, the procedure for ECC with EMB-DENR on 28th of September. Also, The JICA Study Team discussed this matter with R.O. of EMB in each region.

EMB-DENR evaluated the Project through project description and concerning the condition surrounding the Project site as below:

a. The Project is not EPC stipulated by DAO 37-1996.

b. The Project targets a river. However, the Project does not include a reservoir, and there is not much possibility that the river flow will be changed in any way.

c. The Project aims to mitigate the impact of potential natural disasters and would enhance the social environment.

d. A social study would be required because the number of resettlement cases would be high.

e. The Project includes large amounts of excavated soil. Therefore, the handling of the soil disposal issue should be considered and necessary measures prepared and taken.

Based on these considerations, EMB-DENR explained that the Project was categorized as the Environmental Enhancement Project of Type II. The required reports for ECC application for the Project are IEER and RAP report, because there is no significant impact expected on the natural/social conditions, except a certain number of resettlement cases (about 75 houses: more than 375 persons would be relocated). The prepared self-screening checklist was attached as Annex PIIB_9-7.

(2) Necessary items of application for ECC in PEIAS

In accordance with explanations by EMB-DENR, for projects required to submit an Initial Environmental Examination, the requirements would almost be the same as an Environmental Impact Statement, although scaled down. There would be the same modules required, i.e. land, water, air, people but the EMB is usually not stringent in requiring actual water sampling or primary data collection in this case. Presumably, the IEE report can be accomplished in a faster span of time.

(3) Outputs of IEE report of this study

The outline of this study is listed below: 1) Project description, 2) Baseline data of natural/social conditions, 3) Scoping and necessary mitigation measures, 4) Recommendations of the monitoring plan

(4) Comparison of JBIC guideline and requirements for ECC in Philippines

The comparisons between JBIC Guidelines for Confirmation of Environmental and Social Considerations[3] (hereinafter referred to as JBIC guidelines) and requirements for IEE report in PEIAS are described in Annex PIIB_9-8. There is no major difference between them.

(5) Necessary studies for the next step by DPWH

After this preparatory study, DPWH would need to carry out the IEE study and RAP study to obtain ECC. In the case of the Project being implemented by Japan's ODA loan, the environment assessment impact study, and the RAP study are required to satisfy the requirements of the EIA study which are described in page 16 and 17 of the JBIC guideline.

9.3 General IEE study result (not specified IEE in Philippine)

The Project description and the baseline data collection have been described in previous chapters. In this chapter, the results of scoping, mitigation measures and recommendation of the monitoring plan are described.

[3] It was established in 2002 April.

9.3.1 Scoping results

(1) Resettlement, land acquisition

The estimated number of houses which will necessary to be relocated is 75. The average number of family members per house in Kabankalan City is estimated at more than 5; more than 375 people will be resettled. In the case of more than 200 resettled persons it can be said that this constitutes a large scale resettlement in accordance with WB/JICA.

The dike constructions and excavation of the land which is located on the opposite side of the dike (1) would introduce land acquisitions. The estimated land acquisition areas are shown in Table R.9.21. The total estimated area is 40.3 ha. The expected land acquisition areas are almost all in private ownership.

The impact of resettlement and land acquisition are significant with consideration to not only international donors' policies but also in Philippines itself. The members of EMB-DENR with whom the JICA Study team and ESSO held consultations with, had the same opinion.

(2) Effect on traffic, living facilities, and living conditions of residents

(Impact on traffic): It is expected that the dike construction would not cause much disruption to traffic, because the dike construction sites are located along the river where there does not seem to be much traffic. There is sand mining activity in the middle of the dike design (1). Some small boats collect sand and trucks transport sand as well. This activity will be affected by the dike (1), because the tracks entering the river side will be blocked.

The residents in Barangay 9 where the dike (1) is designed use the cable suspension bridge for traffic and there is no water traffic.

(Impact on living conditions of residents): The impacts on the living conditions of residents are expected to be i) temporary noise/vibration, air pollution, water pollution during construction, ii) life style changes due to resettlement. The impacts during the construction period are described (8) in this chapter.

(Benefit impact on living conditions of residents)

<u>i) Mitigation of flood disaster:</u> The residential areas in Kabankalan City and Municipality Ilog are located along the river. These areas have been damaged by flood disasters for a long time. Based on this the Project aims to mitigate such flood disasters. Therefore, the project would have a large beneficial impact on the living conditions of residents. <u>ii) Opportunity for employment:</u> The construction would need many laborers during construction, thus it would introduce opportunities for employment to the local residents.

(3) Water right/right of common

There are no fisheries in Ilog-Hilabangan River. However, fish breeding (tilapia, bangus, etc.) using sea water and river water is conducted near the river mouths of Ilog-Hilabangan River and old Ilog River. The fish breeding ponds mainly use sea water and usage of river water is very limited. The river water being used is salt water. Therefore, if an expansion of salt water intrusion would occur, a significant impact on these activities is not to be expected. Suspended solids in river water seem to increase during the construction period, their impact would not be significant due to sea water being used mainly.

(4) Solid waste/sanitation

Short-term deterioration of sanitary conditions could occur in and around the construction site during construction activities, including worker's camps Disposal of the construction residue of the project would be expected to occur during construction. Waste from worker's camps is also expected to increase during construction in the short-term.

Excavation and dredging will generate about 1,800 000 m^3 of disposal soil in total, with about 850 t000 m^3 of it being used for the construction materials for the dikes. About 950 000 m^3 surplus soil would need to be treated. The sedimentation soil was sampled and analyzed for this Study to test for heavy metals. There are no indications of the presence of hazardous heavy metals. If the surplus soil would be disposed in inappropriate places, the impact could be significant on the environment. Therefore, serious consideration must be given to appropriate treatment methods.

(5) Safety during construction

Due to the dike constructions involving the use of heavy equipment, there is a possibility for the Project to cause a construction-related accident.

The dike constructions are located near the residential areas. There is a possibility of traffic accidents involving the residents due to the increase in the volume of construction equipment and transportation vehicles.

(6) Biological Environment

The major direct impacts on the natural vegetation cover and wildlife would not be expected to be significant. The Project will build dikes near the residential areas where the natural conditions have already been changed to the extent that the area no longer contains much original natural vegetation which could be potentially negatively and directly affected.

There is the possibility for the Project causing an impact on sediment-based live creatures due to the dredging works which would dredge parts of the river sediment. However, the dredging works at Ilog-Hilabangan (new river) would make the asperity on the river cross section more even. A significant impact would therefore not be expected. The dredging at old Ilog River would be about 3m maximum. However, since old Ilog River was developed artificially there would not be a significant introduced impact.

(7) Salt water intrusion

The river dredging work carries a potential impact in the form of an expanding intrusion of salt water. In the case of excavation the river bed would change the vertical shape of the river, the amount of salt water intrusion would go upstream, thus, the area of salt water intrusion would expand. The sugar cane fields and wells - which are sourced by river water - would be impacted by it. The pumping irrigation on sugar cane fields is conducted during low-tide only to prevent impact of salt water (interview result from a farmer at the site). The area affected currently by salt water was determined roughly as going from the river mouth to the Ilog. The drinking water for the residents is almost exclusively provided by piping systems and wells. There is potential impact on the drinking water because some residents use well water for drinking.

The salt water intrusion is not simple. Therefore a detailed survey is necessary to determine any impact caused by it. The recommended survey to follow this study is described in Annex PIIB_9-9.

(8) Impacts during construction

Impacts during the construction period include i) air quality, ii) noise/vibration, iii) traffic, and iv) water pollution These impacts of construction are expected only during the construction stage but their magnitude would be large.

(Air quality): Locally significant impacts of dust emission are expected in the short term during the construction period caused by the movement of haulers and construction vehicles, the operation of construction equipment, earthworks, and other related activities. A degradation of air quality due to gas emissions from those vehicles would be expected in the short term.

(Noise/vibration): Short-term noise created by the operation of the construction equipment and transport vehicles could be expected.

(Traffic): The number of vehicles would increase in the short term during construction. There is not a lot of traffic at present and a significant impact - such as heavy traffic - is not expected.

(Water pollution); There is a possibility in the short term for the Project to cause water pollution due to the dike construction, excavation and dredging of the river.

An existing revetment construction which was smaller in scale than the designed dike of the Project and was located near the dike (1), did not cause water pollution.

In the case of water pollution would be occurred, a fisheries in the downstream and residents who use river water for drink are expected to be affected. There are fish breeding ponds near the river mouths but no fisheries in the river, and most of resident do not use river water for domestic use. The sea water is sued mainly for fish ponds and river water is used only a little.

The total length of Ilog-Hilabangan River is approximately 120km. The scale of excavation is about 2km and it is designed to excavate the locations which are extremely curved, making the river flow more smoothly. The dredging at Ilog-Hilabangan River (new river) is approximately 5km which seemingly is a very limited and section of the entire Ilog-Hilabangan River. Meanwhile, Old Ilog River was basically developed artificially. The water flow was not very strong and sediments have formed on the bottom. The designed dredging plans to excavate them. Therefore, water pollution resulting from excavation and dredging of the river could be expected to return to normal levels again in a comparatively short time.

SS (suspended solids) in those rivers are not measured, the river water looks murky with a charcoal color, it could be estimated that the water includes a lot of silt which would have been carried down from upstream.

There is, therefore, the possibility for the Project to cause water pollution in the short term but there would be no significant impacts in accordance with the overall scale of construction, size and condition of the river, as well as current usage of the river water.

(9) Scoping table

The scoping results are shown in Table R 9.17.

Table R 9.17 Scoping Table

Item	Rating	Rating ground
Social consideration		
Resettlement	-A	- 75 houses (more than 375 persons) are expected to be relocated (large scale resettlement). - The necessary land acquisition area is estimated at approx. 40.3 ha. Most of landowners are private, but the details are unclear.
Affection for traffic, living facilities, and the living of residents	-B/+A	- (negative point) The temporary noise/vibration by the construction and the lifestyle changes by the resettlements are expected. - (negative point) The entrance location for the trucks which transport sand at the downstream from the cable suspension bridge in Kabankalan City. This will be affected by the dike construction. - (positive point) The residential areas have received flood damage before. The protection of these areas as the fundamental base of people's lives, would be very beneficial. - The people use the cable suspension bridge for the transportation to the opposite shore. Therefore, dike construction could be expected to not affect this to any large extent. - (positive point) During construction, employment opportunities for local residents would be created. - (positive point) There is possibility for the protection of the sugar cane factory in Kabankalan City to assist the economic development of the city.
Decupling the areas	D	- The dike would be constructed as close to the river banks as possible. Therefore, no houses would be set in the areas at the river banks from the dike.
The local archeological, historical, cultural, and religious heritage sites	D	- There are no local archeological, historical, cultural, and religious heritage sites in and surrounding the Project area.
Right of water, right of common	D	- There are no fisheries in Ilog-Hilabangan River - The fish breeding ponds located near the river mouths use mainly sea water. In the case of expanding salt water intrusion, the impact on fish ponds could be expected to be insignificant. - The dike constructions, excavation, and dredging would cause water pollution in the short term. The river water, however, is not used much for the fish ponds and the pollution would not be expected to have a significant impact.
Ethnic Minorities and Indigenous Peoples	D	- There are no Ethnic Minorities and Indigenous Peoples in and close to the Project area.
Waste/sanitation	-A	- Deterioration of sanitary conditions could occur in and around the construction sites & worker's camps in the short-term. - Disposal of the construction residue and waste from worker's camps of the project would be expected during construction in the short-term. - Excavation and dredging will generate about 950 000 m^3 of disposal soil in total. - The sedimentations were sampled and analyzed. There are no indications of the presence of hazardous heavy metals. - If the surplus soil was to be disposed in inappropriate

Item	Rating	Rating ground
		places, the impact could be significant.
Safety during the constructions, waste control	-A	- Heavy equipment would be used for the construction. Therefore, there is some chance of accidents occurring. - The construction sites are located near residential areas. There is the potential for traffic accidents. - The work camp sites would generate waste
Natural condition		
Protected areas	D	- There are no national parks, protected areas, endangered or threatened species, protected mangrove areas, protected coral reefs in or near the Project site.
Topography and Geology	D	- The Project components are dike construction, excavation of the river and dredging of the river. These constructions are not expected to introduce significant changes of topography and geology.
Lake, river flow condition	D	- The dike construction would not cause a significant change of river flow. - The river width is large. Therefore, the increase in the normal river flow will not be changed by the river dredging.
Sea shore, marine area	D	- The Project does not include any changing of the drift sands
Flora and fauna	D	- The Project area is a developed area. - There are no endangered species. - The dikes will be constructed near the residential areas which do not include much natural vegetation directly affected. - The river dredging will level the unevenness at the river cross section; it is expected to not cause big changes. - Old Ilog River was developed artificially. - Total length of Ilog-Hilabangan River is 120km, the scale of excavation and dredging are not big. The change in sediment condition could be expected to recover comparatively quickly.
Landscape	D	- The height of the dike is 1 to 3 m. It will not cause topographic change, or change of landscape.
Environmental Pollution		
Air quality	A	- Significant impacts of dust emission are expected in the short term during the construction period - A degradation of air quality due to gas emissions from those vehicles would be expected in the short term
Noise/vibration	-A	- The dikes will be constructed near the residential areas. Therefore, the impact of noise/vibration would be expected to be significant in the short term.
Traffic	D	- The number of vehicles would increase in the short term during construction. - There is not a lot of traffic at present and a significant impact - such as heavy traffic - is not expected.
Water pollution	-B	- There is a possibility for the Project to cause water pollution by dike constructions, excavation and dredging of the river in the short term. - The existing revetment construction did not cause water pollution. - The river water is not used domestically by the majority of residents.

Item	Rating	Rating ground
		- Sea water is used mainly for the fish ponds near the river mouths; river water is used only to a very small extent. - The entire Ilog-Hilabangan River is 120km long and the excavation is 2km in length and would make the river flow more smoothly. - The length of dredging at Ilog-Hilabangan River is 5km, which, overall, seems to be only a short part on the entire scale of the river. - Old Ilog River was developed artificially. The settled and accumulated sediments would be dredged. - The river water looks murky with a charcoal color, it could be estimated that the water includes a lot of silt which would have been carried from upstream.
Expanding salt water intrusion	C	- The river dredging work with change of vertical river shape carries a potential impact in the form of an expanding intrusion of salt water. - In the case of expanding salt water intrusion, irrigation water on sugar cane fields and well water quality could be affected. - Detail survey of salt water intrusion is necessary to evaluate its impact.

A: Significant impact will be expected
B: Some impact will be expected
C: The impact is not clear at this time.
D: No impacts will be expected. No consideration is required for the EIA study
(Source: JICA Study Team)

9.3.2 Recommendations of the mitigation measures

The outlines of the mitigation measures are suggested below, with these representing the minimum requirement. These are expected to be verified and finalized by the results of EIA and RAP study which would be carried out by DPWH

(1) Mitigation measures for Resettlement, land acquisition

75 households (more than 375 persons) would be relocated and the land acquisition area is estimated as 40.3 ha. Thus, the impact of resettlement and land acquisition is expected to be significant. It is a requirement to carry out i) determination of PAPs, ii) a socio-economic survey on PAPs, and iii) public consultations during the RAP study which would be carried out by DPWH. RAP would be prepared through the study referring to the international donors' guidelines such as the World Bank and JICA guidelines. Recommended TOR of the RAP study is shown in Annex PIIB_9-9.

(2) Mitigation measures for Effect on traffic, living facilities, and living conditions of residents

(Impact on traffic): The mitigation measure of construction of the entrance road beside the dike is recommended as figure below. The top of the dike is designed 6m in width to be used as a management road. It can therefore be used as an entrance as well.

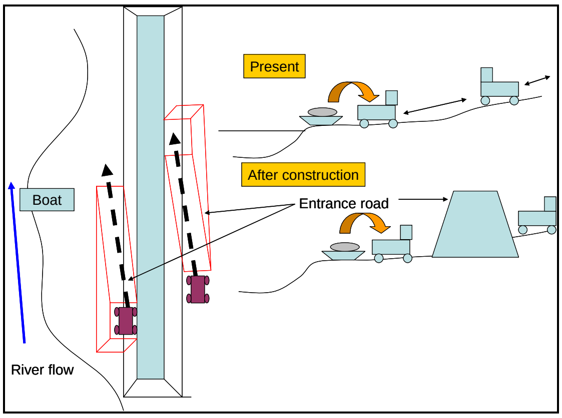


Figure R 9.3 Entrance road plan for sand mining

(Impact on resident's lifestyle): The mitigation measures for i) impacts from construction in the short term such as noise/vibration, air pollution and water pollution are described in (8). The mitigation measures for changes caused by resettlement were described in (1).

(3) Mitigation measures for waste/sanitation

(Sanitation): To provide appropriate waste water treatment facility, toilet and waste collection at the workers' camps and project site.

(Waste): Rubbish, waste surplus and debris be cleared from the site and regularly disposed of in n approved landfill sites in line with and following governing rules and regulations.

(Surplus soil): It is required to confirm the points to prevent any significant impact on the environment from surplus soil as follows; i) the soil is not polluted with heavy metals, ii) preparation of a disposal site, and iii) the disposal site has sufficient capacity,

The construction plan for the Project was considered in SAPROF Study. JICA Study Team discussed with local government of Ilog Municipality and Kabankalan City. It was agreed to use the planned residential areas as disposal area and the surplus soil would be used as filling material for the creation of the land. The soil would be confirmed as containing no heavy metal pollution and the receiving sites would have sufficient capacity. In the case of the construction being carried out in accordance with the plan, the surplus soil would be used for the creation of the land as filling material and it could be treated without significant impact on the environment. The construction plan could therefore function as an effective mitigation measure. It could be expected to mitigate the environmental impact if the construction was carried out as planned.

The mitigation measures are recommended as identical as described in the construction plan in this report; i) the soil would be used as filling material for dike construction, ii) the surplus soil should be carried into the planned sites for residential use in Kabankalan City and would be used as filling material for land creation. When the detailed construction plan is being prepared, it is recommended to discuss with the Local Government of Kabankalan City and to confirm the receiving sites.

(4) Mitigation measures for safety during construction

The recommendations for safety during the construction are: i) keep safety in mind at all times, ii) provide safety helmets to each labourer. It is highly recommended to pay attention to accident prevention especially during heavy equipment operation, iii) emphasis on accident prevention involving residents when transport vehicles access through residential areas, iv) disclosure of information relating to construction to the residents from the construction planning stage onwards and asking them for their understanding and cooperation regarding the impacts of construction.

(5) Mitigation measures for biological conditions

The dredging work would excavate a part of the sediment, which would have an impact on the sediment biology. However, it could be expected to be insignificant and to recover comparatively quickly. In the case of a long span of dredging being carried out in the short term, it is expected to become significant. Therefore, it is recommended to set a sufficient and adequate construction time period. Also, it is recommended to conduct interviews with the residents regarding the river conditions and confirm that significant changes – such as the degradation of fish stocks - would not occur.

(6) Mitigation measures for expanding salt water intrusion

A detailed survey is recommended to assess the expanding of salt water intrusion as a part of EIA study which would be carried out by DPWH. Determination of the river water quality and current water usages are required. The impact could be assessed through analysis of existing data or hearing the local consultants. The recommended survey TOR is described in Annex PIIB_9-9.

(7) Mitigation measures for impacts by construction

The impacts during construction would be expected to be i) air pollution (dust, exhaust emissions), ii) noise/vibration, iii) traffic, and iv) water pollution. The recommendations of mitigation measures for them are as follows:

(Air pollution): It is recommended to mitigate the impact of air pollution as follows: i) launder mud and dust from vehicles, ii) keep the excavated soil or other soil materials wet by watering. The mitigation measures of exhaust emissions are; i) prohibit needless idling of engines, ii) prevent the concentrated operation of heavy equipment in one place, iii) adhere to the construction time schedule.

(Noise/vibration): it is recommended to mitigate impacts of noise/vibration as follows; i) use low noise equipment, ii) prohibit construction work during night time hours, iii) employ low noise construction methods. It is also recommended to disclose the information regarding construction procedures to the residents from the construction planning stage onwards and ask them to understand the resulting impacts of the construction activity.

(Water pollution): The impact from water pollution caused by the dike construction, excavation and dredging. However, it can be expected to be insignificant on the basis of considering the entire scale of construction as well as the river and the current usage of river water. It is recommended to conduct interviews with the operators of fish ponds during construction and operation to confirm the impacts on fish breeding.

9.3.3 Recommendation of the monitoring plan

The environmental monitoring plan is recommended as below. The necessary items are i) air quality, ii) water quality, iii) salt water intrusion, iv) noise/ vibration, v) resettlement/compensation and land acquisition.

The monitoring of air quality and noise/vibration is required during construction. Water quality and salt water intrusion need to be monitored during both the construction and operation stage.

The outlines of the monitoring plan are suggested below. They constitute the minimum requirement. These are expected to be verified and finalized on the basis of the results of EIA and RAP study which would be carried out by DPWH

Table R 9.18 Recommended Monitoring Plan

Item	Location	Parameter	Frequency	Supervision
Preconstruction stage				
Payment of compensation according to the compensation policy described in the RAP				RIC
Public information (campaign) procedures				RIC
Grievance procedures				RIC
Resettlement site location/ design/ construction and plot allocation				RIC
Houses and its construction technical assistance, payment of subsistence and shifting allowances as described in the RAP				RIC
Provision of livelihood restoration programs (job training, etc.)				RIC
Construction stage				
Air quality	Each construction site (see the Figure R 9.4)	PM10, TSP, CO, NOx, and SOx	Once per 4 months	Contractor
Water quality (General)	Downstream, middle, and upstream of the construction sites (see Figure R 9.4)	BOD, (5-Day 20ºC), DO, TDS, TSS ,Temperature, Oil/Grease, pH	Once per 4 months	Contractor
Water pollution	Fish ponds near the river mouths of Ilog-Hilabangan River and old Ilog river	Interview of fisheries: confirmation of impacts of water pollution	Once per 4 months	Contractor
Noise/vibration	Each construction site (see Figure R 9.4)	Leq, sound speed and acceleration	Once per 4 months	Contractor
Soil disposal	Soil disposal locations	Planning and Field check	Once	Contractor
Operation Stage				
Water quality (General & Salty water intrusion)	Downstream, middle, and up stream of the Project site (see Figure R 9.4)	BOD, (5-Day 20ºC), DO, TDS, TSS ,Temperature, Oil/Grease, pH, Concentration of salt	Once a year (Once for low & high tide for salt water)	DPWH
Water pollution	Dredging sites (both of new and old Ilog River)	Interview of relevant persons (City and Municipality), residents (head of Barangay): confirmation of impacts on river conditions	Once per year	DPWH
Livelihood conditions of PAPs (Whether the income of PAPs would not decrease caused by the resettlement)				RIC/ LUGs
Live conditions of PAPs (Whether the life conditions of PAPs would not be changed by the resettlement)				RIC/ LUGs

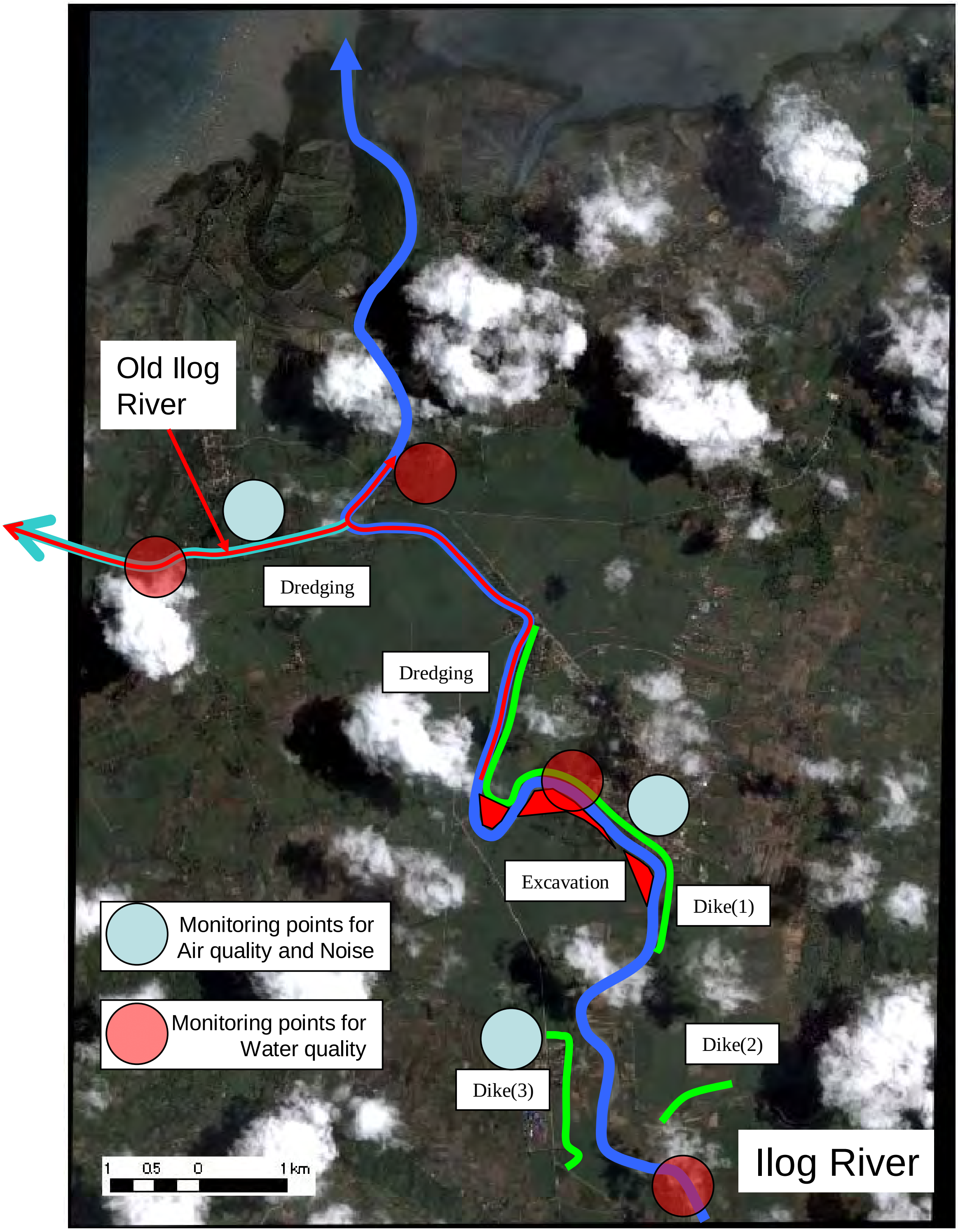


Figure R 9.4 Recommended monitoring locations

9.4 TOR for additional study in next stage for ECC obtaining

The impact of expanding of salt water intrusion could be expected to have a significant impact on the natural environmental conditions by the Project. The following study is required for the next study stage.

Impact assessment for salt water intrusion

1. Current status of river water usage: Confirm the current condition such as, i) pumping and water supply to agricultural lands, ii) well water. The items described below should be determined by field survey and surveys of local residents.

- Area/location of watering farmlands, location/timing of pumping, and amount of watering in agricultural lands near the river. All data should be shown in a map.

- Source of domestic water near the river: well location, depth, and water quality. All data should be shown in a map.

2. Current status of salt water intrusion: Confirm the situation of salt water intrusion such as, i) location of salt water intrusion in time-wise (both of low/high tide), ii) timing of intrusion, iii) salt density of water.

3. Qualitative analysis of impact of salt water intrusion: Analyze the impact of salt water intrusion. Use simple prediction formulae and consultation with specialists/NGOs.

4. If the results of the chapter above show significant impacts, a detailed simulation should be completed to confirm any impact. If significant impacts were indeed confirmed, the river dredge design would be considered.

9.5 Social consideration

9.5.1 Institution of resettlement and land acquisition in Philippines

(1) Policy of DPWH for resettlement and land acquisition

In the case of DPWH implementing a project, a revised policy was established in March 2007 (the contents show as guidelines). It is named as Land Acquisition, Resettlement, Rehabilitation and Indigenous People's Policy, 3rd edition (2007) (hereinafter refer as LARRIPP). It was revised and is now in its third edition. It was established in 1999 as Land Acquisition, Resettlement and Rehabilitation (LARR). The World Bank (WB) assisted in developing it with other financing institutions such as the Asian Development Bank (ADB), JBIC. A second edition of the LARR was formulated in 2004, assisted by ADB with JBIC guidelines. It was revised in 2006 when the DPWH policy of indigenous people was added, based on the Indigenous Peoples' Right Act (IPRA) and NCIP Administrative Order No. 1, series of 2006 or the Free and Prior Informed Consent Guidelines of 2006. Some minor points were revised in 2007 and it is now used as 3rd edition.

This policy includes the principles and objectives of the involuntary resettlement policy, the legal framework, eligibility, compensation and entitlements, the indigenous peoples' policy framework, implementation procedures that ensure complaints are processed, public support and participation, and the provision of internal and external monitoring of the implementation of the RAP with other financing institutions' policies such as WB, ADB and JBIC. It is composed of 8 chapters which are described below:

Chapter 1: INTRODUCTION (the general meaning of this policy, the sequence of revises)

Chapter 2: LEGAL FRAMEWORK

Chapter 3: POLICY ON ELIGIBILITY, COMPENSATION AND OTHER ENTITLEMENTS (1. landowners, 2. PAPs, 3. indicators of severity of impacts, 4. compensation per category of assets affected, 5. entitlement matrix)

Chapter 4: ON INDIGENOUS PEOPLE WHO WILL BE AFFECTED BY THE PROJECT

Chapter 5: PUBLIC PARTICIPATION AND CONSULTATION

Chapter 6: GRIEVANCE PROCEDURES

Chapter 7: INSTITUTIONAL ARRANGEMENTS

Chapter 8: MONITORING AND EVALUATION

The Process of land acquisition was described in 2 cases; i) including the indigenous people in the project site, and ii) not including the indigenous people in the project area. In accordance with LARRIPP, the process of land acquisition in the case of no indigenous people in the project site is summarized below:

DPWH, the project proponent, informs all PAPs of the following 3 points: i) the project would introduce involuntary resettlement, ii) Each PAP is entitled to receive just compensation for his/her affected plot at a rate to be negotiated between the Bureau of Internal Revenue (BIR) zonal valuation and the fair market value as provided by RA 8974, iii) 3. The BIR zonal valuation and the fair market value may differ substantially. The negotiation process is described as follows:

a. The DPWH will explainthe necessity of land acquisition as well as the compensation to PAPs,

b. In the case of PAPs not agreeing with the above, the DPWH will offer compensation at the BIR zonal valuation rates,

c. In case PAPs not agreeing with the above, the DPWH will promptly seek an independent valuation agent / estimator to appraise and determine the fair market value based on the following parameters: i. land use classification, ii. development costs for land improvement, iii. value declared by PAPs, iv. current selling price of similar properties in the vicinity, based on deeds of sale, v. disturbance / inconvenience, vi. tax declaration and BIR zonal valuation, vii. replacement cost,

d. The DPWH will communicate to the PAPs the current market value as determined by an independent land valuation agent,

e. The DPWH then begins negotiations with the PAPs to determine the final compensation,

f. If the PAPs do not accept the terms of this negotiation and the land valuation possible under RA 8974, their affected properties will be expropriated,

g. The DPWH will pay those PAPs whose property is under expropriation the amount equivalent to the sum of one hundred percent (100%) of the BIR zonal valuation and the court shall determine the just compensation to be paid to the PAP within sixty (60) days from the date of filing of the expropriation case. When the decision of the court becomes final and executable, DPWH shall pay the PAP the difference between the amounts already paid and the just compensation as determined by the court. In the interim, DPWH will deposit 100% of the BIR valuation into an escrow account.

The PAPs will be advised and notified of the available channels for complaints and grievances and related procedures. The PAPs will be informed that grievances related to the LARRIPP implementation or any aspect of the project will be handled through negotiations and are aimed at achieving consensus according to the following procedures:

1. The PAPs will lodge their grievances in writing with the Resettlement Implementation Committee (RIC) for immediate resolution.

2. If the complaint is not satisfactorily resolved within 15 days or the PAP does not receive any response from the RIC, the PAP can forward the complaint to or file an appeal with the DPWH Regional Office (RO).
3. If the complaint is not satisfactorily resolved within 15 days or the PAP does not receive any response from the DPWH RO, the PAP can file a legal complaint in any appropriate Court of Law.

The process of information disseminationwill be carried out by the Project Management Office (PMO) with the support of the Environmental and Social Services Office (ESSO, internal organization of DENR), the Regional Offices and District Engineering Offices and will be implemented through community meetings and leaflets. In accordance with Chapter V in the LARRIPP, it is noted that women and the elderly among the PAPs shall be consulted and mobilized to participate in the consultation meeting, and the Resettlement Action Plan discussed with them.

(2) Comparison of JBIC guideline and LARRIPP

The comparisons between JBIC Guidelines and LARRIPP are described in Annex PIIB_9-8. There are some differences between them, as outlined below. However, there is no major difference as to other items.

- Promotion of appropriate participation by the PAPs and their communities in the planning, implementation and monitoring of involuntary resettlement plans: The LARRIPP mentions the promotion of participation in the consultation meeting, but not any implementation and monitoring stages.

- Assistance for the informal settlers: The LARRIPP does not mention informal resettlers.

9.5.2 Stake holders meeting (SHM) and public consultation meeting (PCM)

(1) Plan of SHMs and PCMs

(a) Purpose of the meetings

Purpose of SHMs and PCMs are listed as follows:

- To explain the project concept/design to LGUs and the general population.
- To answer their questions.
- To collect their opinions and revise the design, taking into consideration their opinions.
- To confirm basic agreement on the proposed Project and its design.

(b) Participants

The target participants for SHM are the members of LGUs such as, City/municipality/Barangay government officials, the Mayor and the politicians. The target participants for PCMs are the general population and NGOs. Basically, it is not easy for the general people to express their opinions/questions in front of senior persons and office bearers such as the mayor. Therefore, the JICA Study team decided to divide the meetings into two types. However, the characteristics of Ilog municipality are very special. The municipality is a very small community and the people know each other very well, almost like one family. Therefore, the general people do not feel much pressure in front of high positioned persons compared to other places. Also, the JICA Study Team managed the PCMs to collect the opinions of general people first before asking for the LGUs' opinions. Even the mayor joined the third PCM. Therefore, it can be said that everyone was free and uninhibited to could express their opinion freely.

(c) Achievements

The SHMs in Ilog-Hilabangan were held three times. The date and venue of SHMs are shown in Table R 9.19.

Table R 9.19 SHMs in Ilog-Hilabangan

SHM	Date/time	Host organization	Venue	Major participants	Major Agenda
1st	May 22, 2009	R.O. of DPWH in region 2	Kabankalan C.H.	From City/Municipality: CPDC/MPDC, Engineer, Sanggunian members, etc. From central Agencies: NEDA, DPWH, OCD, etc.	Project concept
2nd	Aug. 7 2009	-ditto-	Ilog M.H	-ditto-	Design alternative
3rd	Sep. 20 2009	-ditto-	Kabankalan C.H.	-ditto-	Revised design
C.H.: City Hall, M.H.: Municipality Hall CPDC: City Planning and Development Coordinator, MPDC: Municipality Planning and Development Coordinator,OCD: Office of Civil Diffence, Sanggunian: Council of City/Municipality					
Source: JICA Study Team					

DPWH hold SHMs as a host organization. The R.O. of DPWH arranged the SHMs with cooperation of government of City/Municipality. The officer of City/Municipality facilitated the meetings at the request of DPWH. The JICA Study Team took presentations of the design and answered the questions put byparticipants.

The JICA Study Team held PCMs with the cooperation of LGUs (City/Municipality) as shown in Table R 9.20. The major participants were local residents and local leaders such as Barangay Captains. The Governor of Municipality Ilog joined to the third PCM, and he only involved himself in proceedings after the discussion with the local residents had concluded, simply in order to prevent any perception of influence on the people.

Table R 9.20 PCMs in Ilog-Hilabangan

SHM	Date/time	Host organization	Venue	Major participants	Major Agenda
1st	July 17	JICA Study Team	Kabankalan City (Barangay Hall)	Barabgay Captains, local residents, LGU officers	Project concept
2nd	Aug 8	-ditto-	Municipality Ilog (Municipality Hall)	-ditto-	Design alternative
3rd	Oct 1	-ditto-	Kabankalan City Municipality Ilog	-ditto- (Governor of Municipality Ilog joined)	Revised design
4th	Nov. 10	-ditto-	Municipality Ilog (Municipality Hall)	Barabgay Captains, local residents, LGU officers	Revised design with options by Ilog Municipality
C.H.: City Hall, M.H.: Municipality Hall					
Source: JICA Study Team					

9.5.3 Necessity of land acquisition and resettlement

(a) Land acquisition

Principle of land acquisition

(Necessary Areas): The necessary land acquisition area for the dike is divided into two categories: i) land acquisition for a dike surrounding a core area (ring dike) and ii) land acquisition for a dike along the river side. The land outside the dike is necessary for the river flow. Therefore, the external land of the dike shall not be used for any purpose and the land shall be acquired. However, the ring dike is far from the river course, because the purpose of the ring dike is to protect the core area. Meanwhile, the excavation area should be acquired in its entirety. The necessary areas for land acquisition are described in Figure R 9.5.

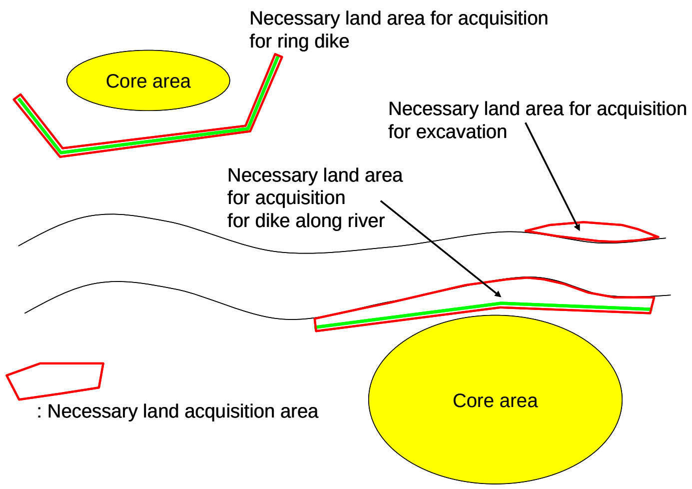


Figure R 9.5 Necessary areas for land acquisition

(Government land next to the river): In accordance with Philippine civil code 464 (or CA 142), the area with a width of 3m from the edge of the river in the residential area shall be deemed as Philippines Government owned land, meaning the land belongs to DPWH. The width in agricultural areas is 20m and 40m in forested areas. The determination of an area's use for residential, agricultural or forest purposes is governed by the land-use plan in each City/Municipality.

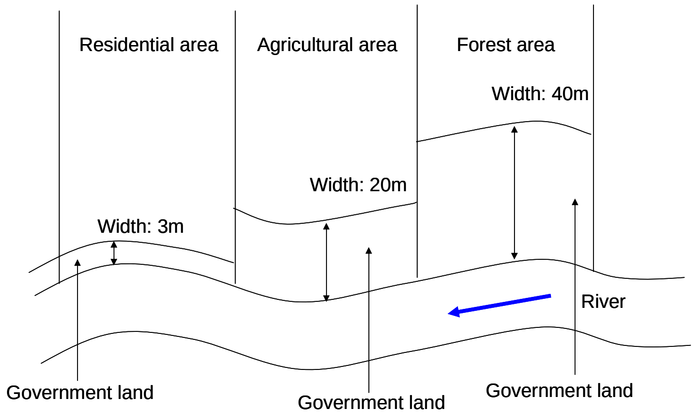


Figure R 9.6 Land ownership adjacent to the river

Necessary areas for land acquisition

The total land acquisition area in the Project site is Approx 40ha. The detail of land acquisition area is shown in Table R 9.21.

Table R 9.21 Land Acquisition Area

Construction	Place	L.A. area (ha)	Initial land use
Dike (2): Dike along river	Kabankalan	2.0	Agricultural area/ residential area
Dike (3): Dike along river	Kabankalan	7.6	Agricultural area
Dike (4): Dike along river	Kabankalan	3.0	Agricultural area/ residential area
Excavation (1)	Kabankalan	27.7	Agricultural area
Excavation (2)	Kabankalan		Agricultural area
Excavation (3)	Kabankalan		Agricultural area
Total		40.3	

L.A.: Land acquisition
Source: JICA Study Team

The location of the land acquisition area is shown in Figure R 9.7.

Figure R 9.7 Location of Land Acquisition

(b) Resettlement

Determination of houses to be relocated

The ring dike can prevent the resettlement because it has no conditionality. However, the dike along the river is required to maintain a necessary width of the river. A 3 to 5 m width to accommodate a road along the dike shape is required. Therefore, in the case that any persons are living inside of the land acquisition area, they will be required to relocate. The relation of dike and land acquisition and resettlement are shown in Figure R 9.8. The houses of Case I are located outside (riverside direction) of the construction road among the dike. In some parts of the houses in Case II are outside the land acquisition area. However, the houses are included in the relocation plans. The houses located inside of the dike will not be relocated.

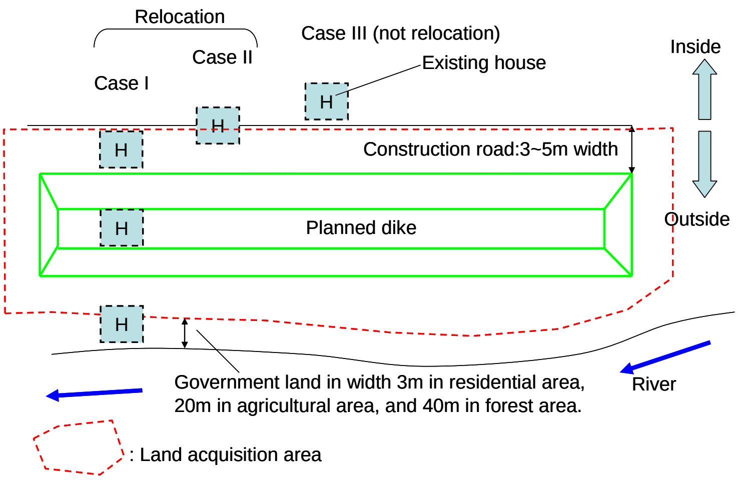


Figure R 9.8 Principle of Land Acquisition and Resettlement

Number and location of resettlement houses

The overall number of houses which will be relocated is 75 in Kabankalan. The locations of the houses being relocated are shown in Figure R 9.9. The average of number of family members is 5.2 per house, in reference to the results of the general social survey. About 390 persons will need to be moved from their existing residential locations.

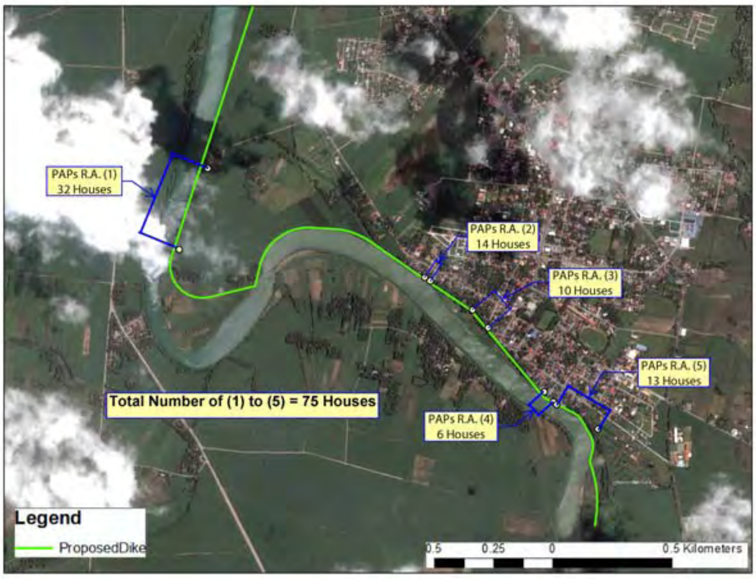


Figure R 9.9 Location of houses which will be relocated by the project in Kabankalan

9.5.4 Preparation of RAP study in the next study stage

The following study items are recommended for the land acquisition and resettlement action plan (RAP).

- Number and distribution of relocated houses, socio-economic conditions of PAPs, resettlement site candidates
- Determination of PAPs, eligible, entitles, -> entitle matrix, necessary study items for RAP (in case of the Project would be implemented with supporting of Japan's Official Development Assistance (ODA) loans, especially JICA requirements shall be considered)
- Recommendation of the restoration program
- Recommendation of the monitoring plan

The recommended TOR for the RAP study at the next study which will be carried out by DPWH is shown in Annex PIIB_9-9.

CHAPTER 10 ADAPTATION TO CLIMATE CHANGE

10.1 Consideration of the Impact of Climate Change in the Study Area

10.1.1 General

The Philippine climate is influenced by large-scale atmospheric phenomena that bring in substantial amounts of rains almost all year round. However, due to the uneven distribution of rain with respect to time and space and the occurrences of extreme events such as floods and droughts, the country's water resources have in the past experienced Imbalances. The Intergovernmental Panel on Climate Change (IPCC) has warned the climate changes associated with global warning. The climate changes include the rises of temperature, storm rainfall intensity and sea level, which could further aggravate the flood conditions of the Study Area.

The IPCC estimated the change of global temperature based on the Fourth Special Report on Emission Scenarios (SRES), which describes several scenarios on the future global emission volume of greenhouse gas (such as carbon dioxide and nitrogen monoxide and methane gas) and sulphate. The IPCC estimated based on the SRES that the present global average temperature would most likely rise by 1.8 to 4.0°C at the end of the 21st Century. Significant changes in the earth's climatic system, particularly an alteration of rainfall and temperature in both time and space, are expected.

The present endeavor is focus on the impacts of climate change in the development of flood control measures for the Ilog-Hilabangan River. Expected output from the analysis would be a proposed component adoptive in future flood control plan of the current Sectoral Loan overall flood control project

10.1.2 Assessment Methodology

Assessment of climate variability and change impacts on the performance of a flood protection system is manifested through the following: (a) climate change scenarios; (b) hydrologic processes; and (c) impacts to the development of flood control measures (structural and non structural).

Climate Change Scenario

The Fourth Special Report on Emission Scenarios (SRES) for IPCC describes several scenarios on the future global emission volume of greenhouse gas and sulphate. Three (3) scenarios taken from the SRES are adapted to the present endeavor namely;

a) ***Status quo scenario***. No climate change

b) ***B1 scenario***. The temperature rise is predicted at the smallest which projects a convergent world with the same global growth of population but with rapid change in economic structures toward a service and information economy, with reductions in material intensity and the introduction of clean and resource efficient technologies

c) ***A1FI scenario***. The temperature rise is predicted at the largest due to a very intensive use of fossil fuel for energy system which is consequent to a very rapid growth of the global economy.

Global Temperature Rise

The IPCC estimated that the present global average temperature would most likely rise by 1.8 to 4.0°C at the end of the 21st Century as shown in Table R 10.1 and delineated in Figure R 10.1.

Table R 10.1 Global Average Temperature Rise at the End of 21st Century

Scenario	Temperature Rise from the Average of 1980-1999 to the Average of 2090-2099 (ºC)	
	Best Estimate	Likely Range
B1	1.8	1.1-2.9
A1F1	4	2.4-6.4

Source:
IPCC 2007, Summary for Policymakers.

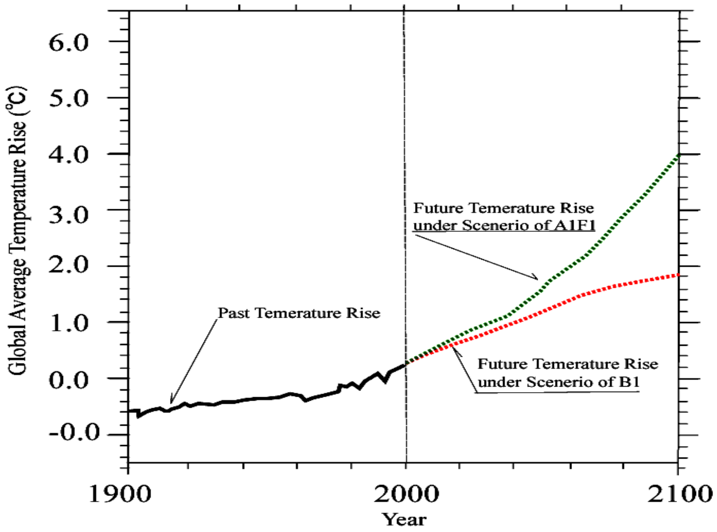


Figure R 10.1 Global Average Temperature Rise

(Consecutive Average Temperature Rise as the Base of Value in 1980-1999)
Source: IPCC 2007, Summary for Policymakers

The 2005 Study Report on Mapping Philippine Vulnerability on Environmental Disasters undertaken by the Department of Environment and Natural Resources (DENR) whose objective is to identify areas in the country that are at high vulnerability and risk to environmental disasters includes analysis on the temperature increases nationwide. Hazards and disasters are mapped and analyzed via geographic information systems (GIS), environmental modeling tools and resulting spatial databases.

One of the results of the analysis relevant to climate change is shown in Figure R10.2 and it tends to support the global trend on temperature increases. The figure suggest that the present temperature increases for the Project Area (Cagayan, Ilog-Hilabangan and Tagoloan River basins) are found to be more than 0.5 ºC.

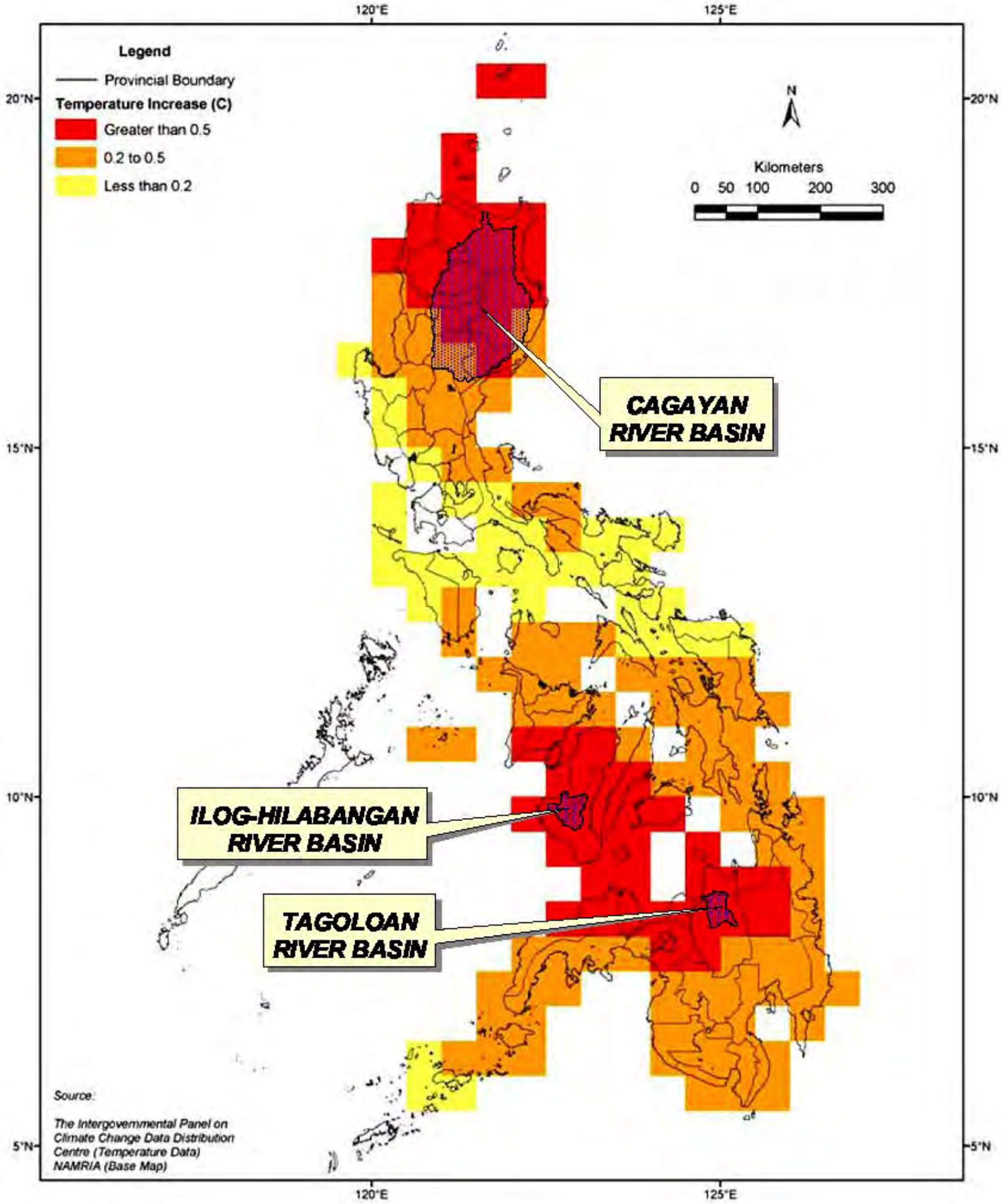


Figure R 10.2 Temperature Increase in the Philippines

Future Temperature Rise in the Project Area

In the recent Project Study titled "The Study on Comprehensive Flood Mitigation for Cavite Lowland Area in the Republic of the Philippines" undertaken in February 2009 undertaken by JICA, the relationship of the future global temperature rises and the local spatial temperature rises in the Philippines is analyzed by the TIGS/CCSR of the University of Tokyo.

The result of the mathematical modeling concerning the relationship between the aforesaid global average temperature rises and the local spatial average temperature rises in the Philippines is shown in Figure 10.3. The simulation, which covers the area of long. 116.0 to 126.0°E and lat. 9.0 to 19.0°N (the area of about 1,000km x 1,000km), is made through a subset of models (twelve models) applied in the Forth Assessment Report of IPCC. The above temperature rises are expressed as the averages of those at each mesh of 100km x 100km, and at the same time as the differences between the late 20th century (1981-2000) and the late 21st century (2081-2100) with assuming SRES A1FI and B1 scenarios.

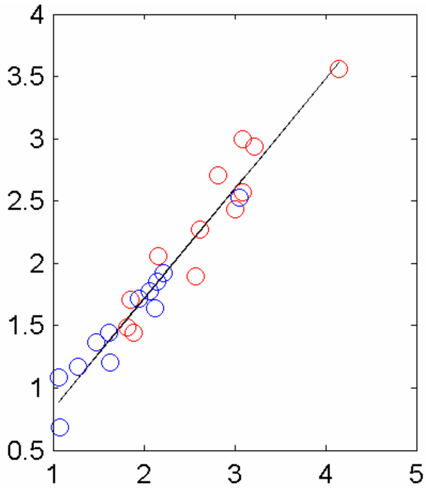


Figure R 10.3 Relation between Global Average Temperature Rise and Local Temperature Rise in the Philippines

According to the results of the above simulation, the local average temperature in the Philippines would rise by 1.1 to 2.3℃ in 2050 and further 1.5 to 3.5℃ in 2100 as shown in the following Table R10.2

Table R 10.2 Relation between Global Average Temperature Rise and Local Temperature Rise in the Philippines

Scenario	Year	Global Average Temperature Rise (ºC)	Local Average Temperature Rise in the Philippines (ºC)
B1	2050	1.2	1.1
	2100	1.8	1.5
A1FI	2050	2.6	2.3
	2100	4	3.5

<u>Increase in Future Rainfall Intensity due to Temperature Rise</u>

The IPCC projected that the global warning would possibly induce increment of the storm rainfall intensity causing more sever flood. In this connection, the aforesaid TIGS/CCSR simulated between the spatial-average changes of precipitable water and local temperature rises over the Philippines. This simulation is made in the same manner as that for the above relation between the global temperature rises and the local average temperature rises in the Philippines The results of the simulation are as shown in Figure R10.4.

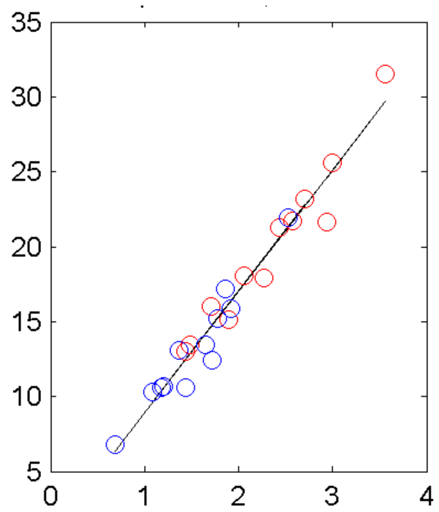


Figure R 10.4 Relationship between Local Average Temperature Rise and Incremental Rate of Precipitable Water in Philippines

The results of the simulations indicated that the storm rainfall intensity in the Philippines would increase by 11 to 20% in 2050 and 14 to 29% in 2100 as shown in Table R10.3

Table R 10.3 Relationship between Local Average Temperature Rise and Incremental Rate of Precipitable Water in Philippines

Scenario	Year	Temperature Rise (°C)	Increase Rate of Rainfall Intensity (%)
B1	2050	1.1	11
	2100	1.5	14
A1FI	2050	2.3	20
	2100	3.5	29

Application of the above results as an increment of storm rainfall intensity for the Study Area will mean increasing the present design probable hyetograph or shortening the return period and consequently, the probable design flood runoff discharges would be increased as a design parameter in the future.

Upon the application of the above factor, the adjusted probable hyetographs for the subject project area of Ilog-Hilabangan River basin are listed in Tables 10.4. The probable hyetographs for the Ilog-Hilabangan River basin are based on maximum 2-day storm.

Table R 10.4 Future Increment of Probable 2-day Storm Rainfall for Ilog-Hilabangan River Basin

Ilog-Hilabangan Design Rainfall (mm)			Return Period (y)					
			2	5	10	25	50	100
Status Quo			122	178	214	258	291	324
A1FI	2050		146	214	257	310	349	389
	2100		157	230	276	333	375	418
B1	2050		135	198	238	286	323	360
	2100		139	203	244	294	332	369

Based on the above figures, probable hyetographs for future design consideration are developed for the subject river basin considering the adopted climatic change scenarios and these are presented in Figures 10.5 to 10.8.

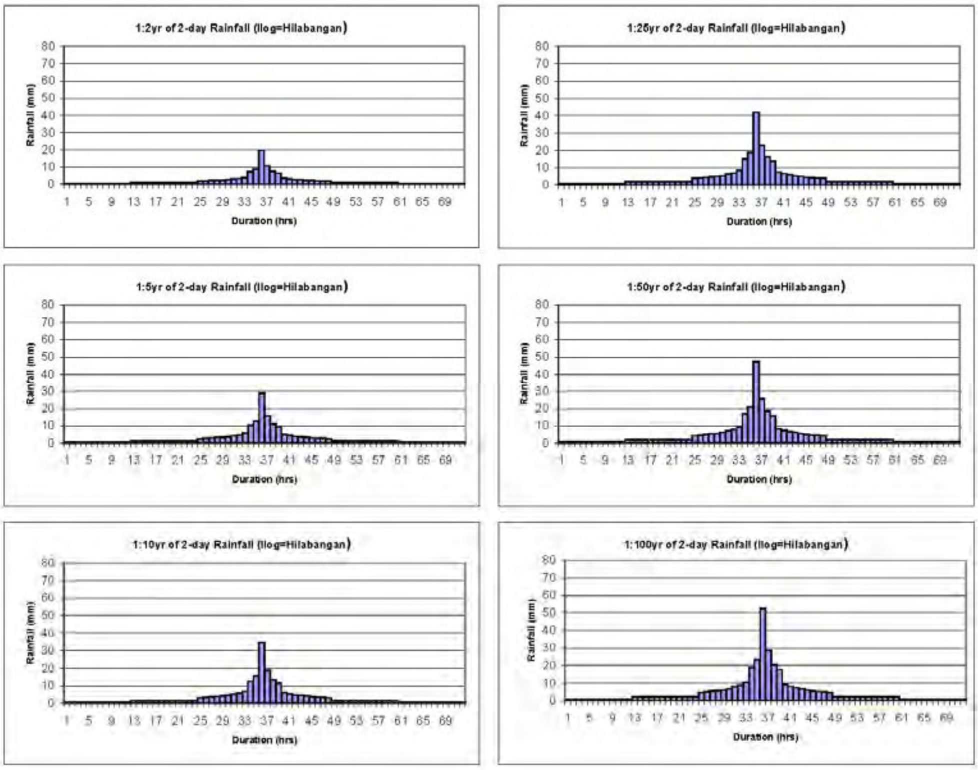


Figure R 10.5 Future Design Probable Hyetograph (B1-2050 Scenario) Ilog-Hilabangan River Basin

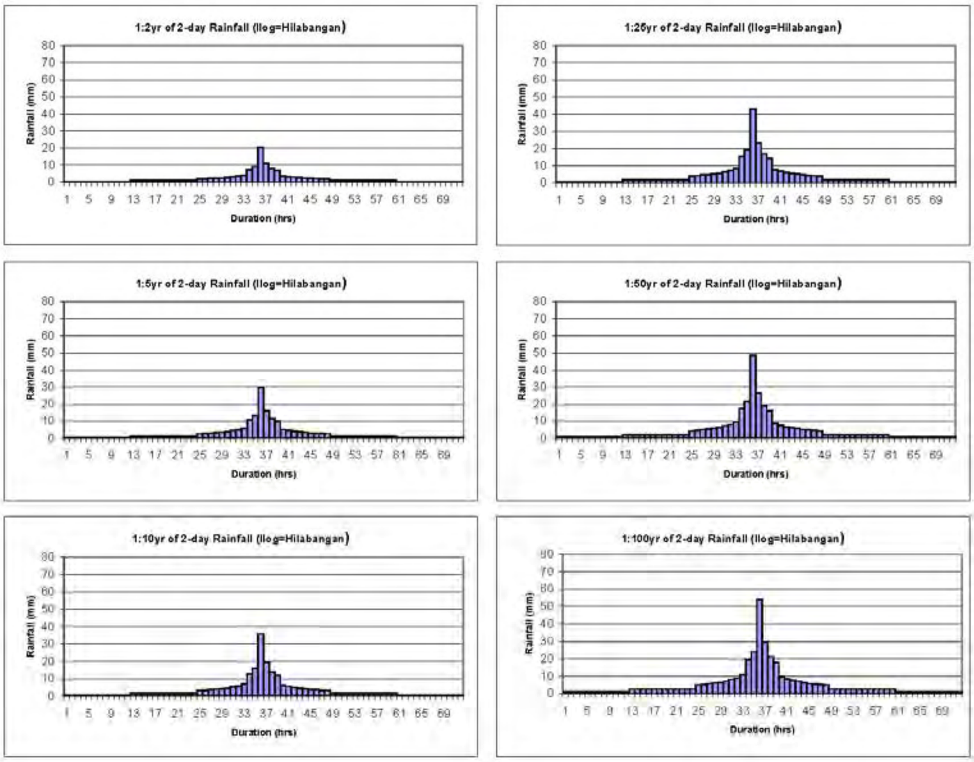


Figure R 10.6 Future Design Probable Hyetograph (B1-2100 Scenario) Ilog-Hilabangan River Basin

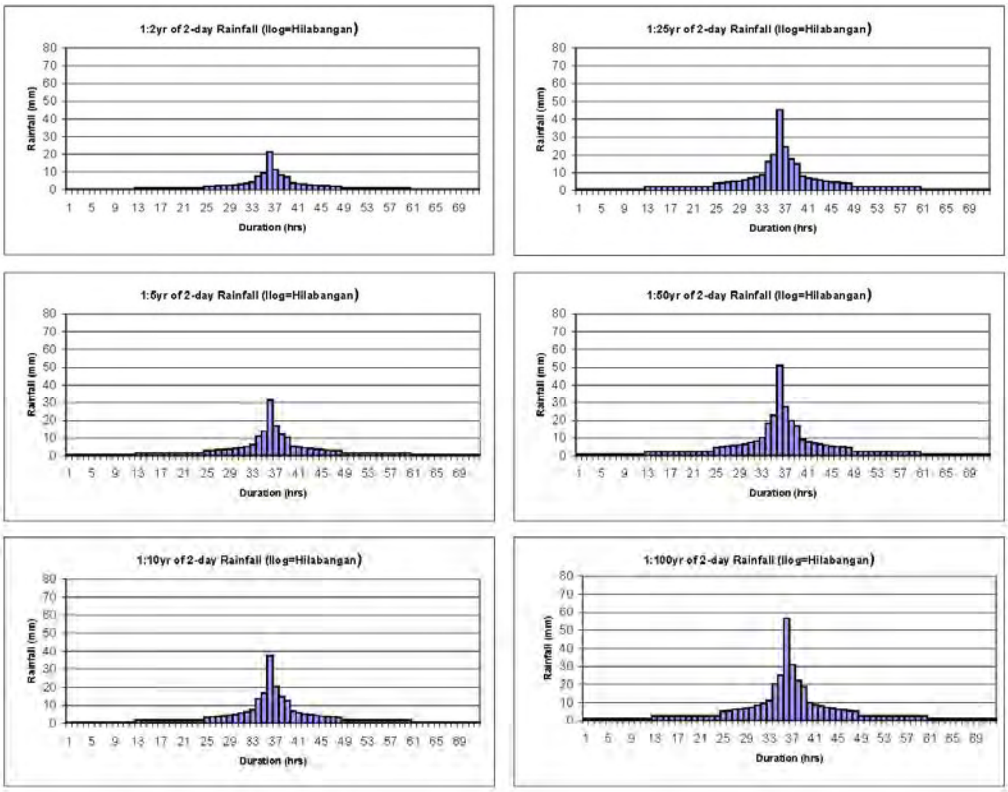


Figure R 10.7 Future Design Probable Hyetograph (A1FI-2050 Scenario) Ilog-Hilabangan River Basin

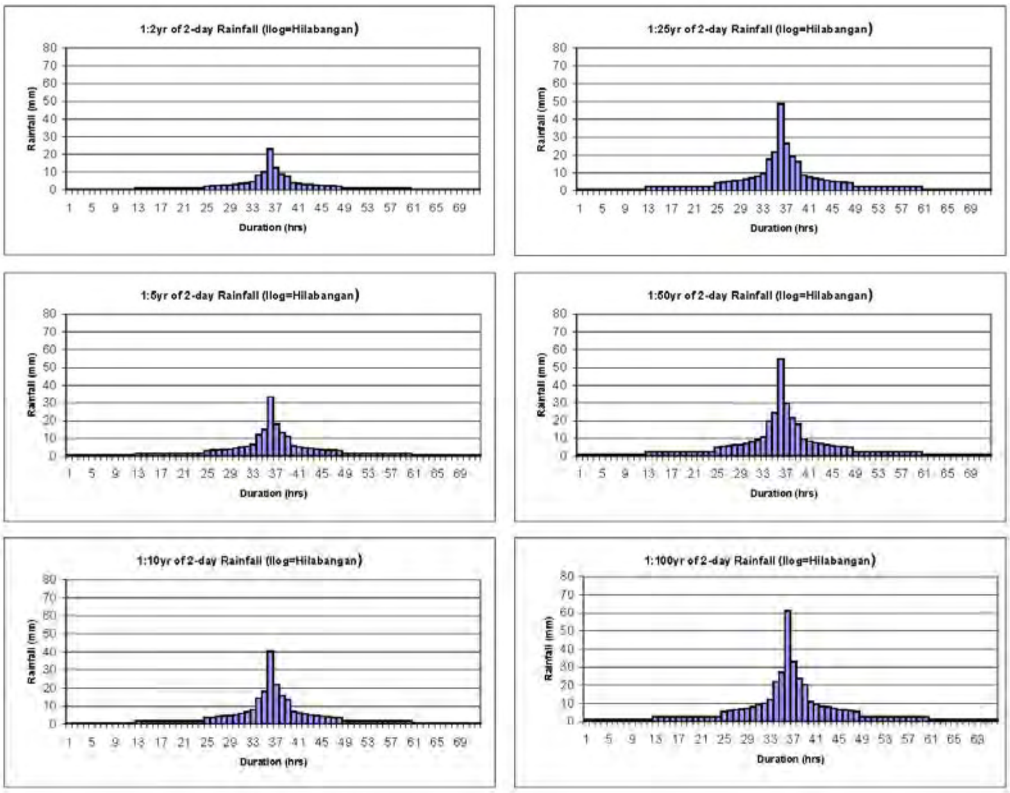


Figure R 10.8 Future Design Probable Hyetograph (A1FI-2100 Scenario) Ilog-Hilabangan River Basin

Increase in Future Sea Level due to Temperature Rise

The IPCC confirmed the global tendency in rise of sea level from the 19th to 20th century and estimated that the global average rate of sea level rises over 1961 to 2003 was about 1.8mm per year, while the rate was faster over 1993 to 2003: about 3.1 mm per year.

The IPCC further projected that the average sea level over 2090-2099 would rise by about 0.38cm at the maximum as compared with the average over 1980-2000 under the B1 Scenario and/or about 0.59cm under the A1FI Scenario as shown in Figure R10.9 and Table R10.5.

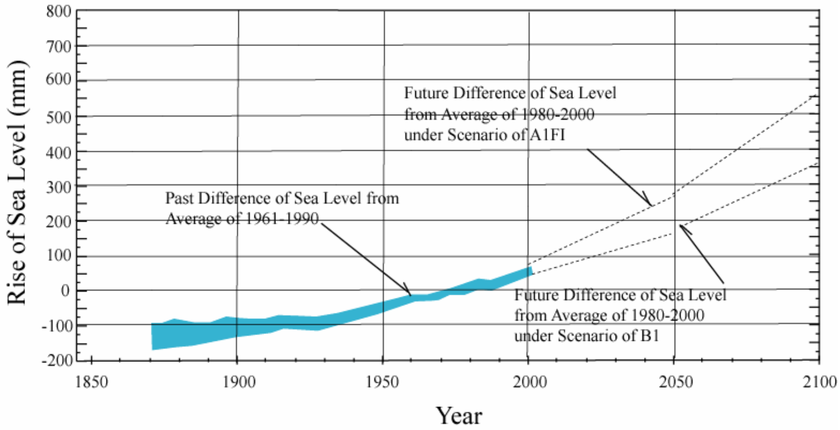


Figure R 10.9 Future Global Sea Level Rise

Table R 10.5 Future Global Sea Level Rise

Sea Rise (m)			Min	Max
A1FI	2050		0.13	0.29
	2100		0.26	0.59
B1	2050		0.09	0.19
	2100		0.18	0.38

The trends in monthly sea levels at Manila South Harbor where the long-term sea level records are available for the Philippines show that sea level has kept rising since 1996 up to the present. However, there is no constant increasing or decreasing trend in long term and the astronomical tide with a period of 19 years is deemed to be more predominant. In addition, datum planes had been adjusted at Manila South Harbor due to relocation of tidal gauge and land subsidence effect according to NAMRIA as of 2006.

Therefore, it is difficult to conclude that sea level at Manila Bay has been rising due to global warming based on the available historical records. Nevertheless, there is a high confidence that the sea level would rise in a long-term rage due primarily to thermal expansion of the oceans and melting of glaciers and ice caps as projected by IPCC.

For the Project Areas in the Ilog-Hilabangan River, hydraulic regimes are directly affected by the sea levels. Applying the above discussion for future design consideration, the recommended sea levels for the Project Area are listed in the succeeding Table R10.6.

Table R 10.6 Future Sea Level Rise for the Project Area

Sea Rise (m)		Status Quo	A1FI		B1	
			2050	2100	2050	2100
Tagoloan		0.75	1.04	1.34	0.94	1.13
Ilog Hilabangan		1.50	1.79	2.09	1.69	1.88
Cagayan		-	-	-	-	-

Hydrologic Process

Determination of the future probable design flood runoff discharges for each of the Project Areas with the consideration of the adopted climatic change scenarios are made by superimposing and routing the respective future probable design hyetograph earlier presented through the respective Project Areas' catchment. The resulting hydrographs for each of the catchment for return period of 25-yr and 50-yr are shown in Figures 10.10 to 10.11.

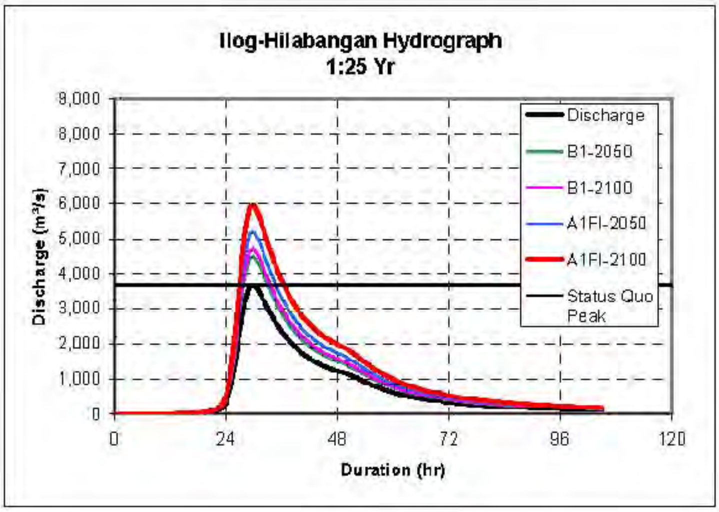


Figure R 10.10 Future 25-yr Probable Design Hydrographs Ilog-Hilabangan River Basin

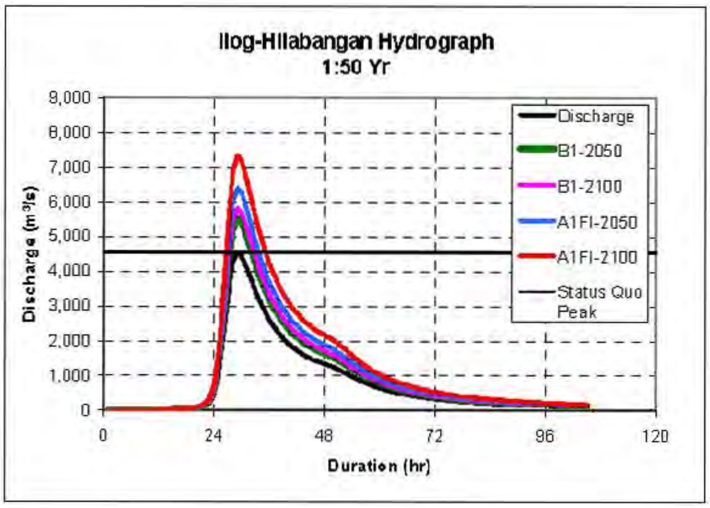


Figure R 10.11 Future 50-yr Probable Design Hydrographs Ilog-Hilabangan River Basin

10.2 Impact on Flood Mitigation Plan

Based on the flood runoff computation as presented in the preceding section, the computed probable peak discharges and safety levels in return period would be changed in line with global warming. The following table summarizes the changes of probable discharge in 25-year and 50-year. Flood discharge would increase by 11 to 20 % in 2050 and by 14 to 29 % in 2100. Those increases of probable flood discharges are illustrated in Figure R10.12.

As a result of the above increscent effects of flood discharge, the safety level of flood control structures would decrease in line with the progress of global warming. Those effects are presented in Figure R10.13. The safety level of 25-year is likely to decrease to 16- to 20-year in 2050 and to 13- to 19-year in 2100.

Table R 10.7 Computed Probable Flood Discharges in Line with Global Warming

Return Period (Status Quo)	Year	Global Warming Scenario	
		B1	A1FI
25-year (3,690)	2050	4,090	4,420
	2100	4,200	4,750
50-year (4,540)	2050	5,040	5,450
	2100	5,180	5,860

unit: m^3/s

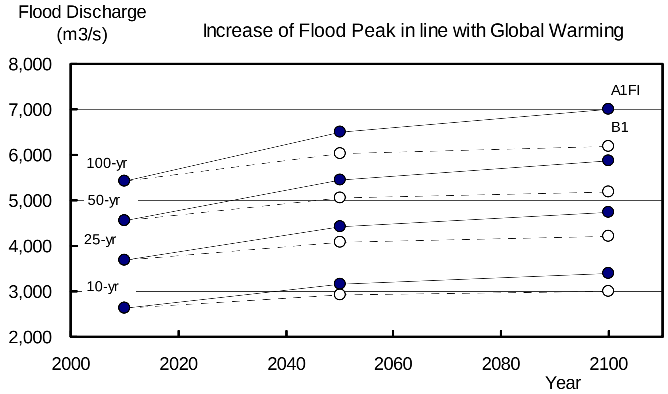


Figure R 10.12 Increase of Probable Flood Peak Discharge in Line with Global Warming

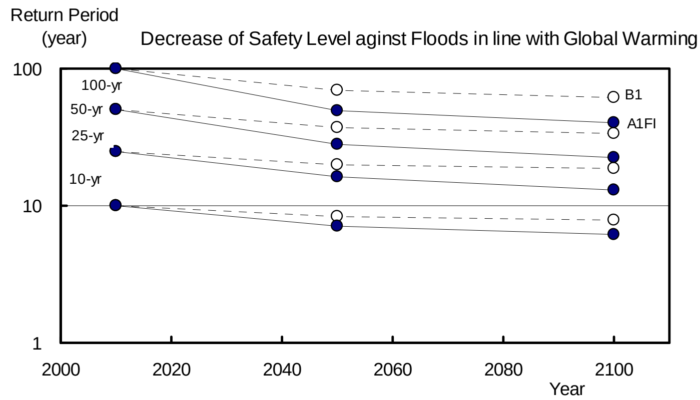


Figure R 10.13 Decrease of Safety Levels in Return Period in Line with Global Warming

10.3 Conceived Mitigation Measures against Climate Change

The global warming in climate change would have intensive impacts on flood control measures to be taken in the future. The process of global warming, however, still contains considerable uncertainty in scientific fields. Thus the mitigation measures shall be formulated with careful deliberation on decrease of secured safety level in temporal process and scientific progress in climate change. The basic concept of mitigation measures against hydrological effects in climate change could be summarized below. The concept of future program is depicted in Figure 10.14.

(1) After implementation of urgent flood control measures

After implementation of the urgent flood control measures, the secured safety level would decrease gradually in line with global warming. In this period, the following measures shall be taken until the effects of climate change will be clarified in a scientific manner and the flood mitigation and management master plan shall be revised through incorporating the effects of climate change.

- Establishment and strengthening of meteo-hydrological monitoring system,
- Establishment and strengthening of early warning dissemination system through installation of flood forecasting system,
- Establishment and improvement of flood preparedness and emergency response plan in each local level, city, municipality and barangay, and
- Strengthening of land use plan or control in due consideration of flooding situation and future flood mitigation measures.

(2) Formulation of future master plan for flood mitigation and management

The future flood mitigation and management plan shall be formulated on the basis of predicted effects of future climate change. To cope with increase of flood discharge due to climate change, construction of a retarding basin is one of the candidates of structural measures.

CHAPTER 11 CONCLUSION AND RECOMMENDATIONS

11.1 Selection of Optimum Flood Mitigation Plan

The alternative structural flood mitigation plans and the potential non-structural flood mitigation measures have been examined in Chapters 7 and 8. Socio-economic considerations on the structural flood mitigation plans were further made in Chapter 9. In addition, Chapter 10 delineates the measures for climate change adaptation in progress. Based on the results of those examinations, the optimum flood mitigation plan in the Sector Loan Project is as summarized below.

11.1.1 Proposed Structural Flood Mitigation Plan

(1) Summary of Structural Scheme to be Implemented under the Sector Loan

The project scale selected for the 1991 M/P was 100-year return period in consideration of the other major rivers in the Philippines and the magnitude of the recorded maximum flood in the basin. Eventually, flood control works against a 25-year return period flood was proposed for completion in the first phase.

Based on the 1991 M/P, the proposed plan against a 25-year return period flood as the first phase has been adopted for the Sector Loan Project to mitigate the core areas where properties are concentrated and where the built-up area is located. In this regard, the city proper of Kabankalan and the area of the sugarcane mill along the Ilog-Hilabangan River have been selected as core areas in the Ilog-Hilabangan River Basin.

In this connection, dredging of the lower reaches of the river channel is recommended so that the protection measures against floodwater will not worsen the flood condition in the non-protected areas.

The main features and estimated costs are as summarized below:

Table R 11.1 Summary of Sector Loan Project Components Proposed for Ilog-Hilabangan River Basin in the Project

Contents of Project	Quantity	Purpose of Project
Construction of Dike along Kabankalan City Proper Area	L=6,100m	To protect thearea against a 25-year return period flood
	L=1,000m	To protect the area against a 25-year return period flood
Construction of Dike along Sugarcane Mill Area	L=2,750m	To protect the area against a 25-year return period flood
Dredging Work in Lower Stretch	V=1.7 million m^3	To mitigate the impact of dike construction

Table R 11.2 Summary of Sector Loan Project Cost Proposed for Ilog-Hilabangan River Basin

Major Item	Cost Item	Estimated Cost (Million Pesos)	Remarks
Cost Applicable for Loan	Construction Base	1,611	Construction Term: 2012-2014
	D/D & S/V	258	
	Contingencies	475	
Sub-Total (1)		2,344	
Cost Not Applicable for Loan	Compensation	16	Houses and Lots
	Administration	81	DPWH and LGUs
	Contingencies	22	
	VAT & Tax	281	
Sub-Total (2)		400	
Total		2,744	
O&M		5.69	
EIRR		15.65 %	

(2) Concerns in Project Implementation

The concerns in project implementation are as follows:

(a) Natural and Social Environmental Impact Evaluation

The dike construction along the Kabankalan Core Area as the structural measure proposed in the Study would require the house relocation of more than 50 families. To achieve such a large-scale resettlement activity, DENR had required the preparation of a relocation action plan (RAP). In addition, the project with such large-scale resettlement activity may require a full EIA study in accordance with the JICA Guideline for Environmental and Social Consideration (2004). In view thereof, the RAP has to be formulated and implemented in accordance with “The Land Acquisition, Resettlement and Indigenous Peoples Policy of the Department of Public Works and Highways (DPWH).”

To execute the RAP, “Census Survey-cum-Structure Tagging (C/T)” shall be performed to identify the PAPs and to prevent illegal settlers from encroaching to the project site. Preparation of the RAP for Cagayan together with the other two candidate river basins (Cagayan and Tagoloan) will require six (6) months, at least, prior to project implementation.

(b) Consideration for Ilog Municipality

During the initial stage of the Study, the proposed plan had included the ring dike encompassing the built-up area around the municipal hall of the Ilog Municipality. However, in the final public consultation meeting conducted by the sub-contractor of the environmental study, the construction of ring dike for the Municipality of Ilog was not acceptable because the ring dike would generate the difference between "protected" and "unprotected" areas in one community where the residents maintain that the communities are equal to each other.

In this connection, the structural measure will contribute a slight shortening of flood inundation time to Ilog residents due to the dredging work in the lower channel. Hence, further careful consideration shall be taken for the residents of Ilog through the provision of non-structural measures.

(c) Disposal Site for Surplus Soil

In the project, approximately 1 million m^3 of surplus soil derived from the excavation and dredging works have to be disposed. According to Kabankalan City as well as the Municipality of Ilog, these surplus soils are welcome to develop the vacant space for urbanization. In this connection, the timing of the expected land development with the project's implementation shall be based on the project's implementation program.

11.1.2 Proposed Non-Structural Measures

Based on the current status and activities in the Ilog-Hilabangan River Basin described in Chapter 8, the following community-based non-structural measures are proposed in parallel with the structural measures:

- Identification of Necessary Preparedness Plan and FEWS
- Establishment of Hazard Map and Preparedness Plan, and
- Revision/Modification of Land Use/Development Plan

As for third item, it is essential for basin-wide flood mitigation effect to undertake the full-scale river improvement works in accordance with the 1991 M/P. To achieve such a full-scale river improvement works, LGUs shall first of all secure the proper river course to implement the widening of river channel. Therefore, the CLUP (comprehensive land use plan) shall delineate the designed dike alignment in the future land use map as the river area.

In connection with the execution of the proposed measures mentioned above, proposed is a Technical Assistant Activity to support and enhance the capacity of related agencies, such as DPWH, OCD and PAGASA, in parallel with and as one sphere of implementation of the Sector Loan.

The main contents in proposed T/A are as follows:

- Establishment of Early Flood Warning System utilizing the Basin Flood Forecasting System.
- Preparation of Flood Hazard Map with the participation of Residents, including dry run and map exercises in flood vulnerable areas.

As described in Chapter 6, the provinces of Negros Oriental and Negros Occidental agreed, on June 26, 2008, to form the Negros Island IWRM Council which will serve as the apex and policy advisory body for integrated water resources planning and management within the Ilog-Hilabangan River Basin thereby contributing towards the realization of Millennium Development Goal No. 7, Environmental Sustainability, and the following targets: Integration of the principles of sustainable development into country policies and programs; reversal of loss of environmental resources and reduction by half of the proportion of people without sustainable access to safe drinking water. It is expected that these activities are sustained to create the appropriate basin condition.

11.1.3 Climate Change Adaptation

In Chapter 10, the basic and primary Climate Change Adaptation methodology is proposed. The flood control framework proposed in the 1991 M/P did not consider the adverse effects of climate change. Basically, the raising of the proposed flood control dike was conceived. However, the raising of dike increases the flood damage potential in case of breach of dike. As for the sugarcane field which expands on the left bank (opposite side of city proper of Kabankalan), it will remain for the time being without any development. Therefore, the construction of a retarding basin that peak discharge of Ilog-Hilabangan River can decline to release the excess water into the basin is proposed for climate change adaptation.

In addition to the structural measures explained above, the following non-structural measures would be applied to climate change adaptation. Actually, non-structural measures shall principally be considered for the adaptation to climate change regarding flood mitigation:

- Enlightenment Activities to Stakeholders regarding the Impact of Climate Change
- Strengthening of Flood Forecasting and Warning System

11.1.4 Support and Capacity Enhancement of Related Agency Activities

As proposed in the Main Report (Part I), the Sector Loan Project aims at not only flood damage mitigation in the target core areas but also at strengthening and enhancing the capacity of the related agencies such as DPWH, LGU, OCD and PAGASA. In this regard, it is proposed that the following T/As regarding support for non-structural activities and contribution to the betterment of O&M activities shall be executed in parallel with the implementation of the project.

(1) Assistance on Setup of Non-Structural Measures

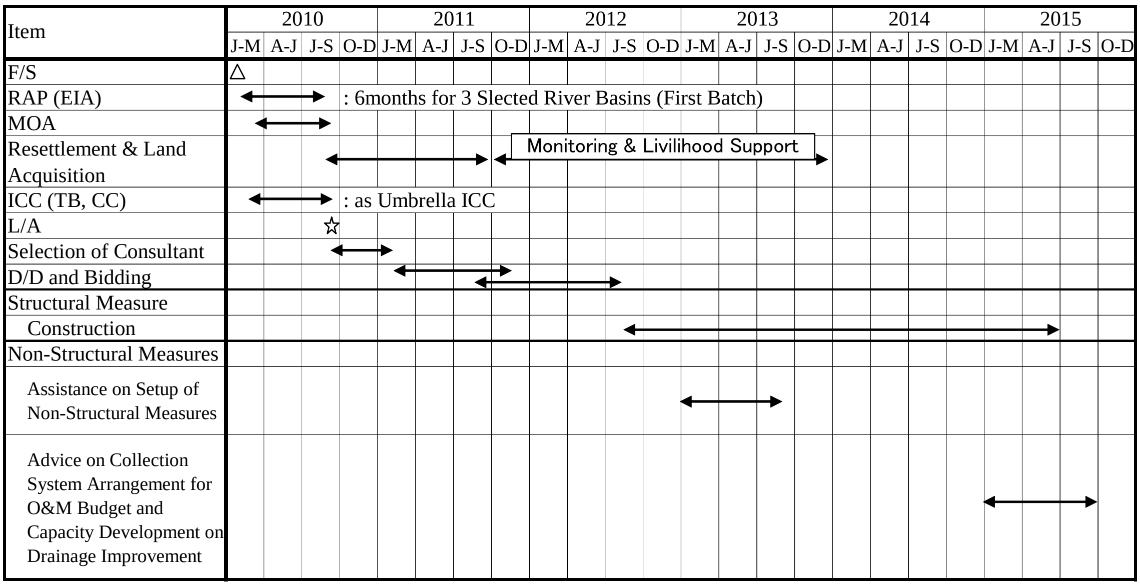
(2) Advice on Collection System Arrangement for the O&M Budget and Capacity Development for Drainage Improvement

The T/As mentioned above would contribute to the strengthening of the capacity for DRM of the Planning Service and FCSEC of DPWH, as well as OCD and PAGASA, and the enhancement of LGUs' activities regarding the DRM (Kabankalan and Ilog)

11.2 Implementation Plan of the Project under Sector Loan

It is proposed in this Study that the construction of flood protection dike and dredging works in the lower channel shall be implemented as the First Batch in the Sector Loan Project. The estimated construction term is three (3) years during 2012-2015, as shown below:

Table R 11.3 Implementation Program of Ilog-Hilabangan River Improvement Works in River in the Sector Loan Project



TABLES

Table 2-1 MONTHLY VARIATINS OF METEOROGICAL DATA AT ILOILO CITY

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1. Temperature (degree centigrade)	29.3	29.9	31.2	32.5	32.3	31.3	30.6	30.2	30.5	30.7	30.4	29.8	30.7
Ave. Daily Max.	22.3	22.5	23.2	24.4	25.3	24.4	24.2	24.4	24.2	24.0	23.8	23.4	23.9
Ave. Daily Min.	25.9	26.2	27.2	28.2	28.8	27.9	27.3	27.3	27.4	27.4	27.2	26.6	27.3
Daily Average													
2. Relative Humidity (%)													
Maximum	94.0	96.0	94.0	94.0	95.0	98.0	97.0	95.0	96.0	97.0	98.0	97.0	95.9
Minimum	71.0	67.0	67.0	65.0	69.0	62.0	83.0	81.0	77.0	77.0	75.0	75.0	72.4
Average	81.2	79.2	75.9	73.4	77.4	81.9	86.4	85.0	85.4	85.4	86.1	85.5	81.9
3. Prevailing Wind													
Dir./Speed(m/s)	NE/5	NE/6	NE/5	NE/5	NE/5	SW/3	SW/3	SW/4	SW/3	NE/3	NE/4	NE/5	NE/4
4. Cloudiness													
Octus	6	6	5	5	6	8	8	8	8	7	7	7	7
5. Pan Evaporation (mm)													
Iloilo City	172	179	221	220	207	169	156	160	154	154	149	163	2,104
Kabankalan	129	152	195	200	163	122	116	115	135	145	128	118	1,719
6. Rainfall													
Amount (mm)	49	28	34	71	98	302	324	359	323	294	173	88	2,143
Rainy Days (day)	8	6	5	5	11	18	20	20	19	18	14	13	157
7. Tropical Cyclones Passing Negros Island													
Occurrrence (%)	0	0	14	4	7	4	0	0	4	7	32	29	100

Source : 1990 M/P

Table 2-2 ANNUAL RAINFALL COMPARISON IN NEGROS ISLAND AND NEIGHBORING AREAS

Unit : mm

Year	Station No.										
	0607	**0612**	**0613**	**0614**	**0615**	**0616**	**0617**	**0618**	**0720**	**0721**	**637-**
1966	**	**	**	**	**	**	**	**	**	**	**
1967	**	**	2,650	**	**	**	**	**	**	**	**
1968	**	**	2,947	**	**	**	**	**	**	**	**
1969	**	**	2,657	**	**	**	**	**	**	**	**
1970	**	**	2,458	**	**	**	**	**	**	**	**
1971	**	**	2,830	**	**	2,862	**	3,218	**	2,220	1,433
1972	1,477	**	3,288	1,813	1,256	2,510	**	3,263	**	1,346	2,472
1973	1,324	2,668	2,767	2,472	1,744	3,151	2,754	3,625	**	1,737	**
1974	1,578	2,329	2,772	**	1,327	2,627	3,758	2,573	**	2,491	2,117
1975	2,056	**	3,260	2,625	**	2,566	3,879	2,712	**	1,575	2,051
1976	1,954	1,699	3,555	1,832	1,789	3,133	3,454	2,799	**	1,875	2,295
1977	1,349	936	**	1,420	1,078	2,629	2,731	2,669	**	1,799	1,596
1978	1,543	1,360	**	1,031	**	2,151	3,056	2,102	**	1,856	1,878
1979	1,126	959	2,638	1,279	1,145	2,228	3,046	**	**	1,743	**
1980	1,313	**	**	**	1,483	**	2,507	**	**	**	**
1981	**	1,914	**	669	1,436	2,662	**	2,410	2,192	1,847	1,757
1982	746	2,614	2,689	381	1,102	**	1,725	2,249	1,274	1,952	2,411
1983	573	2,391	1,892	174	1,136	3,104	1,119	2,296	829	1,644	1,827
1984	996	3,082	2,781	**	**	2,687	2,232	2,409	1,995	971	3,142
1985	983	4,195	**	**	1,499	2,241	2,468	2,716	**	598	2,371
1986	**	3,868	2,512	**	**	**	1,998	**	2,368	581	2,365
1987	**	2,494	**	361	853	1,321	1,604	2,227	**	**	1,833
1988	1,293	2,729	2,269	**	1,460	1,981	**	3,011	**	**	2,586
1989	878	2,370	**	**	1,621	**	1,049	**	**	**	**

Note:
- 0607: Barotac Viejo, Iloilo
- 0612: Kabankalan, Negros Occ.
- 0613: La Granja Exp. Exp. Stn La, Negros Occ.
- 0614: Pulupandan, Negros Occ.
- 0615: San Carlos City, Negros Occ.
- 0616: Silay Hawaiian Central, Negros Occ.
- 0617: Sipalay, Negros Occ.
- 0618: Victorias, Negros Occ.
- 0720: Nonas, Bayawan, Negros Oriental
- 0721: Siaton, Negros Oriental
- 637-: Iloilo City, Iloilo

Table 2.3 MONTHLY AVERAGE RAINFALL BY STATION

Station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
0607	64	39	31	36	90	115	156	116	132	188	169	123	1,259
0612	115	53	44	72	189	319	372	283	311	363	275	111	2,507
0613	98	42	40	105	217	370	435	346	351	432	216	120	2,771
0614	65	16	12	49	97	204	309	311	258	214	113	134	1,782
0615	84	47	60	41	86	116	127	129	148	190	186	138	1,351
0616	142	101	58	77	116	250	247	200	257	327	389	360	2,523
0617	27	19	26	69	172	359	426	449	375	353	140	78	2,492
0618	206	116	85	86	168	219	241	195	270	354	392	352	2,685
0720	35	14	12	26	71	238	235	435	240	295	104	29	1,732
0721	18	11	9	16	70	224	283	318	255	287	86	38	1,616
637-	49	28	34	71	98	302	324	359	323	294	173	88	2,142

Note
0607: Barotac Viejo, Iloilo
0612: Kabankalan Negros Occ.
0613: La Granja Exp. Stn La, Negros Occ.
0614: Pulupandan, Negros Occ.
0615: San Carlos City, Negros Occ.
0617: Sipalay, Negros Occ.
0618: Victorias, Negro Occ.
0720: Nonas, Bayawan, Negros Oriental
0721: Siaton, Negros Oriental
637-: Iloilo City, Iloilo

Table 2.4 MONTHLY RAINFALL AT KABANKALAN

Unit : mm

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1971	*	*	*	*	*	*	*	1,195	692	771	382	232	*
1972	174	52	137	47	416	412	179	336	*	92	126	255	*
1973	46	29	5	27	126	308	313	387	355	322	559	191	2,668
1974	70	88	75	49	206	241	274	172	124	647	184	199	2,329
1975	*	101	29	108	99	253	227	120	164	283	79	108	*
1976	86	95	58	29	234	180	165	186	320	112	152	82	1,699
1977	55	54	28	15	57	61	218	133	179	70	52	15	936
1978	65	16	13	93	44	174	188	184	162	237	117	67	1,360
1979	23	13	14	26	52	131	189	94	98	151	103	66	959
1980	105	*	17	46	174	545	299	383	236	421	332	113	*
1981	69	31	17	9	119	119	385	379	252	220	191	124	1,914
1982	97	62	81	99	115	257	526	677	229	238	168	66	2,614
1983	35	16	6	0	12	168	228	220	484	554	483	185	2,391
1984	160	82	129	110	222	576	434	219	308	397	316	131	3,082
1985	295	50	51	268	372	553	687	349	466	564	392	148	4,195
1986	397	84	58	58	231	453	508	359	556	495	484	186	3,868
1987	112	62	27	19	111	403	551	357	372	158	282	40	2,494
1988	134	47	37	63	687	667	446	375	514	1,079	567	115	4,729
1989	83	66	61	218	241	493	466	157	254	204	80	49	2,370
Average	115	53	44	72	189	319	372	283	311	363	275	111	2,507

Source: PAGASA
Note: Average calculation is based on the years with full data.
Figures may not add uo to totals due to rounding.

Table 2.5 Monthly Average Discharge of the Ilog-Hilabangan River Basin

Pabdan, Orong (C.A.=1,453km^2)												Unit: m^3/s
Year	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1956	23.6	19.8	11.3	26.9	35.7	57.2	208.2	195.9	93.0	165.4	49.2	206.5	91.8
1957	64.3	16.9	10.8	8.3	11.3	30.9	85.3	130.3	150.7	64.4	32.5	11.9	51.7
1958	8.3	6.8	5.8	6.8	15.6	24.9	33.5	62.3	97.6	75.5	104.6	26.2	39.1
1959	13.6	9.8	9.8	11.0	16.7	37.7	214.1	167.8	105.3	199.7	51.8	25.7	72.6
1960	12.9	11.2	9.0	14.3	32.1	120.8	105.8	113.5	122.4	208.7	50.9	16.2	68.4
1961	12.0	9.4	8.7	7.5	14.1	111.0	108.7	201.5	85.0	101.8	46.2	20.4	60.9
1962	13.1	10.6	9.9	24.4	12.5	48.8	175.5	211.4	108.0	56.8	53.3	35.6	63.8
1963	11.3	9.9	9.6	6.8	13.4	64.0	58.0	182.9	119.1	139.6	28.8	52.7	58.4
1964	24.7	23.8	16.3	23.8	80.0	100.2	141.3	90.6	146.9	111.0	262.0	99.5	93.3
1965	60.6	30.9	28.4	23.8	45.7	123.3	272.5	176.7	132.2	87.8	38.5	20.5	87.3
1966	15.3	10.3	7.1	9.9	61.6	92.3	165.5	117.2	99.6	130.7	106.4	84.4	75.5
1967	86.5	57.5	70.4	47.8	67.3	75.1	243.6	194.7	165.8	270.2	220.4	73.1	131.7
1968	60.7	59.0	54.1	50.0	87.8	112.9	174.4	194.5	194.3	136.0	170.8	45.5	111.7
1969	31.8	25.7	21.7	20.1	34.8	68.0	128.7	85.8	12.8	88.2	39.3	39.5	50.1
1970	25.6	22.8	18.8	16.0	23.7	70.7	148.9	93.1	72.9	216.4	69.0	32.8	68.0
1971	31.0	33.2	26.6	19.9	66.3	124.3	136.1	153.4	90.1	374.0	112.6	64.8	103.4
1972	55.4	31.3	15.8	27.7	67.6	114.9	81.0	72.1	206.8	74.2	39.4	40.4	68.8
1973	11.4	9.5	7.2	6.5	7.2	15.9	45.6	73.6	81.2	60.5	194.3	17.9	44.2
1974	15.9	15.3	12.3	10.6	14.4	71.4	89.1	37.7	29.0	90.3	54.3	29.8	39.3
1975	52.0	28.6	20.8	19.5	19.4	15.5	24.3	93.3	16.4	39.0	8.0	6.5	28.8
1976	7.6	5.6	6.6	6.8	79.2	17.9	69.2	74.0	84.9	172.2	7.1	6.7	45.2
1977	8.5	8.2	7.2	6.5	6.2	11.5	9.0	244.2	208.7	16.0	19.7	6.5	46.1
1978	6.7	5.8	5.3	5.1	10.1	20.2	47.8	40.4	85.4	131.3	66.0	11.2	36.4
1979	5.8	5.7	5.6	5.4	20.7	100.3	213.2	101.7	43.4	41.4	23.3	20.2	49.3
Average	27.4	19.5	16.6	16.9	35.1	67.9	124.1	129.5	106.3	127.1	77.0	41.4	66.1
Runoff Height (mm)	51	33	31	30	65	121	229	239	190	234	137	76	1,435

Pangsud (C.A.=431km^2)												Unit: m^3/s
Year	Jan.	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
1955	26.3	11.7	7.8	7.4	7.2	10.3	39.4	32.6	36.3	33.5	136.4	44.4	32.8
1956	9.3	7.5	7.6	13.8	16.9	34.0	59.8	48.9	27.0	33.3	16.9	98.3	31.3
1957	***	***	***	***	***	***	***	***	***	***	***	***	***
1958	***	***	***	***	***	***	***	***	***	***	***	***	***
1959	***	***	***	***	***	***	***	***	***	***	***	7.5	***
1960	***	***	***	***	***	***	***	***	***	***	***	***	***
1961	***	***	***	***	***	***	***	***	***	***	***	***	***
1962	5.5	5.2	5.1	5.0	5.4	11.6	27.0	32.6	25.8	15.0	28.6	26.9	16.2
1963	17.0	14.1	14.6	9.5	9.2	23.6	28.1	47.7	13.2	20.1	4.7	6.5	17.4
1964	10.4	4.0	3.5	5.9	16.9	28.9	33.8	27.8	26.1	32.3	111.2	37.6	28.2
1965	22.3	14.9	16.9	15.9	8.4	45.2	57.0	40.9	38.3	23.2	7.1	5.6	24.7
1966	4.1	5.2	4.8	4.4	8.6	7.9	15.9	22.1	19.1	37.8	84.1	8.3	21.7
1967	26.2	12.2	11.3	7.9	8.0	7.9	15.9	22.1	19.1	37.8	84.1	8.3	21.7
1968	***	***	***	***	***	***	***	***	***	***	***	***	***
1969	***	***	***	***	***	***	***	***	***	***	***	***	***
1970	***	***	***	***	***	***	***	***	***	***	89.9	45.1	***
1971	***	***	***	***	***	***	***	***	***	***	***	***	***
1972	***	***	***	***	***	***	***	***	***	***	***	***	***
1973	***	***	***	***	***	***	***	***	***	***	***	76.0	***
1974	12.3	***	***	***	***	***	***	***	***	59.8	32.5	14.0	***
1975	30.8	13.1	7.2	6.2	6.1	6.8	10.2	6.4	6.9	9.7	7.6	5.6	9.7
1976	6.5	16.6	12.1	9.2	8.7	11.2	17.4	25.1	***	11.1	7.8	7.9	***
1977	6.9	5.9	5.0	4.6	4.6	5.4	6.1	7.4	10.3	11.5	8.0	8.9	7.1
1978	8.5	6.5	6.2	8.6	6.7	7.5	10.3	14.8	26.2	***	22.1	11.7	***
1979	7.0	6.1	5.8	5.8	8.0	11.0	17.7	14.6	10.3	22.8	9.1	6.7	10.5
Average	13.8	9.5	8.3	8.0	8.8	16.3	26.0	26.4	21.6	26.8	43.3	24.7	20.1
Runoff Height (mm)	51	33	31	30	65	121	229	239	190	234	137	76	1,435

Table 2.6 Result of Flooding Conditions in Ilog-Hilabangan River Basin (from Interview Survey)

No.	Place of Interview	Frequency of Flood	Cuase of Flood	Inundation Condition				Property Damaged	Damage to Sugarcane	Source of Flood Information	Place of Evacuation
				Period	Depth (m)	Origin	Velocity				
1	Pob. Ilog	yearly	typhoon rainfall	7days	2.5	mountain	high	houses,agric. Livestock	flooded	ocular	
2	Da-anbanwa Kabankalan	once in 5 years	rainfall	24hours	2.0	mountain	high	houses,agric. Livestock	fallen by flood	barangay (by word of mouth)	
3	Dancalan Ilog	yearly	typhoon	36hours	2.0	creak/ river	high	houses,agric. Livestock	fallen by flood	radio	higher places
4	Bista Alegre	yearly	rainfall	5days	2.5	mountain	high	houses,agric. Livestock	spoiled roots	radio	school building
5	Maralod Ilog	once in a few years	typhoon	3days	2.0	river	high	houses,agric. Livestock		radio	
6	Talubangi-1 Kabankalan	yearly	typhoon rainfall	7days	2.5	mountain	high	houses,agric. Livestock	flooded	ocular	higher places
7	Talubangi-2 Kabankalan	once in 10 years	typhoon	2days	1.0	river	high	houses,agric. Livestock		radio	school building
8	Binlculi Kabankalan	once in 10 years	typhoon	48hours	0.5	creak/ river	low	houses, agric.			
9	Salong Kabankalan	6 times in a year	typhoon	7days	1.0	mountain	high	agric.	fallen by flood	barangay (officers)	school building
10	Linao	once in 10 years	typhoon rainfall	3hours	2.0	river	high	houses,agric. Livestock	spoiled roots	radio	buildings
11	Pob. Kabankalan	once in 10 years	typhoon	2days	1.0	river	high	houses,agric. Livestock	fallen & spoiled flood	radio	school building
12	Hilamonan Kabankalan	once in a few years	typhoon	24hours	4.5	river	high	houses,agric. Livestock	fallen by flood	radio	school building
13	San Juan	once in 5 years	typhoon	3days	2.0	river	high	houses,agric. Livestock	spoiled roots	radio	factory
14	Hacienda San Lucas	yearly	typhoon	29hours	1.0	river	high	houses,agric. Livestock machinery	fallen by flood	radio	higher places
15	Luput-1 Kabankalan	yearly	typhoon rainfall	7days	2.5	mountain	high	houses,agric. Livestock	fallen by flood	ocular	school building
16	Luput-2 Kabankalan	yearly	typhoon	24hours	2.0	river	high	houses,agric. Livestock		radio	higher places
17	Hacienda Calasa	once in a few years	typhoon	10hours	2.5	river	high	houses,agric. Livestock machinery	fallen by flood	radio	hill
18	Orong Kabankalan	yearly	typhoon rainfall	2days	3.0	creak/ river	high	livestock	fallen by flood	radio	higher places

Table 7.1 Result of Flood Inundation Analysis

(1) Without Project

Inundation Depth (m)			Extent of Inundation Area (km2)					
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0.01	-	0.24	2.68	2.38	5.16	6.27	6.30	5.02
0.25	-	0.49	4.08	3.70	6.36	6.69	6.93	6.86
0.50	-	0.99	9.66	10.80	16.01	16.23	16.15	16.42
1.00	-	1.99	9.54	12.86	21.94	24.68	27.02	29.21
2.00	-	2.99	0.94	1.34	2.77	2.95	3.46	5.13
	>=	3.00	0.97	1.93	2.63	3.32	3.77	4.22
Total			27.87	33.02	54.87	60.13	63.63	66.84

(2) Dike & Ring Dike only (Alt-I2)

Inundation Depth (m)			Extent of Inundation Area (km2)					
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0.01	-	0.24	2.27	1.46	3.35	3.52	6.30	5.02
0.25	-	0.49	3.81	3.05	4.10	3.75	6.93	6.86
0.50	-	0.99	9.60	10.07	11.70	12.21	16.15	16.42
1.00	-	1.99	9.46	12.28	15.57	19.35	27.02	29.21
2.00	-	2.99	0.97	1.31	1.64	2.01	3.46	5.13
	>=	3.00	0.93	1.84	2.58	3.31	3.77	4.22
Total			27.04	30.01	38.93	44.14	63.63	66.84

(3) Dike & Ring Dike & River Dredging (Alt-I3)

Inundation Depth (m)			Extent of Inundation Area (km2)					
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0.01	-	0.24	2.26	1.74	3.27	3.39	6.30	5.02
0.25	-	0.49	4.22	3.82	4.02	3.97	6.93	6.86
0.50	-	0.99	9.43	10.19	11.26	12.07	16.15	16.42
1.00	-	1.99	9.17	11.06	15.05	17.76	27.02	29.21
2.00	-	2.99	0.87	1.29	1.38	1.84	3.46	5.13
	>=	3.00	0.76	1.58	2.29	3.11	3.77	4.22
Total			26.71	29.68	37.29	42.14	63.63	66.84

(4) Dike & River Dredging (Alt-I4)

Inundation Depth (m)			Extent of Inundation Area (km2)					
			2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0.01	-	0.24	2.54	2.28	3.54	3.58	6.30	5.02
0.25	-	0.49	4.18	4.13	4.80	4.93	6.93	6.86
0.50	-	0.99	9.51	10.42	12.01	13.22	16.15	16.42
1.00	-	1.99	9.30	11.47	15.22	17.92	27.02	29.21
2.00	-	2.99	0.87	1.26	1.39	1.83	3.46	5.13
	>=	3.00	0.78	1.58	2.27	3.08	3.77	4.22
Total			27.18	31.14	39.23	44.56	63.63	66.84

Table 7.2 Construction Base Cost for Ilog-Hilabangan River Improvement Project

Ilog-Hilabangan Project / *Major* Work Description	Quantity	Unit	Unit Cost		Total Cost		
			L/C	F/C	L/C	F/C	Total
Earth Work							
Clearing and Grubbing	756,566	m^2	8.1	15.9	6,115,478	12,035,286	18,150,764
Removal and Stripping of Topsoil	446,566	m^2	186.3	367.0	83,176,258	163,884,592	247,060,850
Excavation, Open Cut -1	22,247	m^3	13.3	25.9	296,061	575,477	871,537
Excavation and Loading by Backhoe	1,756,072	m^3	34.4	75.4	60,475,797	132,326,373	192,802,171
Loading, Using Backhoe (1.5 cu.m.)	1,756,072	m^3	17.4	36.6	30,474,206	64,349,695	94,823,901
Hauling - 2 km -1	1,358,346	m^3	30.1	60.5	40,829,433	82,237,948	123,067,381
Hauling - 5 km -1	509,287	m^3	56.1	113.0	28,560,170	57,525,408	86,085,578
Spreading	1,018,574	m^3	8.7	16.3	8,811,666	16,638,565	25,450,231
Dike Embankment	849,059	m^3	49.2	103.7	41,765,500	88,027,156	129,792,656
Grass Sodding	251,232	m^2	62.8	5.1	15,765,307	1,282,286	17,047,593
	Subtotal				*316,269,876*	*618,882,787*	*935,152,663*
Drainage Ditch (BxH=0.3m x 0.3m)							
Concrete Work for Small Structure-2	2,390	m^3	1517.6	2518.1	3,627,706	6,019,320	9,647,026
Concrete Work for Leveling Concrete-2	1,062	m^3	1150.8	2104.8	1,222,617	2,236,120	3,458,738
Formwork F2 (for Small Sized Structure)	19,920	m^2	384.5	70.9	7,658,562	1,412,821	9,071,383
Formwork for Leveling Concrete	2,656	m^2	267.6	46.8	710,786	124,329	835,115
	Subtotal				*13,219,672*	*9,792,590*	*23,012,262*
Drainage Sluice							
Concrete Work for Reinforced Concrete-1	594	m^3	1219.5	2571.9	724,897	1,528,735	2,253,632
Concrete Work for Leveling Concrete-2	21	m^3	1,150.8	2,104.8	24,390	44,609	69,000
Formwork F1 (for Large Sized Structure)	1,095	m^2	383.1	58.6	419,647	64,160	483,806
Formwork for Leveling Concrete	11	m^2	267.6	46.8	2,946	515	3,462
Supporting/Scaffolding Work	982	m^3	219.0	81.8	215,058	80,307	295,365
Installation of 1.5x1.5m Slide Gate	0	nos	1,000,000.0	2,000,000.0	0	0	0
Installation of 3.0x3.0m Slide Gate	2	nos	3,000,000.0	9,000,000.0	6,000,000	18,000,000	24,000,000
Steel Sheet Pile Type II	219	m^2	1411.1	10889.8	308,838	2,383,458	2,692,296
Reinforcing Bar (Grade 60)	59	ton	25785.1	47542.7	1,532,672	2,825,947	4,358,620
	Subtotal				*9,228,450*	*24,927,732*	*34,156,181*
Revetment Works							
Demolition & Removal of Existing Revetment	36,769	m^2	372.5	734.0	13,696,809	26,987,219	40,684,028
Stone Masonry/Wet Stone Masonry-1	76,896	m^2	843.3	579.9	64,846,220	44,589,760	109,435,981
Gravel Bedding and Backfill	11,534	m^3	989.4	239.0	11,411,758	2,757,027	14,168,785
Gabion Mattress, w/ Filter Cloth Bedding	7,811	m^3	2602.0	6402.9	20,324,877	50,015,327	70,340,204
Rock Fill, Type A & B (Cobble Stone)	53,964	m^3	1646.0	309.9	88,823,529	16,724,712	105,548,241
Steel Sheet Pile Type IIIA, Furnishing and Driving	5,000	m^2	1685.9	13182.6	8,429,569	65,912,806	74,342,374
Concrete Work for Small Structure-2	1,885	m^3	1517.6	2518.1	2,860,324	4,746,031	7,606,356
Formwork F2 (for Small Sized Structure)	9,163	m^2	384.5	70.9	3,522,862	649,884	4,172,745
Reinforcing Bar (Grade 60)	151	ton	25785.1	47542.7	3,893,550	7,178,942	11,072,492
	Subtotal				*204,112,688*	*192,574,490*	*437,371,206*
Grand Total					*542,830,686*	*846,177,598*	*1,429,692,312*

Table 7.3 Compensation Cost

Project / Item / Description	Quantity	Unit	Unit Cost (Php)	Total Cost (Php)	Remarks
Ilog-Hilabangan Project					
House Relocation					
Informal Dwellers	60	house	100,000	6,000,000	inclusive of Livelihood Support
Tenant Farmer-1	0	house	350,000	0	Compensation House
Tenant Farmer-2	0	family	50,000	0	Livilihood Support
Land Acquisition	19,500	m^2	500	9,750,000	6,500m x 3m (Kabankalan)
	76,050	m^2	100	7,605,000	(33m+6m) x1,950m (Sugarcane)
	300,300	m^2	100	30,030,000	(27m+6m) x9,100m (Ilog Ring Dike)
	30,000	m^2	100	3,000,000	(24m+6m) x1,000m (Hilabangan)
		Total		56,385,000	
Summary					
House Relocation				6,000,000	
Land Acquisition				50,385,000	
Grand Total				56,385,000	

Table 7.4 Project Cost Excluding Contingencies

Objective	Cost			Remarks	
Imus Retarding Basin	L/C	F.C	Total		
Construction Cost (Construction Base Cost)	*629,682,000*	*981,563,000*	*1,611,245,000*		- (A)
Estimated Direct Cost + OPC	542,830,000	846,177,000	1,389,007,000		
Mobilization & Demobilization	5,428,000	8,461,000	13,889,000	1.0%	of Estimated Direct Cost
Site Expenses	27,141,000	42,308,000	69,449,000	5.0%	of Estimated Direct Cost
Temporary Work	54,283,000	84,617,000	138,900,000	10.0%	of Estimated Direct Cost
Compensation Cost (Base Cost)	*15,750,000*	*0*	*15,750,000*		- (B)
House Relocation & Livelihood Support	6,000,000		6,000,000		
Land Acquisition	9,750,000		9,750,000		
Administration Cost (Base Cost)	*81,349,000*		*81,349,000*	5.0%	of (A) + (B)
Engineering Service Cost (Base Cost)	*103,118,000*	*154,678,000*	*257,796,000*		- (C)
Detailed Design Engineering	38,669,000	58,004,000	96,673,000	6.0%	of (A)
Supervision	64,449,000	96,674,000	161,123,000	10.0%	of (A)
Tax and Duties	*224,285,000*		*224,285,000*	12.0%	of (A) + (C)
Total	***1,054,184,000***	***1,136,241,000***	***2,190,425,000***		

Table 7.5 O&M Cost Estimates for Ilog-Hilabangan River Improvement Project

Item of O & M					Annual		Unit Cost		Cost			Remarks
General	Item	Description	Frequency	Unit Item	Q'ty	Unit	L/C	F/C	L/C	F/C	Total	
Inspection												
	Inspection	Conducted by Municipal Government	Monthly	Inspector	24		Salary				0	2 person x 12months
				Gasoline	120	litre	10	40	1,200	4,800	6,000	10litre x 12months
Maintenance												
	Preventive	Conducted by Municipal Government	Semiannually	Labor (Residential P.)	10	persons	200		2,000	0	2,000	Based on Bayanihan
				Small Truck	16	hours	195	455	3,120	7,280	10,400	2cargo truck x 8hours x 2
				Leaders	4		Salary				0	
				Plastic Garbage Bag etc	1	L.S.	30000		30,000	0	30,000	for Garbage Collection
				Subtotal							42,400	
	Corrective (Repair of Structure)	Conducted by Provincial Government or DPWH	As Required	2% for Wet Stone Masonry in New Revetment and 1% for Other Revetment and Sluice	1	L.S.	2,781,874	2,620,920	2,781,874	2,620,920	5,402,793	
Operation												
				Electrical Charge	1	L.S.	200,000	0	200,000	0	200,000	
	In Flood	Personnel committed	6month contract	Personnel committed	12	months	3000	0	36,000	0	36,000	2 persons x 6 months
Grand Total									3,019,074	2,625,720	5,687,193	

Table 7.6 Estimated Flood Damage

Without Project

(under Plesent Land Status) unit: million pesos

Return Period	(1) Buildings	(2) Value Added	(3) Industry	(4) Agriculture	(5) Infrastructure	(6) Other Indirect	TOTAL
2-year	123	19	7	30	18	36	233
5-year	284	42	14	50	39	78	507
10-year	938	141	71	129	128	256	1,662
25-year	1,153	173	82	148	156	311	2,023
50-year	1,246	187	88	163	168	337	2,189
100-year	1,400	210	98	181	189	378	2,456

(under Future Land Status) unit: million pesos

Return Period	(1) Buildings	(2) Value Added	(3) Industry	(4) Agriculture	(5) Infrastructure	(6) Other Indirect	TOTAL
2-year	156	22	48	39	27	53	346
5-year	360	51	112	60	58	117	758
10-year	1,190	169	794	116	227	454	2,950
25-year	1,462	208	929	131	273	546	3,549
50-year	1,580	225	1,075	142	302	604	3,928
100-year	1,776	253	1,260	153	344	688	4,474

With Project

(under Plesent Land Status) unit: million pesos

Return Period	(1) Buildings	(2) Value Added	(3) Industry	(4) Agriculture	(5) Infrastructure	(6) Other Indirect	TOTAL
2-year	108	14	8	28	16	31	204
5-year	197	26	12	43	28	56	361
10-year	293	38	17	73	42	84	548
25-year	413	53	23	95	58	117	760
50-year	1,246	187	88	163	168	337	2,189
100-year	1,400	210	98	181	189	378	2,456

(under Future Land Status) unit: million pesos

Return Period	(1) Buildings	(2) Value Added	(3) Industry	(4) Agriculture	(5) Infrastructure	(6) Other Indirect	TOTAL
2-year	112	16	41	36	21	41	267
5-year	206	29	83	52	37	74	482
10-year	305	43	139	82	57	114	740
25-year	429	61	224	102	82	163	1,061
50-year	1,580	225	1,075	142	302	604	3,928
100-year	1,776	253	1,260	153	344	688	4,474

Table 7.7(1) Estimation of Annual Average Flood Damages to Be Mitigated

Under Present Land Use Status

In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	233	117	58	58
5-year	0.2000	0.3000	507	370	111	169
10-year	0.1000	0.1000	1,662	1,085	108	278
25-year	0.0400	0.0600	2,023	1,843	111	388
50-year	0.0200	0.0200	2,189	2,106	42	430
100-year	0.0100	0.0100	2,456	2,323	23	454

In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	204	102	51	51	7
5-year	0.2000	0.3000	361	283	85	136	33
10-year	0.1000	0.1000	548	454	45	181	96
25-year	0.0400	0.0600	760	654	39	220	168
50-year	0.0200	0.0200	2,189	1,474	29	250	180
100-year	0.0100	0.0100	2,456	2,323	23	273	180

(= A - B)

Table 7.7(2) Estimation of Annual Average Flood Damages to Be Mitigated

Under Future Land Use Status

A. In Case of Without-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages
2-year	0.5000	0.5000	346	173	86	86
5-year	0.2000	0.3000	758	552	166	252
10-year	0.1000	0.1000	2,950	1,854	185	437
25-year	0.0400	0.0600	3,549	3,249	195	632
50-year	0.0200	0.0200	3,928	3,738	75	707
100-year	0.0100	0.0100	4,474	4,201	42	749

B. In Case of With-Project (million Pesos)

Return Period	Annual Average Probability of Exceedance	Probability of Occurrence	Flood Damages by Return Period	Average Amount of Assumed Damages	Average Annual Amount of Probable Damages	Accumu-lated Amount of Probable Damages	Annual Average Mitigated Damages to Be Expected (may be converted into E. Benefit)
2-year	0.5000	0.5000	267	134	67	67	20
5-year	0.2000	0.3000	482	375	112	179	73
10-year	0.1000	0.1000	740	611	61	240	197
25-year	0.0400	0.0600	1,061	901	54	294	338
50-year	0.0200	0.0200	3,928	2,494	50	344	363
100-year	0.0100	0.0100	4,474	4,201	42	386	363
							(= A - B)

Table 7.8 Cash Stream of the Project Implementation (Economic Cost)

Withtout Price Contingency (without Tax, etc (VAT)) million P.

No.	Year	Construction				Compe-nsation	Admin.	Engineering Service Cost				O&M				Grand Total
		L/C		F/C	Total			L/C		F/C	Total	L/C		F/C	Total	
		Labor	M&E			L/C	L/C	Labor	M&E			Labor	M&E			
0	2009	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	2010	0	0	0	0	8	0	0	0	0	0	0	0	0	0	8
2	2011	0	0	0	0	8	0	32	4	61	97	0	0	0	0	105
3	2012	14	106	190	310	0	15	16	2	30	48	0	0	0	0	373
4	2013	33	237	427	697	0	34	19	2	35	56	0	0	0	0	788
5	2014	25	185	332	542	0	27	16	2	30	48	0	1	1	2	619
6	2015	0	0	0	0	0	0	3	0	5	8	0	2	2	5	13
7	2016	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
8	2017	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
9	2018	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
10	2019	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
11	2020	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
12	2021	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
13	2022	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
14	2023	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
15	2024	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
16	2025	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
17	2026	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
18	2027	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
19	2028	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
20	2029	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
21	2030	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
22	2031	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
23	2032	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
24	2033	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
25	2034	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
26	2035	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
27	2036	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
28	2037	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
29	2038	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
30	2039	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
31	2040	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
32	2041	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
33	2042	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
34	2043	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
35	2044	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
36	2045	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
37	2046	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
38	2047	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
39	2048	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
40	2049	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
41	2050	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
42	2051	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
43	2052	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
44	2053	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
45	2054	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
46	2055	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
47	2056	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
48	2057	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
49	2058	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5
50	2059	0	0	0	0	0	0	0	0	0	0	0	2	2	5	5

Table 7.9 Economic Evaluation for Ilog-Hilabangan Rivers

(million Pesos)

Calendar Year	Year in Order	Economic Cost: Project Cost	OM Cost	Total	Base of Benefit from Economic Product	Benefit to Be Derived		Economic Benefit in Total	Cash Balance
2005	-4			0				0	0
2006	-3			0				0	0
2007	-2			0				0	0
2008	-1			0				0	0
2009	Base Year	0	0	0				0	0
2010	1	8	0	8			0	0	-8
2011	2	105	0	105			0	0	-105
2012	3	373	0	373			0	0	-373
2013	4	788	0	788	74		25	25	-763
2014	5	617	2	619	158		79	79	-540
2015	6	8	5	13	280		280	280	267
2016	7	0	5	5	297		297	297	291
2017	8	0	5	5	313		313	313	308
2018	9	0	5	5	330		330	330	325
2019	10	0	5	5	346		346	346	341
2020	11	0	5	5	363		363	363	358
2021	12	0	5	5	363		363	363	358
2022	13	0	5	5	363		363	363	358
2023	14	0	5	5	363		363	363	358
2024	15	0	5	5	363		363	363	358
2025	16	0	5	5	363		363	363	358
2026	17	0	5	5	363		363	363	358
2027	18	0	5	5	363		363	363	358
2028	19	0	5	5	363		363	363	358
2029	20	0	5	5	363		363	363	358
2030	21	0	5	5	363		363	363	358
2031	22	0	5	5	363		363	363	358
2032	23	0	5	5	363		363	363	358
2033	24	0	5	5	363		363	363	358
2034	25	0	5	5	363		363	363	358
2035	26	0	5	5	363		363	363	358
2036	27	0	5	5	363		363	363	358
2037	28	0	5	5	363		363	363	358
2038	29	0	5	5	363		363	363	358
2039	30	0	5	5	363		363	363	358
2040	31	0	5	5	363		363	363	358
2041	32	0	5	5	363		363	363	358
2042	33	0	5	5	363		363	363	358
2043	34	0	5	5	363		363	363	358
2044	35	0	5	5	363		363	363	358
2045	36	0	5	5	363		363	363	358
2046	37	0	5	5	363		363	363	358
2047	38	0	5	5	363		363	363	358
2048	39	0	5	5	363		363	363	358
2049	40	0	5	5	363		363	363	358
2050	41	0	5	5	363		363	363	358
2051	42	0	5	5	363		363	363	358
2052	43	0	5	5	363		363	363	358
2053	44	0	5	5	363		363	363	358
2054	45	0	5	5	363		363	363	358
2055	46	0	5	5	363		363	363	358
2056	47	0	5	5	363		363	363	358
2057	48	0	5	5	363		363	363	358
2058	49	0	5	5	363		363	363	358
2059	50	0	5	5	363		363	363	358
2060	51	0	0	0	363		363	363	363
2061	52	0	0	0	363		363	363	363
2062	53	0	0	0	363		363	363	363
2063	54	0	0	0	363		363	363	363
2064	55	0	0	0	363		363	363	363
2065	56	0	0	0	363		363	363	363
2066	57	0	0	0	363		363	363	363
2067	58	0	0	0	363		363	363	363
2068	59	0	0	0	363		363	363	363
2069	60	0	0	0	363		363	363	363
2070	61	0	0	0	363		363	363	363
2071	62	0	0	0	363		363	363	363
Total		1,899	235	2,135		0	20,541	20,541	18,406

Applied Discount Rate: 15 % according to a regulation of the nation.

NPV				1,111				1,165	55
EIRR									15.65%
B/C									1.05