expected to increase in the future, the project benefit was estimated assuming the increase of assets such as houses and household effects.

4.2 Selection of Project Scale and Target Year

Project Scale

In accordance with the above concept, the project scale in the Ilog-Hilabangan River Basin is conceived as discussed below.

In the ongoing studies on flood control plan for the other major rivers such as Pasig River, Agno River, Cagayan River, Pampanga River and Panay River, the project scale of a 100-year return period was adopted. Among them, the Panay river basin conditions such as land use, flood damage and catchment basin are similar to those of the Ilog-Hilabangan River Basin.

The recently recorded maximum flood was in November 1990 caused by Typhoon Ruping. This flood seems to be of a 90-year return period according to the flood frequency analysis based on the flood data including this flood. Consequently, it is necessary to adopt the project scale of more than 90-year return period if this Master Plan is required to cover the project scale against a flood of bigger magnitude than the recorded maximum flood.

Judging from the said condition, a 100-year return period to the Master Plan of flood control in the Ilog-Hilabangan River Basin is proposed to be adopted.

Target Year

In accordance with the basic concept of formulation of the Master Plan, the target year for economic evaluation is assumed from the availability of the basic data. The year 2020 is employed for the target year on the following consideration.

Among the ongoing flood control plans, the furthest target year is 2020 which was adopted for the formulation of the Master Plan of the Pasig River Basin (refer to Fig. 4.2-1). In the Ilog-Hilabangan River Basin, this year seems to be the furthest one to accurately presume future conditions such as population, land use, water demand and others.

4.3 Design Criteria

For the formulation of Master Plan, the following design criteria were applied.

Basic Project Flood

The basic project flood, which is a basic figure to examine the flood control plan alternatives, is 5,450 m^3/s. This was derived by rounding the peak discharge of 5,430 m^3/s which corresponds to a 100-year return period flood at the reference point downstream of the confluence with the Hilabangan River. The basic project flood of the Ilog River before the confluence is 4,300 m^3/s and that of Hilabangan, 2,900 m^3/s. Fig.4.3-1 shows the design discharge in the Ilog-Hilabangan River Basin. Since the flow capacity of the existing river channel is about 500 m^3/s at minimum, the excess discharge to be controlled by flood control measure is more than 5,000 m^3/s.

Design Highwater

The design high water level at the river mouth was set considering the mean high water spring of 1.5 m. To minimize the flood damage potential, the design high water in the stretch where many houses are located along the river course was set at the ground height, while that in the stretch where land use is more for agriculture was set, at least, below the recorded maximum flood mark or about 1.5 m high above the ground level.

4.4 Alternative Study Cases

4.4.1 Selection of Applicable Method

Observation of Applicability of the Flood Control Measures

Judging from the river basin conditions, the following flood control measures are considered as applicable.

(1) River Improvement

This measure has been partially applied to this river basin and it seems to be effective. Cut-off channels which have also been provided in this river basin is included in this measure.

(2) Diversion Channel

This measure was once employed in the Bungul diversion channel in this basin and it seems to be still one of the applicable measures.

(3) Dam and Reservoir

As mentioned in Section 3.3, Ilog No. 1 upper and lower dam sites and Hilabangan No. 1 were finally selected as possible dam sites.

(4) Retarding Basin

There is no site suitable for a retarding basin.

Among the above measures, river improvement has been compared with the diversion channel from the similarity of their function on flood control, i.e., to confine the flood discharge in the channel and make it flow down safely to the sea or elsewhere. The dams selected at three sites were also further examined. In this connection, preliminary comparison studies between river channel and diversion channel and among dams/reservoirs were made to narrow down the applicable measures and simplify the comparative study as discussed hereafter.

<u>Comparison between River Improvement and Diversion Channel</u>

The objective river improvement stretch will be from the river mouth to 20 km for the Ilog River and from the confluence point with the Ilog River to 1.5 km for the Hilabangan River where the flood damage is expected.

A cut-off channel at the meandering section near Kabankalan and Talubangi is considered to be provided as an alternative study case. Therefore, two cases of river improvement plans are proposed as follows (Refer to Fig. 4.4-1):

Case R1 : River channel alignment is proposed, based on the existing river channel.

Case R2 : Cut-off channel is proposed at the meandering section near Kabankalan Municipality and Barangay Talubangi and the existing river channel alignment is adopted to the remaining section.

As for the diversion channel, the following three cases are proposed judging from the topographic condition (refer to Fig. 4.4-1):

Case D1 : The channel will be diverted from the upper stream point at Kabankalan City (13.5 km), pass the eastern part of the city and connect with the existing Binicuil River.

Case D2 : The old Ilog River will be used as diversion channel by expanding the river width and excavation.

Case D3 : The channel will be diverted from the 15.0 km point, pass the western part of the Ilog-Hilabangan River and connect with the Salong River.

Discharge distribution to the existing river and diversion channels in the above-said cases is determined through a cost comparison study on several alternative cases.

The comparison results of the above alternative cases of river improvement and diversion channel are shown in Table 4.4-1. Judging from this table, river improvement based on the existing river channel has an economical advantage over the other cases, because the excavation and embankment volume for river improvement are less than those of the other alternative cases, while there is not much difference in the number of house evacuation and land acquisition among these cases. Eventually, river improvement along the existing channel (Case R1) is proposed as one of the applicable measures for further alternative study.

Comparison among Dams/Reservoirs

The possible study cases for dam/reservoir are as follows:

Case Dam1 : Ilog No.1 upper dam site
Case Dam2 : Ilog No.1 lower dam site
Case Dam3 : Hilabangan No. 1 dam site

To identify the most suitable dam site among the three dam sites, rough cost comparisons by effective storage capacity and regulation effect were made as shown in Table 4.4-2, Figs. 4.4-2 and 4.4.-3, respectively. Judging from the figures, Ilog No. 1 lower dam site has an economical advantage over the other dam sites, while the number of house evacuation is not much different among the sites. Ilog No. 1 lower dam site is then proposed as one of the applicable measures for further alternative study.

4.4.2 Possible Alternative Study Cases

From the study, it was identified that the dam and reservoir and river channel improvement are applicable measures for flood control in this river basin. In this connection, the following alternative cases are conceivable; namely, (1) river improvement only, (2) dam/reservoir only, and (3) combination of river improvement with dam/reservoir.

In the case of dam/reservoir, however, Ilog No. 1 lower dam cannot regulate the flood discharge up to the flow capacity of about 500 m^3/s of the present river channel, because the flood discharge from the Hilabangan river basin is over 500 m^3/s. Flood damage still occurs even if the Ilog No. 1 dam can regulate all the flood discharge from the Ilog River Basin. Thus, the case of dam and reservoir only was eliminated and the following alternative cases were considered:

Case 1 : River improvement only
Case 2 : Combination of river improvement and Ilog No. 1 lower dam

4.5 Selection of Optimum Case

To select the optimum case, further comparative study on the two (2) alternative cases was made. The results of the study are discussed hereinafter.

4.5.1 Study on River Improvement (Case 1)

The river improvement plan is composed mainly of the following components; namely, (1) alignment, (2) longitudinal profile, and (3) cross section. The basic principles for planning these components are as follows:

(1) Alignment

The existing river course, which has been relatively stable for a few decades is adopted to the alignment of this river improvement plan, though minor modification is taken to make it more smooth as seen in the section around the diversion point to Bungul diversion channel. The proposed alignment is shown in Fig. 4.5-1.

(2) Longitudinal Profile

The design riverbed elevation and gradient is set along the present average riverbed, which seems to be stable as mentioned in Chapter 2, Present Condition, so that the design riverbed can be easily maintained. The design longitudinal profile is shown in Fig. 4.5-2.

(3) Cross Section

In planning the cross section, one of the study points is to select the suitable cross section type; i.e., compound cross section or single cross section. In the case of Ilog-Hilabangan River, the single cross section is adopted on the following considerations:

(a) A compound cross section is generally applied to confine the low water discharge in the low water channel and the compound cross section has the advantage in maintaining the channel. In case of a single cross section the low water discharge flows down, changing the course at the bottom of a single cross section, and the river channel is sometimes subject to bank erosion resulting in the problem of maintenance of the channel.

However, the river improvement stretch is in the tidal influence and the river channel is under submergence of sea water. Further, the low water discharge flows down without so much adverse influence such as bank erosion. Therefore, it is not necessary to provide a low water channel to maintain the river channel.

(b) In general, the compound cross section requires a wider river channel and a larger current flow area compared with the single cross section, usually resulting in the increase of construction cost. Since it is not recommendable to largely widen the present river channel in the stretch where Kabankalan Municipality and Barangay Tarubangi exist along the river course, it is preferable to apply a single cross section.

(c) In the stretch far from the tidal influence, a compound cross section is considered. However, this stretch which is presently of a single cross section seems to be stable and not so long. If the compound cross section is applied to this stretch, it is necessary to provide a transition section in this short stretch to connect the compound section to the single section, so that a compound cross section is not substantially advantageous compared with the increase in cost.

A typical cross section for river improvement is shown in Fig. 4.5-3.

(4) Related River Structures

The following river structures are provided to obtain the required flow capacity, stabilize the river channel and guarantee the existing condition:

(a) Dike

To pass the design discharge safely, dikes are planned at both sides of the river channel from the river mouth to the mountainous portion. The top elevation of the dike was obtained by adding a freeboard allowance to the Design High Water Level.

(b) Revetment

For the protection of the dike and the river channel from erosion, revetment is applied at the water colliding front of the meandering sections. Furthermore, since turbulent river flow occurs at the upper and lower portions of structures, revetment is provided at both sides of sluices, drainage facilities and abutments of bridges.

(c) Sluice

Sluices are proposed at the confluence of related rivers (Old Ilog River, Bagacay River, Bungul River) to prevent the flood discharge of the Ilog River from flowing into the related river and to supply freshwater to fishponds.

(d) Drainage Facilities

Drainage facilities are to be provided at the area surrounded by dike and the existing area such as the traces of the old river course to drain inner water.

(b) Bridge

There are two bridges accross the Ilog River; namely, Talubangi Bridge and Bungul Bridge. In connection with the construction of dike along both sides of the river, it is necessary to reconstruct these bridges.

4.5.2 Study on Combination of River Improvement with Ilog No. 1 Lower Dam (Case 2)

Design Discharge Distribution for River Channel and Dam/Reservoir

The following design discharge distribution cases were examined to determine the most economical combination of river improvement and dam/reservoir.

Case	River Channel (m^3/s)	Dam (m^3/s)
1	4,800	650
2	4,000	1,450
3	3,400	2,050
4	2,750	2,700
5	2,300	3,150

River Improvement

The river channel improvement under the cases mentioned above is planned by narrowing the river width of the design cross section to effectively confine the discharge, but applying an alignment based on the present river course.

Dam and Reservoir

(1) Regulation Effect of Dam

To know the regulation effect of the dam for flood control purpose, runoff calculation using various cases of reservoir capacity was made as shown in Table 4.5-1.

(2) Dam Type

Rock fill type dam with center core which is commonly used for relatively high dams is selected on the following basis:

(a) The foundation rock composed of volcanic clastic rocks is classified as "Low" to "Very Low" strength class according to the results of the unconfined compressive tests. Under such condition of the foundation, a concrete dam of considerable size will be technically inappropriate to be constructed due to insufficient strength against sliding, and will not also be economically justifiable.

(b) Unconsolidated portion exists irregularly in the foundation rock. Therefore, such condition of the foundation is not suitable for a concrete dam.

(c) From the topographic point of view, a spillway can be located on the right bank of the dam site where a gentle ridge extends towards the east.

(d) Embankment materials are available in the vicinity of the dam site.

(3) Design Flood Discharge

The spillway is designed to pass the design flood discharge of 7,400 m3/s, which is calculated at 1.2 times the peak discharge with a 200-year return period.

(4) Protection Work for Water Leakage

As stated in the preceding chapter, the reservoir area at approximately above 25 meters of elevation covers the very porous limestone zone which is likely to cause leakage problems to the surrounding areas. To estimate the dam construction cost, concrete channels above 25 meters of elevation along the river course in the reservoir are planned to prevent leakage through the limestone zone.

(5) Provision of Storage Capacity for Sedimentation

The required sedimentation capacity is estimated in the following condition:

(a) The sediment volume is based on the accumulated volume for 50 years which is employed for several dams constructed in this country.

(b) Specific sediment volume of 650 m^3/km^2/year is adopted with reference to the observed data at Dahile in the Ilog River.

Consequently, the required sedimentation capacity is estimated as follows:

650 m^3/km^2/year x 50 years x 1,430 km^2 = 46 MCM

Since the required sedimentation capacity is large compared with the required flood control capacity, a sediment control dam is planned in the upper reaches to reduce the required sediment capacity of the proposed Ilog No.1 lower dam site. This has an economic advantage over the case of providing a sediment storage capacity at the Ilog No.1 lower dam site without sediment control dam.

Therefore, a sediment control dam with a height of 30 m at the upper reaches of the Ilog No.1 lower dam site is proposed to detain the sediments from the upper reaches. The sediment storage capacity is about 37 MCM, though the sediment balance of 9 MCM coming from the remaining area between the sediment control dam and Ilog No.1 lower dam site is detained in Ilog No.1 lower dam site.

(6) Relation between Regulation Effect and Dam Cost

The relation between flood regulation effect and the cost of Ilog No.1 lower dam is presented in Fig. 4.5-4.

4.5.3 Selection of Optimum Case

Cost Comparison of Alternative Cases

Basic cost, including direct construction cost and land acquisition cost was roughly estimated for the alternative cases. The construction cost is summarized in the following table. (Refer to Fig. 4.5-5.)

Case No.	Discharge Distribution (m^3/s)		Cost (million ₱)		
	River Channel	Dam	River Channel*	Dam	Total
Case 1	5,450	-	1,187	-	1,187
Case 2- 1	4,800	650	1,012	1,440	2,452
2	4,000	1,450	779	1,560	2,339
3	3,400	2,050	639	1,670	2,309
4	2,750	2,700	534	1,810	2,344
5	2,300	3,150	481	3,400	3,881

* Cost estimate was based on unphased implementation schedule.

Selection of Optimum Case

Judging from Fig. 4.5-5, river improvement should be the optimum flood control measure in this river basin, explained as follows:

(1) The river improvement plan is economically advantageous to the case of river improvement in combination with dam.

(2) In case of expansion of the present river width, social problems regarding house evacuation sometimes ensue. Although the number of house evacuation is not small at about 350 houses for this river improvement plan, which number is not much different from the 300 houses for dam construction, the plan is expected to be accepted because there is no other way to assure safety from flood damage as discussed before.

4.6 Preliminary Design, Construction Plan and Cost Estimate

4.6.1 Preliminary Design

Related structures, as described herein, are dike, revetment, sluice, drainage facility and bridge. These are designed in consideration of the availability of construction materials near the project sites, structural stability, construction efficiency and economy.

Design Criteria

The basic design in this study was made on the basis of the following two standards:

(1) Design Guidelines, Criteria and Standards (Prepared by DPWH)

(2) Technical Standard for River and Sabo Facilities (Prepared by the Ministry of Construction of Japan)

Structural Design

(1) Dike

The standard design section of river dike is shown in Fig. 4.6-1. The dike height is determined by adding a freeboard to the design high water level which is reckoned on the design flood discharge.

Freeboard, which is the margin of height to guard against overtopping and wave wash, is given by the design flood discharge.

Top width should be planned in consideration of dike stability and function of road during maintenance operations. Top width is also given by the design flood discharge.

The side slopes on both landside and riverside of the dike are designed as 2:1 from the aspect of dike stability. Berms are provided along the slopes of high dikes as erosion control measures and also to improve the stability of the side slopes. When the crest height from the riverbed is more than 5 m, berms of the riverside shall be provided at 5 m in height from the riverbed elevation with a width of 10 m. When the crest height from the existing ground is more than 3 m, berms of the landside shall be provided at 3 m in height from the crest elevation with a width of 3 m.

(2) Revetment

Revetment, which is a flood control structure constructed along dike slopes for protection against scouring and wave wash, is designed with the use of wet masonry 0.3 m thick. The standard design section of revetment is shown in Fig. 4.6-2. The base concrete of revetment should be above mean sea level to execute all works in the dry condition. Under the base concrete, concrete sheet pile foundation combined with percolation control is constructed. Height of revetment is based on the required design high water level.

(3) Sluice

Sluice gates protect the tributary catchment areas from the flood flow of the main river and lead riverwater or brackishwater to branch rivers. The standard design of sluice gates, classified into two types according to scale, Type A and Type B, are shown in Figs. 4.6-3 and 4.6-4, respectively. Type A, which is placed at Bagacay River, Old Bungul River and so on, has one box culvert of 1.5 m by 1.5 m. Type B, which is placed at Old Ilog River, has three box culverts of 3 m by 3 m. These are determined not to change the existing conditions based on the existing river width. To prevent differential settlement, wooden or reinforced concrete piles are provided at the foundation.

(4) Drainage Facility

Drainage facility, which is provided to drain landside water, is composed of a box culvert of 1 m by 1 m with flap gate under the dike and drainage ditch at landside.

(5) Bridge

There are two bridges, Talubangi and Bungul Bridge, to be reconstructed according to the river improvement plan. Judging from the existing condition of these bridges, the following widths are to be applied.

Talubangi Bridge:	10 m wide for two-lane traffic and railway
Bungul Bridge :	4 m wide for one-lane traffic

The standard designs are shown in Figs. 4.6-5 and 4.6-6 so as to conceptually understand the type of bridge structures.

4.6.2 Construction Plan

Implementation Schedule

In general, a master plan of this kind of infrastructure project requires a huge amount of money and a very long period to be implemented. Therefore, in preparing an implementation schedule of a master plan which consists of some components, consideration is given to the priority of each component; i.e., components with high priority are put into implementation in the earlier phases, prior to the others.

In this master plan, however, it may be difficult to identify the clearly divided components due to the land-use and flooding conditions in the flood-prone area and the Master Plan is to be formulated on condition that an Urgent Project be included in its early stage. A phased implementation schedule according to safety degree is, therefore, proposed on the following premises:

Phase I : A project with a scale smaller than the designed one is completed as a first step before the target year (Urgent Project).

Phase II : The Phase I project is up-graded until the target year to achieve the design scale.

Considering the flood control scales in other river basins in the Philippines, flood control works for a 25-year return period flood will be completed in the first phase as the Urgent Project, and subsequently it is upgraded to the design scale of a 100-year return period until the target year 2020. The technical and economic aspects of the Urgent Project can also be justified as discussed in detail in Section 4.8, Selection of Urgent Project. The implementation schedule is presented in Fig. 4.6-7.

Outline of Work

Major work quantities for the master plan of the Ilog-Hilabangan River Basin are as follows:

Work Item	Unit	Quantity Phase I	 Phase II
Excavation	1,000 m^3	2,831	3,870
Dredging	1,000 m^3	1,551	1,172
Embankment*	1,000 m^3	967	0
Revetment	1,000 m^3	102	51
Sluice	unit	10	0
Bridge	m^2	4,150	0

* Excavated material can be used.

Workable Days

Since construction will be much influenced by rainfall and flooding, the workable days were estimated on the basis of past rainfall records and the regulations applied in the Philippines. Except in the rainy season, the annual workable days are 110 days for embankment works and 145 days for excavation and concrete works.

Standard Construction Method

Excavation works are planned to be carried out by a combination of the following major equipment:

Bulldozer, 11 ton : 6 units
Bulldozer, 21 ton : 3 units
Backhoe, 0.66 m^3 : 6 units
Dump truck, 15 ton : 18 units

Embankment includes the works of excavation and loading in river channel, hauling to the embankment site, materials moisture content control, stripping of surface soil of dike foundation, and spreading and compacting of embankment materials. Embankment work is planned to be carried out by a combination of the following major equipment:

Bulldozer, 11 ton : 2 units
Bulldozer, 15 ton : 1 unit
Tire roller, 8 ton : 1 units
Water wagon, 2,000 ltr. : 1 unit

Dredging Works

The dredging work section is assumed from the river mouth up to 6 km on the Ilog River, considering the tidal section. The work is to be performed by a cutter suction dredger of the 800 HP class. The dredging works per group are planned to be carried out by a combination of the following major equipment.

Dredger, 800 HP : 1 unit
Tugboat, 30 PS : 1 unit
Bulldozer, 11 ton : 3 units

4.6.3 Cost Estimate

Conditions for Cost Estimate

Project cost was estimated at the price level of November 1990 and the currency conversion rates of US$1.00 = ₱28.00 = ¥130 under the following conditions.

(1) Main Construction Cost

Main construction cost consists of the cost of preparatory works and main works. The cost of preparatory works is assumed to be 15% of the cost of main works. The cost of main works is estimated by multiplying the unit cost with the corresponding work quantity.

The unit cost of each work item consists of direct cost and indirect cost. The direct cost in unit cost consists of the cost of construction materials, labor and equipment.

(2) Engineering Services and Administration Cost

Engineering services herein estimated is to cover the detailed design and construction supervision. The total engineering cost is 16% of the main construction works.

The engineering cost is allocated at 6% for the detailed design and 10% for construction supervision. (These rates are the maximum percentage of the NEDA's guideline.) The administration cost for the government is computed at 5% of the main construction cost.

(3) Project Contingency

Project contingency consists of physical contingency and price escalation contingency. Physical contingency is estimated at 10%, however, the price escalation is not considered here because the study stage is in the master plan.

(4) Compensation Cost

Land acquisition and house evacuation costs are estimated on the basis of the prevailing cost for land, buildings and other private properties, as follows:

(a) Land Acquisition

- Residential Area	:	3,800,000	pesos/ha
- Sugarcane Field	:	110,000	pesos/ha
- Fishpond	:	230,000	pesos/ha

(b) House Evacuation

- Building	:	40,000	pesos/unit

Unit Cost

The unit cost of each work item for river improvement is estimated as presented in Table 4.6-1, according to the foregoing criteria, standard design of riparian structures and preliminary construction plan. Labor wages and unit prices of major construction materials adopted here are as shown in Tables 4.6-2 and 4.6-3, respectively.

Project Cost

The total project cost for the master plan is estimated at 1,253 million pesos with the following components. The breakdown is in Table 4.6-4.

Item	Cost (in million-P)
1. Construction	893
2. Administration	45
3. Engineering Services	143
4. Physical Contingency	108
5. Compensation	64
Total	1,253

Operation and Maintenance Cost

Operation and maintenance cost is required annually after completion of the project in order to keep the full designed function. This cost is estimated at 4.6 million pesos, assuming the required volume for each work as presented in Table 4.6-5.

Replacement

Some of the facilities, especially mechanical equipment, have shorter useful lives than the civil works and require replacement within a certain period. Water gates are applicable for this item, however, their useful life is considered to be 30-year which accords to the project service life. Therefore, the replacement cost of water gates is not counted here

4.7 Project Evaluation

The Master Plan was formulated to protect the flood prone area from a 100-year return period flood at the maximum, and its economic viability was assessed on the basis of annual average benefit and economic project cost. Basic conditions for project evaluation are summarized below.

(1) Annual average benefit or potential flood damage is calculated by the mesh unit (500 m x 500 m) in accordance with the flood inundation analysis.

(2) Target completion year is fixed at the year 2020, and project life is assumed to be until 2050, considering the durable life of facilities to be installed.

(3) Project benefit is estimated on the development stage in the target completion year of 2020.

(4) Price level for all the monetary calculations is November 1990, and the conversion rates of currencies are US$1.00 = ¥130 = ₱28.00 (₱1.00 = ¥4.64).

4.7.1 Annual Average Benefit

Flood control benefit is defined as the reduction of potential flood damage attributed to the design works. The reduction is obtained as the difference between the estimated flood damages under the the with- and the without-the-project situations.

Methodology and Calculation Conditions

(1) Mesh Data in the Flood Prone Area

The flood prone area or the beneficial area is limited to the lowest reaches of about 125 km^2, which is divided into 500 meshes. The land use and assets in each mesh were identified by examining the topographic map with a scale of 1:5,000 prepared by JICA in 1990. The detailed mesh data are presented in Table 4.7-1.

(2) Classification of Flood Damage

Flood damage in general consists mainly of tangible and intangible damages, and the tangible damage is further classified into direct and indirect damage. Direct damages are defined as the monetary losses. Indirect damages include the net monetary cost of lost wages, lost production, and lost sales. Intangible flood damages are defined as flood effects which cannot be measured in monetary terms.

In the study area, the direct damage is to be inflicted on the agricultural crops of sugarcane and paddy, aquaculture crops of prawns and milkfish, residential houses and non-residential buildings together with their indoor movables, and infrastructure facilities such as roads and railways. Flood damage on other agricultural crops is not considered because it is negligibly small judging from their occupied areas and low productivity.

(3) Value of Properties Vulnerable to Flood Damage

All the properties in the flood prone area may be vulnerable to flood damage. Their economic value to be assigned for the monetary computation, referred to as "damageable value", is as described below.

(a) Agriculture and Aquaculture

The degree of damage on crops varies from month to month, depending on the cropping pattern and when flooding occurs. Therefore, the annual average damageable value of crops per hectare should be taken, and this is estimated as an aggregate of the expected net income and accumulated expenditure for the production spent until the time when flood takes place, where flood frequency and cultivated area in each month have to be taken into account.

The damageable values per hectare were thus estimated at 9,900 pesos for paddy, 28,600 pesos for sugarcane, and 32,500 pesos for aquacultural crops. Details of calculation process are set forth in Tables 4.7-2 to 4.7-4. Economic farm gate prices, as presented in Tables 4.7-5 and 4.7-6, were applied for the calculation of net income from paddy and sugarcane production.

(b) House and Building

The damageable value of house/building was estimated as the average value per unit; that is, 81,200 pesos for a residential house and 262,500 pesos for a non-residential building. This was calculated from the construction cost of a new house/building, floor area, distribution ratio and average depreciation ratio.

The indoor movables or household effects are assumed to have a half value of their immovables; namely, 40,600 pesos for a residential house and 131,300 pesos for a non-residential building.

(c) Infrastructure

The unit damage value of infrastructures such as roads and railways was obtained in the same concept as the house and building, as tabulated below:

National Road : 1,250 pesos/m
Provincial Road : 600 pesos/m
Barangay Road : 300 pesos/m
Railway : 500 pesos/m
Irrigation Channel : 100 pesos/m

(4) Damage Rate and Inundation Depth

The damage rates for each item vulnerable to flood damage have been determined in accordance with inundation depth, on the basis of interview at the site, flood damage records in the past, and the technical standard for river and sabo works, Ministry of Construction, Japan. These rates are presented in Table 4.7-7.

Inundation depth was calculated by the mesh unit for the floods of 2-, 5-, 10-, 25-, 50- and 100-year return periods as discussed in Subsection 3.2.2. (Refer to Fig. 3.2-4.)

(5) Flood Damage in the Future (Target Completion Year)

Direct flood damage was calculated in the concept of [Direct Damage] = [Unit Value] x [Quantity] x [Damage Rate], which was applied for each mesh in six (6) cases of flooding conditions; 2-, 5-, 10-, 25-, 50- and 100-year return periods.

Indirect damage is considered to be the loss of productivity of the affected people, which was calculated as: [Number of Affected People] x [Per Capita GDP] x [Affected Period]. (Affected period is assumed to be one week for all the flooding conditions.)

The present land use in the flood-prone area stands on the almost fully developed stage, so that no drastic change would be expected in the future. The most reliable data to estimate the future flood damage is the population, which reflects on direct damage on the house/building and also indirect damage estimated on the number of affected people.

The future population in the river basin is projected, as discussed in Subsection 2.8.2, to be about 519.1 thousand in 2020, the target completion year of the Master Plan, which is about 1.497 times as much as the present population. Based on this figure and the estimated flood damage at the current development level, the flood damages in 2020 were estimated as follows, and the details are presented in Table 4.7-8.

Estimate of Annual Average Benefit

Flood control benefit is defined as the damage reduction by the designed works, and its annual average has to be obtained to identify the economic viability, which is discussed in the following subsection. In calculating the annual average benefit, reference should be made to probability or frequency of flooding in such cases as mentioned above. Based on the estimated flood damages in 2020 for each probable discharge, the annual average benefit was calculated using the following formula:

$$B = \sum_{i=1}^{n} \frac{1}{2} \cdot [D(Q_{i-1}) + D(Q_i)] \cdot [P(Q_{i-1}) - P(Q_i)]$$

where;

B : annual average benefit

$D(Q_i\text{-}1), D(Q_i)$: flood damage caused by floods with Q_i-1 and Q_i discharges, respectively.

$P(Q_i\text{-}1), P(Q_i)$: probabilities of occurrence of Q_i-1 and Q_i discharges, respectively.

n : number of floods applied

The annual average benefit of the Master Plan is thus estimated at 126.6 million pesos. The calculation process is presented in Table 4.7-9.

4.7.2 Economic Evaluation

The Master Plan has been evaluated from the economic viewpoint by figuring out the economic viability in terms of internal rate of return (IRR), benefit-cost ratio (B/C) and net present value (NPV), comparing the economic project cost and annual average benefit which may accrue in accordance with the expected cost-benefit flow in the project life.

Economic Project Cost

Economic costs of the project are nominal figures that duly reflect the true economic value of goods and services involved. These costs were used only for the economic evaluation of the project.

Transfer items such as taxes and duties imposed on construction materials and equipment, including government subsidy and contractor profit, were excluded from the elements of financial cost. It is assumed that about 20% of the financial construction cost is involved as the transfer items. The economic construction cost is thus estimated at 714.2 million pesos.

The estimated administration and engineering service costs are applied as the economic cost. Land will be acquired for project implementation, and its economic value is considered to correspond to the productivity foregone by the project, which is reflected by the estimated compensation cost. Price contingency, though physical contingency is included, is not considered in the economic cost. The economic project cost thus estimated amounts to 1,056 million pesos.

Annual Cost-Benefit Flow

To calculate IRR, B/C and NPV of the Master Plan, the annual cost-benefit flow was prepared basically in accordance with the implementation schedule or annual disbursement schedule, as shown in Table 4.7-10.

The benefit is assumed to accrue during the construction period because some of the completed works may bring about flood control effect to a certain degree, and to increase gradually until the target year of 2020 and keep the same level until the end of project life. The estimated operation and maintenance cost is needed annually after project completion to keep duly the designed function.

Economic Viability of the Master Plan

The economic viability of the Master Plan was assessed by means of IRR, B/C and NPV as mentioned above, which were calculated on the annual cost-benefit flow. A discount rate of 10% was applied for the calculation of B/C and NPV. The economic viability was figured out as follows:

IRR : 12.6%
B/C : 1.266
NPV : 68.55 million pesos

Sensitivity Analysis

Sensitivity analysis of the above-said economic viability was carried out on several cases of changes in both the project benefit and economic construction cost as summarized below.

Case	IRR (%)	B/C	NPV (mil. P)
1. Project benefit 10% down	11.4	1.139	35.90
2. Project benefit 20% down	10.1	1.013	3.25
3. Construction cost 10% up	11.6	1.161	45.20
4. Construction cost 20% up	10.7	1.072	21.85

4.7.3 Project Justification

The IRR is the most reliable tool to economically justify a project and the borderlinein this kind of infrastructure project is generally around 10%. The economic viability analysis for the Master Plan shows an internal rate of return of 12.6%, and in any case of the sensitivity analysis, it is over 10% as presented above. The Master Plan is, therefore, evaluated to have an adequate economic viability.

Further, consideration is given to intangible benefits brought about by the project such as saving of invaluable human life that may possibly be lost by flooding, protection from possible injuries, and prevention of disease occurrence.

The number of people affected by a 100-year return period flood is estimated at as much as 70,000 in the year 2020, and all of them will be released from the menace of flooding by implementing the Master Plan. The Master Plan should then be put into implementation in the near future, considering the progress of development in the river basin.

4.8 Selection of Urgent Project

The urgent project is selected within the framework of the Master Plan by narrowing down the area to be protected and/or lowering the project scale. In this connection, the following considerations were made to select the urgent project.

4.8.1 Area to be Protected

The Master Plan was formulated to protect the whole inundation area in the lower reaches by applying the river channel improvement. To narrow down the area to be protected by the urgent project, prioritization of the area may be considered and partial river improvement can be adopted to protect the area based on the priority. In this river basin, however, it is not so useful to identify the priority area in view of the following reasons:

(1) In this basin, land use for sugarcane is dominant, though some small urban areas exist. Under this land use condition, prioritization cannot be given.

(2) Judging from the inundation condition, partial river improvement is not effective because the overflow discharge widely spreads and sometimes flows down even in the area which is to be protected by partial river improvement.

Consequently, it is not realistic to select the urgent project by narrowing down the area to be protected.

4.8.2 Project Scale

A 100-year return period is adopted as the project scale of the Master Plan, of which implementation schedule is composed of two phases; namely, flood control works with a smaller scale are completed as the Urgent Project, and subsequently upgraded to the design scale in the second phase until the target year 2020. For the Urgent Project, a 25-year return period is adopted to narrow down the project scale, judging from the social requiremnt together with economic justification as discussed below.

Social Requirement

From the social aspect, reference was made to the relation between project scale and target year adopted to the other river basins (refer to Fig. 4.2-1). A 30-year return period was applied to the priority project in the Pasig River Basin, a 25-year return period in the Cagayan River, and a 20-year return period in the Pampanga River, though some other rivers employ a 10-year return period depending on project necessity. The target completion years set for these projects range from 10 to 30 years after the planning time.

The project scale of a 25-year return period and the completion year may be suitable for the urgent flood control project in the Ilog-Hilabangan River Basin, though it is necessary to confirm the economic viability in the feasibility study stage.

Economic Aspect

The internal rate of return (IRR) of the Urgent Project was calculated to confirm the economic viability, and the IRRs of other alternative cases were also obtained as discussed in Supporting Report IX, Economic Evaluation.

The economic viability of the Urgent Project is figured at as high as 15.2% in IRR, and accordingly, the B/C exceeds 1.0 even at the discount rate of 15%. The Urgent Plan is thus acceptable enough from the economic viewpoint, although it is necessary to confirm its viability in the feasibility study stage.

4.8.3 Outline of Urgent Project

The urgent project will be formulated on the following considerations:

(1) As the flood control measure, river channel improvement is proposed for the river stretch described in the Master Plan.

(2) The project scale of a 25-year return period is applied.

CHAPTER 5. RECOMMENDATION

1. Early Conduct of a Feasibility Study

Under the present situation in the study area, the Study has to be terminated after the completion of the Master Plan Study Stage. The Master Plan shows a relatively high economic viabiliy of 12.6 % in the economic internal rate of return (EIRR). It is, therefore, recommended to conduct a feasibility study as soon as possible for the implementation of the project.

2. Considerations for the Feasbility Study

The following considerations should be taken into account in the feasibility study stage:

(a) Typhoon Ruping hit the study area on November 13, 1990 and caused a tremendous flood damage. In this regard, the data on flooding condition and flood damage by this typhoon have been collected. (These data are compiled in Volume III, Data Book of the Master Plan Report.)

(b) It is necessary to examine the river channel improvement paln through the field investigation, focusing on land acquisition and house evacuation which may cause a social problem.

3. Consideration in Case of Implementing River Improvement Works without the Feasibility Study

In case that river improvement works are to be partially carried out without implementing a feasbility study, reference should be made to the components of the proposed Master Plan in order to avoid double investment when the project is implemented.

4. Continuation of Hydrological Observation in the Study Area

Several hydrological gauging stations have been installed in the study area by this Study. Since the hydrological data will be useful for conducting the feasibility study, it is desirable that data collection by these hydrological gauging stations shall be continued.

TABLES

Table 1.5-1 MEMBERS OF JICA STUDY TEAM

No.	Name	Designation/Assignment
1	Katsuhisa Abe	Team Leader
2	Yoshiharu Matsumoto	Assistant Team Leader/Flood Control Planner
3	Keiji Sasabe	Hydrologist/Hydraulics and Runoff Analyst
4	Yoichiro Kuroda	Water Resources Potential Analyst
5	Makoto Okada	Geologist/Soil Mechanics Engineer
6	Hiroshi Shimizu	River Planner
7	Noboru Yamaguchi	Dam and Reservoir Planner
8	Takahiro Mishina	Structural Design Engineer
9	Seiichi Yamakawa	Construction Planner/Cost Estimator
10	Kimio Shimomura	Project Economist/Flood Damage Analyst
11	Daikichi Nakajima	Survey Expert (Aerial Photography/Field Verification)
12	Tetsuya Otsuki	Survey Expert (GPS Survey)
13	Masashi Narumi	Survey Expert (GPS Survey and Leveling Survey)
14	Fujio Ito	Survey Expert (GPS Survey and Leveling Survey)
15	Kuniaki Takamatsu	Survey Expert (River Survey)

Table 1.5-2 MEMBERS OF TECHNICAL ADVISORY COMMITTEE

No.	Name	Designation/Assignment	Office
1	Shigehiro Furui	Chairman	Ministry of Construction
2	Takashi Shinoda	Flood Control Planning	- do -
3	Akira Yamamoto	Hydrology, Hydraulics	- do -
4	Mitsuaki Furukawa	Coordinator	JICA

Table 2.2-1(1/2) LIST OF METEOROLOGICAL AND RAINFALL STATIONS

(1) Stations under PAGASA

Code	Station Name	Coordinates Longitude(E)	 Latitude(N)	Type	Remarks
056	La Granja, La Carlota, Negros Occ.	122-56'	10-24'	AG	Data are the same with those at 0613
0607	Barotac Viejo, Iloilo	122-57'	11-03'	OR	
0611	Sagay, Negros Occ.	123-30'	10-56'	OR	Contains many unreliable data
0612	Kabankalan, Negros Occ.	122-49'	09-59'	OR	
0613	La Granja Exp. Stn La, Negros Occ.	122-59'	10-25'	CR	
0614	Pulupandan, Negros Occ.	122-48'	10-31'	VSS	Contains many unreliable data especially after 1980
0615	San Carlos City, Negros Occ.	123-25'	10-29'	OR	
0616	Silay Hawaiian Central, Negros Occ.	122-58'	10-48'	CC	
0617	Sipalay, Negros Occ.	122-24'	09-45'	OR	
0618	Victorias, Negros Occ.	123-05'	10-55'	CC	
0719	Guihulngan, Negros Oriental	123-16'	10-07'	OR	Contains many unreliable data
0720	Nonas, Bayawan, Negros Oriental	122-48'	09-22'	OR	
0721	Siaton, Negros Oriental	123-02'	09-04'	OR	Contains many unreliable data especially after 1984
637	Iloilo City, Iloilo	122-34'	10-42'	SY	

Note SY : Synoptic Station
AG : Agromet Station
OR : Official Rainfall Station
CR : Cooperative Rainfall Station
CC : Cooperative Climate Station
VSS : Visual Storm Signal

Table 2.2-1(2/2) LIST OF METEOROLOGICAL AND RAINFALL STATIONS

(2) Automatic Rainfall Gauging Stations installed by the Study Team

No.	Name	Coordinates		Approx. Elevation	
		Longitude(E)	Latitude(N)	(EL m)	Location
1.	Caningay	122-40'36"	09-50'26"	160	in Bgy. farmland of Bgy. Caningay, Negros Occidental
2.	Magballo	122-44'04"	09-46'05"	140	In the Bgy. plaza of Bgy. Magballo, Negros Occidental
3.	Bugay	122-47'48"	09-40'49"	200	in private farm in Bgy. Bugay (outside the Bgy. proper), Negros Oriental
4.	Tara	122-52'51"	09-39'53"	210	in the elementary school compound in Bgy. Tara, Negros Oriental
5.	Mabinay	122-56'00"	09-43'30"	80	behind Dept. of Agriculture Office in Municipality of Mabinay (inside town proper), Negros Oriental
6.	Tibyawan	123-05'08"	09-53'49"	420	in farmland of Vice-Mayor of Municipality of Ayungon, Negros Oriental
7.	Carol-an	122-57'42"	09-51'53"	490	in Bgy. proper of Bgy. Carol-an, Negros Occidental
8.	NOAC	122-53'10"	09-50'57"	100	in the compound of Negros Occidental Agricultural School (NOAC) in Bgy. Camingawan, Negros Occidental
9.	Kabankalan	122-48'24"	10-00'00"	5	in the house lot of Vice-Mayor of Kabankalan, Negros Occidental

Table 2.2-2 LIST OF STREAMWATER GAUGING STATIONS

(1) Stations under NWRB

No.	River	Station Name	Coordinates		Catchment Area (km2)	Observation Period
			Long.(E)	Lat.(N)		
I-1	Ilog	Camugao	122-48'30"	9-59'15"	1,959	1964 - 1979
I-2	Ilog	San Juan	122-48'15"	9-58'00"	1,947	1964 - 1979
I-3	Ilog	Pandan, Orong	122-50'20"	9-55'30"	1,453	1956 - 1979
I-4	Ilog	Dahile	122-50'40"	9-53'20"	1,390	1962 - 1978
I-5	Ilog	Inapoy	122-52'20"	9-49'42"	1,245	1965 - 1979
H-1	Hilabangan	Pangsud	122-50'10"	9-58'06"	431	1955 - 1979
H-2	Hilabangan	Tagbac	122-56'12"	9-56'58"	392	1962 - 1979

(2) Automatic Water Level Gauging and Discharge Measurement Stations Installed by the Team

No.	River	Station Name	Coordinates		Catchment Area (km2)	Location
			Long.(E)	Lat.(N)		
1.	Ilog	Orong	122-49'50"	9-55'42"	1,432.2	3.9km upstream from junction with Hilabangan River in Bgy. Orong
2.	Hilabangan	Overflow	122-50'07"	9-58'09"	444.6	4.6km upstream from junction with Ilog River in Bgy. Overflow
3.	Ilog	Talubangi Brdg.	122-47'58"	10-00'36"	1,981.0	just downstream of Talubangi Bridge on Ilog River in Bgy. Talubangi

Note : Observation started in May 1990.

(3) Water Level Staff Gauging Stations Installed by the Team

No.	River	Station Name	Coordinates		Location
			Long.(E)	Lat.(N)	
1.	Ilog	Malabon Div. Channel	122-47'03"	10-01'29"	Pier of Malaban Bridge
2.	Ilog	Cutoff Channel	122-46'11"	10-01'05"	At the bridge
3.	Ilog	Old Ilog No.1	122-46'08"	10-01'32"	Pier of the Session Hall of Ilog Municipality
4.	Ilog	Old Ilog No.2	122-45'46"	10-01'35"	Pier of the bridge
5.	Binicuil	Binicuil	122-49'48"	10-01'35"	Pier of the bridge

Note : Observation started in May 1990.

Table 2.2-3 MONTHLY VARIATIONS OF METEOROLOGICAL DATA AT ILOILO CITY

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
1. Temperature (degree centigrade)													
Ave. Daily Max.	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 Min.	22.5	22.5	23.2	24.4	25.3	24.4	24.2	24.4	24.2	24.0	23.8	23.4	23.9
Daily Average	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
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													
Occurrence (%)	0	0	14	4	7	4	0	0	4	7	32	29	100

Tablle 2.2-4 SUMMARY OF TROPICAL CYCLONES WHICH PASSED THROUGH NEGROS ISLAND (1948-88)

No.	Year	Class	Name	Date	Max. Winds Observed			Min. SLP Observed			Max. 24 hrs. Rainfall		
					m/s	Place	Date	mmbar	Place	Date	mm	Place	Date
1	1949	T.S.	NONE	NOV. 04-08	10.8	LAHUG	0	996.0	OVERWATER	0	142.2	SURIGAO	0
2	1949	T.Y.	NONE	OCT.31-NOV.3	44.4	LAHUG	1	1006.6	OVERWATER	0	213.6	SURIGAO	0
3	1949	T.S.	RENA	NOV. 10-13	28.9	APARRI	11	1002.7	MANILA	12	241.3	DALA.CEBU	11
4	1950	T.Y.	DINAH	OCT. 18-20	0.0	NONE	0	0.0	NONE	0	0.0	NONE	0
5	1950	T.Y.	DELILAH	NOV. 18-22	33.6	SURIGAO	20	1000.2	OVERWATER	0	355.1	DALA.CEBU	0
6	1951	T.Y.	AMY	DEC. 05-16	44.7	CEBU	9	978.0	CEBU	9	518.0	CEBU	9
7	1954	T.Y.	RUBY	NOV. 05-09	42.2	CASIGURAN	8	0.0	NONE	0	368.0	ILAGAN	8
8	1954	T.S.	NONE	DEC. 23-27	23.3	HINATUAN	24	986.0	OVERWATER	0	215.0	BAGONEG.OC	24
9	1954	T.Y.	NONE	MAR. 01-04	10.4	HINATUAN	3	1007.0	BASCO	4	177.0	MAM.CAM.IS	3
10	1954	T.Y.	ELSIE	MAY. 05-09	31.1	SURIGAO	7	1002.6	OVERWATER	0	356.0	DALA. CEBU	6
11	1954	T.Y.	TILDA	NOV. 27-30	26.9	ILOILOCUYO	29	998.2	OVERWATER	0	170.0	CEBU	29
12	1958	T.D.	NONE	NOV. 24-25	17.8	ILOILO	24	1004.3	BORONGAN	24	133.1	CATARMAN	24
13	1960	T.Y.	KAREN	APR. 20-26	18.1	SURIGAO	21	1001.9	SURIGAO	21	173.0	SURIGAO	21
14	1967	T.Y.	BEBENG	MAR. 02-05	33.3	SURIGAO	3	1000.6	SURIGAO	3	94.0	BASCO	5
15	1970	T.D.	ANING	NOV. 24-25	9.2	BORONGAN	24	1007.2	SURIGAO	26	71.4	VIRAC	24
16	1971	T.Y.	GOYING	OCT. 19-22	27.8	CEBU	20	990.8	SURIGAO	20	85.5	CEBU	21
17	1971	T.D.	HOBING	NOV. 02-05	12.5	SAURIGAO	4	1005.4	SURIGAO	4	54.5	CAG.DE ORO	6
18	1972	T.Y.	UNDANG	DEC. 01-08	30.6	CUYO	4	997.3	HINATUAN	3	199.5	CUYO	10
19	1974	T.D.	KADING	DEC. 14-17	13.9	BALER	15	1003.3	MASBATE	16	162.5	BALER	15
20	1975	T.Y.	AURING	MAR. 22-25	30.6	MACTAN	24	984.9	SURIGAO	24	102.2	BALER	25
21	1976	T.D.	KAYANG	DEC. 29-30	13.1	CUYO	30	1005.4	DAVAO	30	150.5	DAVAO	29
22	1977	T.Y.	KURING	JUN. 13-14	41.7	OVERWATER	0	976.0	OVERWATER	0	44.0	SCI GARDEN	16
23	1978	T.D.	GARDING	DEC. 13-16	26.4	VIRAC/RADA	0	1001.6	CAG.DE SUL	0	1469.0	VIRAC	13
24	1979	T.Y.	BARANG	DEC. 09-13	41.7	RECON	11	1007.9	CATBALOGAN	11	22.0	INFANTA	10
25	1979	T.S.	KARING	MAY 10-16	18.1	S.FRANCIS	16	1005.5	TAGBILARAN	0	128.5	CASIGURAN	13
26	1982	T.Y.	BISING	MAR. 23-29	45.0	MAASIN	26	991.9	MAASIN	26	157.2	MAASIN	26
27	1983	T.D.	DADANG	DEC. 18-19	18.1	JFJB	18	1005.0	EREI	19	69.1	HIMATUAN	19
28	1984	T.Y.	NITANG	AUG.31-SEP.4	60.0	SURIGAO	1	993.6	ILOILO	2	221.6	CUYO	2

Source : Climatological Normal & Extremes of Tropical Cyclones in the Philippines, May 1989, PAGASA

TABLE 2.2-5 MONTHLY NUMBER OF TROPICAL CYCLONES WHICH PASSED THROUGH NEGROS ISLAND (1948-88)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
1949											3		3
1950										1	1		2
1951												1	1
1952													0
1953													0
1954			1		1						2	1	5
1955													0
1956													0
1957													0
1958											1		1
1959													0
1960				1									1
1961													0
1962													0
1963													0
1964													0
1965													0
1966													0
1967			1										1
1968													0
1969													0
1970											1		1
1971										1	1		2
1972												1	1
1973													0
1974												1	1
1975			1										1
1976												1	1
1977						1							1
1978												1	1
1979					1							1	2
1980													0
1981													0
1982			1										1
1983												1	1
1984									1				1
Total	0	0	4	1	2	1	0	0	1	2	9	8	28
Ave.	0.00	0.00	0.11	0.03	0.06	0.03	0.00	0.00	0.03	0.06	0.25	0.22	0.78
(%)	0	0	14	4	7	4	0	0	4	7	32	29	100
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year

Source : Climatological Normal & Extremes of Tropical Cyclones
in the Philippines, May 1989, PAGASA

Table 2.2-6 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	683	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	835	1,312	1,604	2,227	**	**	1,833
1988	1,293	4,729	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. 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 2.2-7 MONTHLY AVERAGE RAINFALL BY STATION

Unit : mm

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	432	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, Negros Occ.
0720 : Nonas, Bayawan, Negros Oriental
0721 : Siaton, Negros Oriental
637- : Iloilo City, Iloilo

Table 2.2-8 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	452	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 up to totals due to rounding.

Table 2.2-9 MONTHLY AVERAGE DISCHARGE OF THE ILOG RIVER AT PANDAN, ORONG (C.A.=1,453km2)

Unit: m3/s

	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	5.9	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	54.2	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	85.3	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

Table 2.2-10 MONTHLY AVERAGE DISCHARGE OF THE HILABANGAN RIVER AT PANGSUD (C.A.=431km2)

Unit: m3/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	10.1	27.1	22.2	12.9	19.5	9.8	6.3	11.3
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	15.1	9.1	8.1	7.9	9.0	17.7	29.3	27.6	20.6	23.5	38.5	23.2	19.2
Runoff Height (mm)	94	51	51	47	56	107	182	171	124	146	232	144	1,404

Table 2.5-1 RESULT OF INTERVIEW SURVEY ON FLOODING CONDITIONS

No.	Place of Interview	Frequency of Flood	Cause of Flood	Inundation Condition				Property Damaged	Damage to Sugarcane	Source of Flood Information	Place of Evacuation
				Period	Depth (m)	Source of Flood	Velocity				
1	Poblacion Ilog	yearly	typhoon rainfall	7 days	2.5	mountain	high	houses, agric., animals	flooded	ocular	
2	Da-anbanwa, Kabankalan	once in 5 years	rainfall	24 hours	2.0	mountain	high	houses, agric., animals	fallen by flood	people in Barangay	
3	Brgy. Dancalan, Ilog	yearly	typhoon	36 hours	2.0	creek/ river	high	houses, agric., animals, roads	fallen by flood	radio	higher places
4	Brgy. Bista Alegre	yearly	rainfall	5 days	2.5	mountain	high	houses, agric., animals	spoiled roots	radio	school building
5	Brgy. Maralod, Ilog	once in a few years	typhoon	3 days	2.0	river	high	houses, agric., machinery		radio	
6	Brgy. Talubangi, Kabankalan	yearly	typhoon rainfall	7 days	2.5	mountain	high	houses, agric., animals	flooded	ocular	higher places
7	Brgy. Talubangi	once in 10 years	typhoon	2 days	1.0	river	high	houses, agric., animals		radio	school
8	Brgy. Binicuil, Kabankalan	once in 10 years	typhoon	48 hours	0.5	creek/ river	low	houses, agric.,			
9	Brgy. Salong Kabankalan	6 times in a year	typhoon	7 days	1.0	mountain	high	agric.	fallen by flood	Barangay officers	school building
10	Brgy. Linao	once in 10 years	typhoon rainfall	3 hours	2.0	river	high	houses, agric., animals	spoiled roots	radio	buildings
11	Poblacion Kabankalan	once in 10 years	typhoon	2 days	1.0	river	high	houses, agric., animals	fallen & spoiled roots	radio	school buildings
12	Sitio Panique, Brgy. Hilamonan, Kabankalan	once in a few years	typhoon	24 hours	4.5	river	high	houses, agric., animals	fallen by flood	radio	school building
13	Brgy. San Juan	once in 5 years	typhoon	3 days	2.0	river	high	houses, agric., animals, roads	spoiled roots	radio	factory
14	Hacienda San Lucas	yearly	typhoon	29 hours	1.0	river	high	houses, agric., animals, roads, machinery	fallen by flood	radio	higher places
15	Sitio Overflow, Brgy. Lupui, Kabankalan	yearly	typhoon rainfall	7 days	2.5	mountain	high	houses, agric., animals	fallen by flood	ocular	school building
16	Brgy. Overflow	yearly	typhoon	24 hours	2.0	river	high	houses, agric., animals		radio	higher places
17	Hacienda Calasa	once in a few years	typhoon	10 hours	2.5	river	high	houses, agric., animals, machinery	fallen by flood	radio	hill
18	Brgy. Orong Kabankalan	yearly	typhoon rainfall	2 days	3.0	creek/ river	high	agric.	fallen by flood	radio	higher places

Note : Locations of interview points are presented in Fig. 2.5-2.

Table 2.5-2 SUMMARY OF DAMAGE BY TYPHOON NITANG IN NEGROS OCCIDENTAL PROVINCE

Damage Item	Quantity	Damage (million Pesos)
1. Deaths	140 persons	--
2. Injuries	4 persons	--
3. Housing Damage		
3.1 Houses damaged	9,001 units	9.0
3.2 Families affected	37,058 families	--
3.3 Persons affected	227,408 persons	--
4. Damage on Production		530.8
4.1 Agricultural crops	69,843 ha.	416.9
- Rice	44,817 ha.	211.2
- Corn	6,980 ha.	21.4
- Veg./root crops	1,181 ha.	22.0
- Banana	2,923 ha.	11.7
- Fruit trees	10,942 ha.	64.3
- Sugarcane	3,000 ha.	50.4 *
- Copra	6,938 M.T.	36.0
4.2 Fishery	5,044 ha.	109.0
4.3 Livestock and Poultry	42,410 heads	4.6
4.4 Forest	30,635 trees	0.3
5. Damage on Infrastructure		71.2
5.1 Power supply system		25.0
5.2 Road system		25.5
- National roads	294 km	8.1
- Barangay roads	105 sections	5.9
- Provincial roads	100 sections	11.5
5.3 Portworks	6 ports	2.2
5.4 School buildings	758 units	12.7
5.5 Irrigation canals, etc.		1.0
5.6 Other public facilities		4.8
6. Relief and Rehabilitation		4.6
Total		615.6

Source : NEDA, Region Office VI
Note * : Estimate.
Price level = Year 1984

Table 2.6-1 PRODUCTION AND CONSUMPTION BALANCE OF RICE IN NEGROS ISLAND BY YEAR

Item	Unit	1986	2000	2020
Paddy Area Utilized	x1000 ha	108.1 *	108.1	108.1
Production per One Hectare	ton	2.54	2.60	2.65
Total Production (1)	ton	274,700 *	281,060	286,470
Population	x1000 persons	3,138.3	4,067.0	5,075.0
Per Capita Consumption	kg	100	95	90
Total Consumption of Rice	ton	313,800	386,370	456,759
Total Consumption of Paddy (2)	ton	523,000	643,940	761,260
Balance [(1)-(2)]	ton	- 248,000	- 363,000	- 474,790
Self Sufficiency Rate	%	53	44	38

Note * : Actual Average Amount in 1984 to 1986
(Provincial Profile, March 1988, DA)

Table 2.6-2 PRESENT AND PROJECTED POPULATION IN ILOG-HILABANGAN RIVER BASIN

Unit : 1000 persons

Year	Lower Basin			Upper Basin			Whole Basin		
	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural
1990	152.4	30.8	121.6	194.3	39.2	155.1	346.7	70.0	276.7
2000	183.0	46.7	136.3	233.8	59.7	174.1	416.8	106.4	310.4
2020	227.9	63.6	164.3	291.2	81.4	209.8	519.1	145.0	374.1

Table 2.6-3 PRESENT LAND USE

Unit : km2

Land Use	Lower Basin	Upper Basin	Total
Mangrove	2.0	0.0	2.0
Fishpond	24.0	0.0	24.0
Lowland Paddy	17.0	21.0	38.0
Upland Paddy	10.0	90.0	100.0
Sugarcane	70.0	299.0	369.0
Upland Crop	15.0	530.0	545.0
Coconut	1.0	19.0	20.0
Grassland	20.0	517.0	537.0
Forest/Shrubs	33.0	415.0	448.0
Residential	5.0	30.0	35.0
River Reservation	6.0	38.0	44.0
Total	203.0	1,959.0	2,162.0

Source : BSWM, Calculated by JICA Study Team

Table 2.6-4 WATER QUALITY OF ILOG RIVER

Item of Analysis	Station 1	Station 2
Temperature (Centigrade)	29.2	29.4
PH	7.6	7.9
Order, Threshold Odor-Number	1.0	1.0
Color, Color Units	-	-
Turbidity Silica Scale	-	-
Alkalinity, in mg/l	143.0	132.8
Dissolved Oxygen, mg/l	5.8	6.0
B.O.D. (5 days), mg/l	21.9	8.9
Chlorides, mg/l	78.6	9.8
Sulfates, mg/l	12.8	13.7
Total Solids, mg/l	900.0	780.0
Suspended Solids, mg/l	-	-
Phosphates, mg/l	0.50	0.35
Total Hardness, mg/l	168.2	131.3
Coliform, MPN/ 100 ml x 10^5	44.8	34.0

Note : - Smpling Period : 1974 to 1975
- Sampling Sites : Ilog
Station 1 : Ilog Poblacion (9.0 km)
Station 2 : Bgy. Talubangi, Kabankalan (15.5 km)

Table 2.6-5 DIVERSION WATER REQUIREMENT

Unit : mm

Month/ Decade		Rainfall		Paddy				Sugarcane			
		*1	Re *2	C.W.R. *3	F.W.R. *4	D.R. *5	M.R. *6	C.W.R. *3	F.W.R. *4	D.R. *5	M.R. *6
	1	6	5	80	75	125		25	20	33	
Jan.	2	-	-	80	80	133	405	25	25	42	120
	3	1	-	88	88	147	(4.05)	27	27	45	(1.20)
	1	-	-	80	80	133		45	45	75	
Feb.	2	6	5	80	75	125	365	45	40	67	202
	3	-	-	64	64	107	(3.65)	36	36	60	(2.02)
	1	1	-	16	16	27		64	64	107	
Mar.	2	-	-	-	-	-	27	64	64	107	331
	3	1	-	-	-	-	(0.27)	70	70	117	(3.31)
	1	-	-	-	-	-		68	68	113	
Apr.	2	-	-	-	-	-	-	68	68	113	341
	3	3	-	-	-	-	(-)	69	69	115	(3.41)
	1	6	5	-	-	-		50	45	75	
May	2	16	13	36	23	38	95	50	37	62	185
	3	33	26	60	34	57	(0.95)	55	29	48	(1.85)
	1	29	23	60	37	62		33	10	17	
Jun.	2	40	32	42	10	17	102	33	1	2	19
	3	50	40	54	14	23	(1.02)	33	-	-	(0.19)
	1	57	46	60	14	23		26	-	-	
Jul.	2	29	23	60	37	62	127	26	3	5	5
	3	51	41	66	25	42	(1.27)	29	-	-	(0.05)
	1	44	35	60	25	42		27	-	-	
Aug.	2	30	24	60	36	60	165	27	3	5	7
	3	35	28	66	38	63	(1.65)	29	1	2	(0.07)
	1	37	30	60	30	50		28	-	-	
Sep.	2	8	6	60	54	90	187	28	22	37	37
	3	40	32	60	28	47	(1.87)	28	-	-	(0.37)
	1	33	26	-	-	-		30	4	7	
Oct.	2	39	31	36	5	8	85	30	-	-	39
	3	17	14	60	46	77	(0.85)	33	19	32	(0.39)
	1	29	23	60	37	62		20	-	-	
Nov.	2	18	14	42	28	47	186	20	6	10	30
	3	10	8	54	46	77	(1.86)	20	12	20	(0.30)
	1	-	-	80	80	133		19	19	32	
Dec.	2	4	-	80	80	133	413	19	19	32	99
	3	-	-	88	88	147	(4.13)	21	21	35	(0.99)
Annual				1,792	1,293	2,157	(21.57)	1,320	847	1,415	(14.15)

Note *1 : Assuming an 80% of probability of occurrence (Kabankalan, 1957 - 1982)
*2 : Effective rainfall
*3 : Crop water requirement based on the Hilabangan River Irrigation Project by NIA, Oct. 1975
*4 : Farm water requirement = *3 - *2
*5 : Diversion requirement = *4/0.6 (irrigation efficiency)
*6 : Monthly requirement (1000 cu.m/ha)

Table 2.6-6 BRACKISHWATER AQUACULTURE

	Item	Unit	Negros Occ. (1)	Study Area (2)	Rate (2)/(1)
	No. of Operators	person	972	140	14.4%
Bangus	Area	ha	12,418	2,273	18.3%
	Production	ton	8,044	1,590	19.8%
	No. of Operators	person	355	24	6.8%
Prawn	Area	ha	3,363	124	3.7%
	Production	ton	14,842	639	4.3%
	No. of Operators	person	1,327	164	12.4%
Total	Area	ha	15,781	2,397	15.2%
	Production	ton	22,886	2,229	9.7%

Source : Fisheries Extension Section, BFAR
Note : Study area for this table covers the municipalities of Kabankalan and Ilog.

Table 2.6-7 PERCENTAGE OF POPULATION SERVED BY WATER SUPPLY LEVEL

Area	*1 Level I	Level II	Level III	*2 Others	Total	*3 W.D.
Negros Occidental	48.8%	1.6%	28.7%	20.9%	100.0%	n = 14
Kabankalan & Ilog	56.6%	4.2%	13.8%	25.4%	100.0%	2

Source : Provincial Health Office, 1989
Note *1 : Per capita consumption is estimated at 30 to 60 lpd.
*2 : Droughtful sources.
*3 : Water District (LWUA)

Table 2.6-8 WATER DISTRICT DATA AS OF OCTOBER 1990

Item	Unit	Kabankalan W.D.	Ilog W.D.	Total
Water Resources				
- Deep Well	unit	2	-	2
- Spring	unit	1	2	3
Withdrawal Capacity	lps	1,710	246	1,956
Monthly Production	m3	55,300	2850	58,150
Monthly Distribution	m3	35,400	1700	37,100
Loss	%	36	40	36
No. of Connections	H.H.	1,687	128	1,815
Population Served	person	11,800	700	12,500
Consumption	lpcd	100	80	100
Annual Volume	MCM	0.664	0.035	0.699
Service Per Day	Hr.	24	5	

Table 2.6-9 DROUGHT DAMAGE IN CROPPING YEAR 1989/1990

District	Total Area Affected (ha)	Total Area Damaged (ha)	Estimated Production Loss (ton)	Estimated Value (1000 Peso)
1. Rice				
Negros Occidental (1)	4,934	3,318	10,571	39,801
Study Area (2)	2,893	1,883	5,328	20,236
Rate (2)/(1)	0.59	0.57	0.50	0.51
2. Corn				
Negros Occidental (1)	1,891	791	1,796	9,830
Study Area (2)	1,759	687	1,506	8,335
Rate (2)/(1)	0.93	0.87	0.84	0.85

Source : DA,Region VI, Iloilo City, as of April 18, 1990

Table 2.6-10 EXISTING WELL DATA AND POTENTIAL WELL CAPACITY

Item	Unit	Ilog	Kabankalan	Mabinay	Total
No. of Wells Considered	no.	13	18	10	41
Specific Capacity	lit./sec./m	0.34	0.74	0.68	
Well Depth	m	26	35	42	
Static Water Level	mbgs	3	3	10	
Average Capacity Per Well (SW)	m3/day	55	52	-	
Average Capacity Per Well (DW)	m3/day	323	396	197	
Safe Yield *1 (SW)	1000 m3/day	15	40	-	
Safe Yield *1 (DW)	1000 m3/day	50	160	25	
Potential Max. No. of Wells (SW)	no.	270	770	-	1,040
Potential Max. No. of Wells (DW)	no.	150	400	125	675
Annual Capacity	MCM/year	23.1	72.4	9.0	104.5

Source : Rapid Assessment of Water Supply Sources, May 1982, NWRC
*1 - Estimated by JICA Study Team on the basis of water balance.

Note : mgbs - meter below ground surface
SW - Shallow well
DW - Deep well

Table 2.8-1 GROSS REGIONAL DOMESTIC PRODUCT BY MAJOR INDUSTRIAL ORIGIN IN THE PHILIPPINES, REGION VI AND REGION VII, AND ANNUAL GROWTH RATE, 1972-1989

Unit : million Peso at 1972 price

Area/Sector	Gross Regional Domestic Product								Annual Growth Rate	
	1972	1982	1983	1984	1985	1987	1988	1989	'72-'82	'82-'89
Philippines	56,464	99,102	99,920	94,214	90,470	95,373	101,450	107,144	5.79%	0.78%
Agriculture, Fishery & Forestry	16,135	25,378	24,845	25,409	26,010	26,834	27,793	28,986	4.63%	1.34%
Industry	18,068	35,806	35,955	32,159	28,880	30,499	33,235	35,534	7.08%	-0.08%
Services	22,261	37,918	39,120	36,646	35,580	38,040	40,422	42,624	5.47%	1.18%
REGION VI	5,926	8,410	8,171	7,817	7,241	6,608	6,913	7,155	3.56%	-1.60%
Agriculture, Fishery & Forestry	2,238	3,387	3,058	3,253	2,926	2,766	2,847	2,906	4.23%	-1.52%
Industry	1,594	2,361	2,380	2,010	1,850	1,247	1,247	1,280	4.01%	-5.94%
Services	2,094	2,662	2,733	2,554	2,465	2,595	2,819	2,969	2.43%	1.10%
REGION VII	4,013	7,000	7,101	6,804	6,332	6,989	7,514	8,085	5.72%	1.45%
Agriculture, Fishery & Forestry	930	1,484	1,527	1,527	1,534	1,548	1,578	1,837	4.78%	2.16%
Industry	1,202	2,460	2,436	2,271	1,846	2,263	2,451	2,572	7.42%	0.45%
Services	1,881	3,056	3,138	3,006	2,952	3,178	3,485	3,676	4.97%	1.86%

Source: Medium-Term Western Visayas Region Development Plan, 1987-1992, NEDA
Medium-Term Central Visayas Region Development Plan, 1987-1992, NEDA
Gross Regional Domestic Product Summary (1987 to 1989), NSCB

Table 2.8-2 PERCENTAGE DISTRIBUTION OF GROSS REGIONAL DOMESTIC PRODUCT BY MAJOR INDUSTRIAL ORIGIN IN THE PHILIPPINES, REGION VI AND REGION VII, 1972-1989

Area/Sector	Percentage Distribution of GRDP							
	1972	1982	1983	1984	1985	1987	1988	1989
Philippines	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Agriculture, Fishery & Forestry	28.6%	25.6%	24.9%	27.0%	28.7%	28.1%	27.4%	27.1%
Industry	32.0%	36.1%	36.0%	34.1%	31.9%	32.0%	32.8%	33.2%
Services	39.4%	38.3%	39.2%	38.9%	39.3%	39.9%	39.8%	39.8%
REGION VI	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Agriculture, Fishery & Forestry	37.8%	40.3%	37.4%	41.6%	40.4%	41.9%	41.2%	40.6%
Industry	26.9%	28.1%	29.1%	25.7%	25.5%	18.9%	18.0%	17.9%
Services	35.3%	31.7%	33.4%	32.7%	34.0%	39.3%	40.8%	41.5%
REGION VII	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Agriculture, Fishery & Forestry	23.2%	21.2%	21.5%	22.4%	24.2%	22.1%	21.0%	22.7%
Industry	30.0%	35.1%	34.3%	33.4%	29.2%	32.4%	32.6%	31.8%
Services	46.9%	43.7%	44.2%	44.2%	46.6%	45.5%	46.4%	45.5%

Source: Medium-Term Western Visayas Region Development Plan, 1987-1992, NEDA
Medium-Term Central Visayas Region Development Plan, 1987-1992, NEDA
Gross Regional Domestic Product Summary (1987 to 1989), NSCB

Note : Figures may not add up to the totals due to rounding.

Table 2.8-3 GROSS REGIONAL DOMESTIC PRODUCT BY DETAILED INDUSTRIAL ORIGIN, PERCENT DISTRIBUTION AND CONTRIBUTION TO NATION, 1989

Unit : million Peso at 1972 constant price

Industry/Sector	GRDP by Region			Percentage Distribution			Contribution to Nation	
	Philippines	Region VI	Region VII	Philippines	Region VI	Region VII	Region VI	Region VII
Agriculture, Fishery & Forestry	28,986	2,906	1,837	27.1%	40.6%	22.7%	10.0%	6.3%
- Agricultural crops	17,019	1,441	765	15.9%	20.1%	9.5%	8.5%	4.5%
- Livestock & poultry	6,289	691	510	5.9%	9.7%	6.3%	11.0%	8.1%
- Fishery	5,046	774	560	4.7%	10.8%	6.9%	15.3%	11.1%
- Forestry	632	0	2	0.6%	0.0%	0.0%	0.0%	0.3%
Industry	35,534	1,279	2,572	33.2%	17.9%	31.8%	3.6%	7.2%
- Mining & quarrying	1,563	165	519	1.5%	2.3%	6.4%	10.6%	33.2%
- Manufacturing	26,886	917	1,759	25.1%	12.8%	21.8%	3.4%	6.5%
- Construction	4,947	133	212	4.6%	1.9%	2.6%	2.7%	4.3%
- Elec., gas, water	2,137	64	82	2.0%	0.9%	1.0%	3.0%	3.8%
Services	42,624	2,969	3,676	39.8%	41.5%	45.5%	7.0%	8.6%
- Transportation	5,761	217	476	5.4%	3.0%	5.9%	3.8%	8.3%
- Trade	16,795	1,620	2,112	15.7%	22.6%	26.1%	9.6%	12.6%
- Finance & housing	6,843	373	334	6.4%	5.2%	4.1%	5.5%	4.9%
- Private services	6,766	453	515	6.3%	6.3%	6.4%	6.7%	7.6%
- Government services	6,458	305	238	6.0%	4.3%	2.9%	4.7%	3.7%
Gross Regional Domestic Product	107,144	7,154	8,086	100.0%	100.0%	100.0%	6.7%	7.5%

Source : Gross Regional Domestic Product Summary (1987 to 1989), NSCB

Note : Figures may not add up to totals due to rounding.

Table 2.8-4 PER CAPITA GROSS DOMESTIC PRODUCT BY REGION, 1981-1989

Unit : Peso at 1972 constant price

Region	* 1981	* 1982	* 1983	* 1984	* 1985	* 1986	** 1987	** 1988	** 1989
Philippines	1,942	1,949	1,920	1,760	1,644	1,628	1,663	1,728	1,783
NCR Metro Manila	4,968	4,984	4,968	4,339	3,842	3,724	3,866	4,108	4,281
CAR Cordillera Administrative Region	---	---	---	---	---	---	1,360	1,404	1,477
I Ilocos Region	1,044	1,082	1,079	1,020	1,026	1,072	956	982	981
II Cagayan Valley	1,160	1,140	1,081	979	941	887	848	869	872
III Central Luzon	1,680	1,698	1,630	1,466	1,405	1,320	1,339	1,392	1,465
IV Southern Tagalog	2,081	2,073	2,027	1,939	1,822	1,868	1,759	1,791	1,821
V Bicol Region	882	878	891	827	795	762	767	794	801
VI Western Visayas	1,684	1,728	1,638	1,519	1,292	1,219	1,241	1,271	1,288
VII Central Visayas	1,807	1,764	1,745	1,626	1,497	1,514	1,602	1,690	1,785
VIII Eastern Visayas	800	803	788	730	739	734	929	946	945
IX Western Mindanao	1,286	1,267	1,245	1,145	1,138	1,150	1,213	1,236	1,271
X Northern Mindanao	1,629	1,632	1,531	1,503	1,516	1,533	1,572	1,635	1,684
XI Southern Mindanao	1,731	1,737	1,762	1,685	1,673	1,698	1,766	1,774	1,809
XII Central Mindanao	1,487	1,471	1,461	1,351	1,351	1,417	1,387	1,417	1,459

Source *: 1989 Philippine Statistical Yearbook, NSCB
**: Gross Regional Domestic Product Summary (1987 to 1989), NSCB

Table 2.8-5 NUMBER OF FAMILIES, AVERAGE ANNUAL INCOME AND EXPENDITURE, SAVINGS AND SAVING RATIO BY REGION, 1988

Unit : Peso at current price

Region	No. of Families (x1000)	Average Income (Peso)	Average Expendit (Peso)	Savings (Peso)	Saving Ratio
Philippines	10,534.9	40,408	32,521	7,887	19.5%
NCR Metro Manila	1,435.4	79,314	60,355	18,959	23.9%
CAR Cordillera Administrative Region	213.6	33,838	28,722	5,116	15.1%
I Ilocos Region	624.7	34,031	27,670	6,361	18.7%
II Cagayan Valley	437.9	32,939	24,582	8,357	25.4%
III Central Luzon	1,038.2	46,855	38,660	8,195	17.5%
IV Southern Tagalog	1,284.5	37,978	32,058	5,920	15.6%
V Bicol Region	738.0	26,570	23,253	3,317	12.5%
VI Western Visayas	956.6	31,164	27,162	4,002	12.8%
VII Central Visayas	829.5	27,972	22,157	5,815	20.8%
VIII Eastern Visayas	598.5	25,345	20,533	4,812	19.0%
IX Western Mindanao	539.3	31,984	24,624	7,360	23.0%
X Northern Mindanao	606.8	35,801	28,865	6,936	19.4%
XI Southern Mindanao	737.8	37,132	30,061	7,071	19.0%
XII Central Mindanao	493.1	35,090	27,696	7,394	21.1%
Negros Island	526.4	25,116	22,541	2,575	10.3%
- Negros Occidental Province	347.8	26,389	24,175	2,214	8.4%
- Negros Oriental Province	178.6	22,637	19,360	3,277	14.5%

Source : 1988 Family Income & Expenditures Survey, NSO

Note : Figures exclude data for Rizal Province.

Table 2.8-6 POPULATION, DENSITY AND AVERAGE ANNUAL GROWTH IN ILOG-HILABANGAN RIVER BASIN, 1970 AND 1980

	Provice/ Municipality	Municipality Area (km2)	1 9 7 0 Population	1 9 7 0 Density	1 9 8 0 Population	1 9 8 0 Density	Average Annual Growth
	NEGROS ORIENTAL						
1	Ayungon	153.6	23,165	150.8	27,656	180.1	1.8%
2	Bais City	316.9	40,095	126.5	49,301	155.6	2.1%
3	Bawayan	722.5	44,615	61.8	71,153	98.5	4.8%
4	Bindoy	173.7	18,334	105.5	23,638	136.1	2.6%
5	Jimalalud	139.5	18,568	133.1	18,863	135.2	0.2%
6	Mabinay	142.6	33,785	236.9	46,871	328.7	3.3%
7	Manjuyod	264.6	20,545	77.6	26,257	99.2	2.5%
8	Tanjay	539.3	51,458	95.4	57,299	106.2	1.1%
9	Tayasan	154.2	20,132	130.6	21,473	139.3	0.6%
	Sub-total/Ave.	2,607	270,697	103.8	342,511	131.4	2.4%
	NEGROS OCCIDENTAL						
10	Candoni	191.7	10,258	53.5	10,831	56.5	0.5%
11	Cauayan	519.9	52,508	101.0	70,017	134.7	2.9%
12	Himamaylan	384.2	53,663	139.7	70,467	183.4	2.8%
13	Ilog	281.7	30,573	108.5	38,956	138.3	2.5%
14	Kabankalan	726.4	72,567	99.9	92,109	126.8	2.4%
15	Sipalay	442.7	34,771	78.5	51,264	115.8	4.0%
	Sub-total/Ave.	2,547	254,340	99.9	333,644	131.0	2.8%
	Total/Ave.	5,154	525,037	101.9	676,155	131.2	2.6%

SOURCE : NCSO, Special Report No.3

NOTE : Calculation of the basin population in 1988 is as follows:

Province	Area (km2)	Population Density	Population
Negros Occidental	1,211	131.0	158,623
Negros Oriental	951	131.4	124,985
Total	2,162		283,608

Table 2.8-7 URBAN AND RURAL POPULATION IN ILOG-HILABANGAN RIVER BASIN IN 1970 AND 1980

	Provice/ Municipality	1 9 7 0					1 9 8 0				
		Urban	(%)	Rural	(%)	Total	Urban	(%)	Rural	(%)	Total
	NEGROS ORIENTAL										
1	Ayungon	0	0.0%	23,165	100.0%	23,165	1,455	5.3%	26,201	94.7%	27,656
2	Bais City	6,809	17.0%	33,286	83.0%	40,095	8,225	16.7%	41,076	83.3%	49,301
3	Bawayan	8,115	18.2%	36,500	81.8%	44,615	8,618	12.1%	62,535	87.9%	71,153
4	Bindoy	0	0.0%	18,334	100.0%	18,334	2,233	9.4%	21,405	90.6%	23,638
5	Jimalalud	2,248	12.1%	16,320	87.9%	18,568	2,378	12.6%	16,485	87.4%	18,863
6	Mabinay	1,567	4.6%	32,218	95.4%	33,785	1,815	3.9%	45,056	96.1%	46,871
7	Manjuyod	875	4.3%	19,670	95.7%	20,545	988	3.8%	25,269	96.2%	26,257
8	Tanjay	12,012	23.3%	39,446	76.7%	51,458	17,020	29.7%	40,279	70.3%	57,299
9	Tayasan	1,674	8.3%	18,458	91.7%	20,132	1,702	7.9%	19,771	92.1%	21,473
	Sub-total	33,300	12.3%	237,397	87.7%	270,697	44,434	13.0%	298,077	87.0%	342,511
	NEGROS OCCIDENTAL										
10	Candoni	1,902	18.5%	8,356	81.5%	10,258	2,701	24.9%	8,130	75.1%	10,831
11	Cauayan	4,994	9.5%	47,514	90.5%	52,508	5,762	8.2%	64,255	91.8%	70,017
12	Himamaylan	6,636	12.4%	47,027	87.6%	53,663	9,207	13.1%	61,260	86.9%	70,467
13	Ilog	4,741	15.5%	25,832	84.5%	30,573	5,649	14.5%	33,307	85.5%	38,956
14	Kabankalan	14,154	19.5%	58,413	80.5%	72,567	20,208	21.9%	71,901	78.1%	92,109
15	Sipalay	0	0.0%	34,771	100.0%	34,771	17,051	33.3%	34,213	66.7%	51,264
	Sub-Total	32,427	12.7%	221,913	87.3%	254,340	60,578	18.2%	273,066	81.8%	333,644
	Total	65,727	12.5%	459,310	87.5%	525,037	105,012	15.5%	571,143	84.5%	676,155

Source : NCSO, Special Report No.4

Table 2.8-8 POPULATION PROJECTIONS FOR NEGROS ISLAND AND ILOG-HILABANGAN RIVER BASIN, 1980 - 2030

Unit : thousand persons

Year	Region VI*	Region VII*	Negros Island			River Basin		
			Occidental	Oriental	Total	Occidental	Oriental	Total
1980	4,538	3,796	1,930.3 **	819.4 **	2,749.7	158.6	125.0	283.6
1981	4,645	3,873	1,975.8	836.0	2,811.8	162.3	127.5	289.9
1982	4,756	3,952	2,023.0	853.1	2,876.1	166.2	130.1	296.4
1983	4,866	4,032	2,069.8	870.3	2,940.2	170.1	132.8	302.8
1984	4,979	4,113	2,117.9	887.8	3,005.7	174.0	135.4	309.5
1985	5,092	4,195	2,166.0	905.5	3,071.5	178.0	138.1	316.1
1986	5,207	4,278	2,214.9	923.4	3,138.3	182.0	140.9	322.9
1987	5,323	4,362	2,264.2	941.6	3,205.8	186.0	143.6	329.7
1988	5,439	4,446	2,313.6	959.7	3,273.3	190.1	146.4	336.5
1989	5,556	4,531	2,363.3	978.1	3,341.4	194.2	149.2	343.4
1990	5,572	4,616	2,370.1	996.4	3,366.5	194.7	152.0	346.7
1991	5,789	4,701	2,462.4	1,014.8	3,477.2	202.3	154.8	357.1
1992	5,905	4,786	2,511.8	1,033.1	3,544.9	206.4	157.6	364.0
1993	6,021	4,870	2,561.1	1,051.2	3,612.3	210.4	160.4	370.8
1994	6,136	4,954	2,610.0	1,069.4	3,679.4	214.4	163.1	377.6
1995	6,250	5,037	2,658.5	1,087.3	3,745.8	218.4	165.9	384.3
1996	6,363	5,120	2,706.6	1,105.2	3,811.8	222.4	168.6	391.0
1997	6,474	5,201	2,753.8	1,122.7	3,876.5	226.3	171.3	397.5
1998	6,584	5,282	2,800.6	1,140.2	3,940.8	230.1	173.9	404.0
1999	6,693	5,362	2,847.0	1,157.4	4,004.4	233.9	176.6	410.5
2000	6,800	5,441	2,892.5	1,174.5	4,067.0	237.7	179.2	416.8
2005	7,302	5,811	3,106.0	1,254.4	4,360.4	255.2	191.4	446.6
2010	7,728	6,131	3,287.2	1,323.4	4,610.6	270.1	201.9	472.0
2015	8,119	6,425	3,453.5	1,386.9	4,840.4	283.8	211.6	495.3
2020	8,521	6,720	3,624.5	1,450.6	5,075.1	297.8	221.3	519.1
2025	8,910	7,000	3,790.0	1,511.0	5,301.0	311.4	230.5	541.9
2030	9,264	7,216	3,940.6	1,557.6	5,498.2	323.8	237.6	561.4

SOURCE * : 1989 Philipine Statistical Yearbook, NSCB

** : 1980 Census of Population, NCSO

NOTE * : Based on Medium Assumption - Moderate Fertility and Moderate Mortality Decline.

Table 2.8-9 HOUSEHOLD POPULATION 15 YEARS OVER AND EMPLOYMENT STATUS

Item/Region	1980	1981	1982	1983	1984	1985	1986	1987	1988	Remarks
Projected Household Population 15 years old and over :										
1. Number (in thousand)										
Philippines	28,967	29,847	30,748	31,676	32,382	33,646	33,838	34,840	35,865	2.7%*
Region VI	2,702	2,776	2,851	2,927	3,001	3,073	3,067	3,150	3,234	2.3%*
Region VII	2,276	2,342	2,408	2,476	2,543	2,609	2,605	2,670	2,736	2.3%*
2. Percent in the labor force										
Philippines	59.8%	61.7%	60.1%	64.1%	64.2%	63.4%	63.8%	65.7%	65.4%	63.1%**
Region VI	63.1%	63.4%	62.8%	70.4%	65.6%	64.7%	64.6%	66.7%	64.9%	65.1%**
Region VII	62.4%	66.0%	63.7%	69.3%	68.7%	66.9%	68.6%	68.3%	68.0%	66.9%**
Percent of labor force :										
1. Employment Rate										
Philippines	95.0%	94.7%	94.0%	94.6%	93.8%	92.9%	88.9%	90.9%	91.7%	92.9%**
Region VI	95.8%	95.8%	95.8%	97.2%	95.5%	95.5%	89.2%	92.0%	92.7%	94.4%**
Region VII	96.4%	96.6%	95.8%	95.7%	97.5%	96.6%	94.4%	92.8%	94.3%	95.6%**
2. Unemployment Rate										
Philippines	5.0%	5.3%	6.0%	5.4%	6.2%	7.1%	11.1%	9.1%	8.3%	7.1%**
Region VI	4.2%	4.2%	4.2%	2.8%	4.5%	4.5%	10.8%	8.0%	7.3%	5.6%**
Region VII	3.6%	3.4%	4.2%	4.3%	2.5%	3.4%	5.6%	7.2%	5.7%	4.4%**

Source : 1989 Philippine Statistical Yearbook, NSCB

Note * : Average annual growth rate
** : Average

Table 2.8-10 EXISTING ROADS CLASSIFIED ACCORDING TO PAVEMENT AND ADMINISTRATIVE JURISDICTION IN NEGROS OCCIDENTAL, 1986

Unit : m

Administrative Office	Concrete	%	Asphalt	%	Gravel/ Earth	%	Total Length	Total Percent
1. National	102,745	2.20%	292,027	6.25%	482,135	10.32%	876,907	18.78%
- 1st Highway Engineering District	36,730	0.79%	79,865	1.71%	102,790	2.20%	219,385	4.70%
- 2nd Highway Engineering District	29,605	0.63%	106,482	2.28%	324,995	6.96%	461,082	9.87%
- Cities	36,410	0.78%	105,680	2.26%	54,350	1.16%	196,440	4.21%
2. Provincial	28,410	0.61%	54,830	1.17%	839,860 **	17.98%	923,100	19.77%
3. City	57,143	1.22%	151,233	3.24%	42,545 *	0.91%	250,921	5.37%
4. Municipal	19,088	0.41%	113,797	2.44%	107,074 *	2.29%	239,959	5.14%
5. Barangay	33,039	0.71%	145,887	3.12%	2,200,362	47.12%	2,379,288	50.95%
- 1st Highway Engineering District	0	0.00%	0	0.00%	570,299 *	12.21%	570,299	12.21%
- 2nd Highway Engineering District	650	0.01%	4,640	0.10%	1,059,650 *	22.69%	1,064,940	22.80%
- City	32,389	0.69%	141,247	3.02%	570,413 *	12.21%	744,049	15.93%
Total	240,425	5.15%	757,774	16.23%	3,671,976	78.63%	4,670,175	100.00%

Source : Provincial Planning and Development Office

Note * : Not in good condition.
** : 70% are not in good condition.

Table 3.1-1 ANNUAL MAXIMUM 2-DAY AND 1-DAY RAINFALL AT KABANKALAN

Unit : mm

Year	Annual Maximum Rainfall	
	1-Day Rainfall	2-Day Continuous Rainfall
1971	142.4	189.0
1972	123.2	230.4
1973	89.6	135.8
1974	85.6	143.5
1975	54.8	85.5
1976	62.5	80.8
1977	28.4	52.3
1978	50.8	65.1
1979	26.9	49.5
1980	68.8	113.0
1981	82.0	136.8
1982	117.3	233.8
1983	57.4	105.0
1984	56.1	94.8
1985	98.7	147.2
1986	180.8	216.3
1987	79.3	111.4
1988	194.5	216.4
1989	70.0	90.6

Table 3.1-2 MONTHLY OCCURRENCE OF ANNUAL MAXIMUM 2-DAY AND 1-DAY RAINFALL AT KABANKALAN

Month	Occurrence	
	Number	Rate (%)
January	1	5.3
February	0	0.0
March	0	0.0
April	0	0.0
May	0	0.0
June	2	10.5
July	2	10.5
August	3	15.8
September	3	15.8
October	3	15.8
November	4	21.0
December	1	5.3
Total	19	100.0

Table 3.1-3 CHARACTERISTIC FEATURES OF SUB-BASIN

Sub-Basin No.	Catchment Area (km2)	Longest Stream (km)	Maximum Elevation (El.m)	Minimum Elevation (El.m)	Altitude Difference	Average Gradient (1/I)
1	109.7	15.6	520	156	364	42.9
2	53.5	6.6	500	143	357	18.5
3	118.3	19.6	400	112	288	68.1
4	62.2	22.8	558	114	444	51.4
5	83.8	11.6	280	101	179	64.8
6	63.1	16.6	544	150	394	42.1
7	69.8	11.3	400	134	266	42.5
8	112.0	26.9	650	102	548	49.1
9	71.8	16.8	395	102	293	57.3
10	54.2	19.8	333	57	276	71.7
11	88.0	18.5	960	197	763	24.2
12	24.2	3.7	280	160	120	30.8
13	16.2	4.0	140	40	100	40.0
14	99.7	14.5	620	95	525	27.6
15	51.4	10.8	420	67	353	30.6
16	76.7	13.9	778	25	753	18.5
17	125.8	16.1	239	12	227	70.9
18	84.8	11.3	840	15	825	13.7
19	75.1	15.6	700	10	690	22.6
20	66.8	21.2	360	10	350	60.6
21	98.1	16.7	1,260	330	930	18.0
22	100.4	13.6	1,350	240	1,110	12.3
23	118.8	28.0	885	190	695	40.3
24	50.3	11.0	1,120	87	1,033	10.6
25	84.3	16.3	1,350	60	1,290	12.6
Sub-Total	1,959.0					
26	31.1	12.8	340	10	330	38.8
27	11.4	7.6	200	10	190	40.0
Total	2,001.5	-	-	-	-	-

Table 3.1-4 CHARACTERISTIC FEATURES OF RIVER CHANNEL

Channel No.	Upstream Elevation (El.m)	Downstream Elevation (El.m)	Channel Length (km)	Average Gradient (1/I)	Average Width (m)
1	156	140	12.6	787.5	50
2	140	110	19.7	656.7	70
3	110	38	21.7	301.4	100
4	150	75	16.8	224.0	70
5	102	75	9.7	359.3	70
6	75	38	7.6	205.4	100
7	197	40	15.2	96.8	70
8	38	25	7.0	538.5	100
9	95	25	16.4	234.3	70
10	25	10	20.7	1380.0	100
11	10	2.5	13.2	1760.0	150
12	330	190	14.2	101.4	100
13	87	2	18.6	218.8	100

Table 3.1-5 SUMMARY OF PARAMETERS OF STORAGE FUNCTION MODEL FOR RIVER BASINS

Sub-Basin No.	Catchment Area (km2)	Rsa (mm)	f1	f2	K	p	Tl
1	109.7	20.0	0.5	1.0	32.4	0.423	0.17
2	53.5	20.0	0.5	1.0	41.8	0.347	0.00
3	118.3	20.0	0.5	1.0	28.2	0.472	0.36
4	62.2	20.0	0.5	1.0	30.7	0.442	0.51
5	83.8	20.0	0.5	1.0	28.6	0.466	0.00
6	63.1	20.0	0.5	1.0	32.6	0.422	0.22
7	69.8	20.0	0.5	1.0	32.5	0.422	0.00
8	112.0	20.0	0.5	1.0	31.1	0.437	0.70
9	71.8	20.0	0.5	1.0	29.7	0.453	0.23
10	54.2	20.0	0.5	1.0	27.8	0.478	0.37
11	88.0	20.0	0.5	1.0	38.4	0.370	0.31
12	24.2	20.0	0.5	1.0	35.8	0.392	0.00
13	16.2	20.0	0.5	1.0	33.1	0.416	0.00
14	99.7	20.0	0.5	1.0	37.0	0.382	0.12
15	51.4	20.0	0.5	1.0	35.8	0.391	0.00
16	76.7	20.0	0.5	1.0	41.7	0.347	0.09
17	125.8	20.0	0.5	1.0	27.8	0.476	0.20
18	84.8	20.0	0.5	1.0	45.6	0.324	0.00
19	75.1	20.0	0.5	1.0	39.2	0.364	0.17
20	66.8	20.0	0.5	1.0	29.2	0.459	0.44
21	98.1	20.0	0.5	1.0	42.0	0.345	0.22
22	100.4	20.0	0.5	1.0	47.2	0.315	0.08
23	118.8	20.0	0.5	1.0	33.0	0.417	0.76
24	50.3	20.0	0.5	1.0	49.2	0.305	0.00
25	84.3	20.0	0.5	1.0	46.7	0.318	0.21

Note Rsa : Saturation rainfall depth
f1 : Primary runoff ratio
f2 : Secondary runoff ratio
K,p : Constants of storage function model
Tl : Lag time

Table 3.1-6 SUMMARY OF PARAMETERS OF STORAGE FUNCTION MODEL FOR RIVER CHANNELS

Channel No.	Channel Length (km)	Average Gradient (1/I)	K	p	Tl	Tlz
1	12.6	787.5	15.1	0.6	0.260	0.260
2	19.7	656.7	25.6	0.6	0.372	0.372
3	21.7	301.4	25.7	0.6	0.277	0.277
4	16.8	224.0	15.8	0.6	0.185	0.185
5	9.7	359.3	10.5	0.6	0.135	0.135
6	7.6	205.4	8.0	0.6	0.080	0.080
7	15.2	96.8	11.1	0.6	0.110	0.110
8	7.0	538.5	9.9	0.6	0.120	0.120
9	16.4	234.3	15.6	0.6	0.185	0.185
10	20.7	1,380.0	38.7	0.6	0.566	0.566
11	13.2	1,760.0	31.2	0.6	0.408	0.408
12	14.2	101.4	12.1	0.6	0.105	0.105
13	18.6	218.8	20.0	0.6	0.203	0.203
14	9.0	3,000.0	33.0	0.6	0.363	0.363

Note K,p : Constants of storage function model
Tl : Lag time
Tlz : Lag time in river channel

Table 3.4-1 REQUIRED STORAGE VOLUME

Order	Year	Volume (MCM)	W
1	1978	52.60	1/10.3
2	1979	48.59	1/8.9
3	1976	42.78	1/7.1
4	1977	39.15	1/6.1
5	1958	37.34	1/5.7
6	1973	28.07	1/3.8
7	1961	18.07	1/2.4
8	1963	16.24	1/2.1
9	1966	14.02	1/1.9
10	1957	7.43	1/1.4

Note :
- Irrigation area is 5,900 ha as follows:
  1,200 ha (paddy) + 4,700 ha (sugarcane)
- Proposed dam has 1,430 km2 of catchment area.
- River maintenance flow is 0.33 m3/sec. for 100 km2.
- W = 1/T (Return period in year)

Table 3.4-2 WATER BALANCE CALCULATION

Unit : MCM

Year	Inflow	Base Flow	Available Flow	Irrigation Demand	Evaporation	Spilled Water	Annual Shortage	Accumulative Shortage
1956	2,857.74	142.44	2,715.30	92.39	6.16	2,616.75	0.00	0.00
1957	1,604.77	142.05	1,462.72	92.39	6.24	1,371.51	7.43	7.43
1958	1,209.47	142.05	1,067.42	92.39	6.91	1,005.46	37.34	37.34
1959	2,254.87	142.05	2,112.82	92.39	6.30	2,019.36	5.24	5.24
1960	2,127.59	142.44	1,985.15	92.39	6.23	1,891.45	4.92	4.92
1961	1,890.89	142.05	1,748.84	92.39	6.48	1,668.05	18.07	18.07
1962	1,980.45	142.05	1,838.40	92.39	6.20	1,742.44	2.63	2.63
1963	1,813.80	142.05	1,671.75	92.39	6.41	1,589.18	16.24	16.24
1964	2,903.22	142.44	2,760.78	92.39	6.16	2,662.22	0.00	0.00
1965	2,708.90	142.05	2,566.85	92.39	6.16	2,468.30	0.00	0.00
1966	2,344.35	142.05	2,202.30	92.39	6.41	2,117.52	14.02	14.02
1967	4,087.41	142.05	3,945.36	92.39	6.16	3,846.80	0.00	0.00
1968	3,477.31	142.44	3,334.87	92.39	6.16	3,236.31	0.00	0.00
1969	1,553.63	142.05	1,411.58	92.39	6.16	1,313.02	0.00	0.00
1970	2,111.75	142.05	1,969.70	92.39	6.16	1,871.14	0.00	0.00
1971	3,210.37	142.05	3,068.32	92.39	6.16	2,969.77	0.00	0.00
1972	2,140.53	142.44	1,998.09	92.39	6.16	1,899.54	0.00	0.00
1973	1,371.43	142.05	1,229.38	92.39	6.70	1,158.36	28.07	28.07
1974	1,220.97	142.05	1,078.92	92.39	6.18	981.73	1.38	1.38
1975	892.59	142.05	750.54	92.39	6.16	656.95	4.96	4.96
1976	1,406.76	142.44	1,264.32	92.39	7.08	1,207.10	42.25	42.78
1977	1,432.55	142.05	1,290.50	92.39	7.26	1,230.53	39.68	39.15
1978	1,130.69	142.05	988.64	92.39	7.54	936.34	47.64	52.60
1979	1,530.43	142.05	1,388.38	92.39	7.19	1,337.38	48.59	48.59
Mean	2,052.60	142.15	1,910.45	92.39	6.45	1,824.88	13.27	

Table 4.4-1 COMPARISON OF ALTERNATIVE PLANS

Item	Unit	River Improvement		Diversion		
		Existing River (Case R1)	Shortcut (Case R2)	Binicuil (Case D1)	Old Ilog (Case D2)	Salong (Case D3)
Features						
Design Discharge						
Ilog River	m3/s	5,450.0	5,450.0	2,650.0	2,650.0	2,650.0
Diversion Channel	m3/s	-	5,450.0	2,800.0	2,800.0	2,800.0
Diversion Point		-	6.0k-15.0k	13.5k	6.0k	15.0k
Improved River Length						
Ilog River	km	20.0	11.0	20.0	20.0	20.0
Diversion Channel	km	-	6.0	11.0	6.5	11.0
Gradient						
Ilog River		1/5,000	1/5,000	1/5,000	1/5,000	1/5,000
		-1/2,500	-1/2,500	-1/2,500	-1/2,500	-1/2,500
Diversion Channel		-	1/3,000	1/3,000	1/5,000	1/3,000
River Width						
Ilog River	m	160-300	160-300	80-140	80-140	80-140
Diversion Channel	m	-	230	140	150	140
Work Quantity						
Main Work						
Excavation	1000 m3	9,425.5	11,651.7	11,618.5	10,459.1	10,830.9
Embankment	1000 m3	966.7	1,444.1	1,575.5	1,393.7	1,686.9
Revetment	1000 m2	102.1	87.2	164.8	128.0	133.2
Bridge	m2	4,000.0	3,700.0	5,150.0	4,900.0	4,550.0
Sluice	unit	4.0	4.0	4.0	11.0	4.0
Drainage facility	unit	6.0	8.0	11.0	6.0	12.0
Diversion Weir	m	-	-	320.0	280.0	250.0
Compensation						
Land Acquisition	ha	222.6	307.5	277.5	205.1	256.7
House Evacuation	unit	354.0	211.0	404.0	311.0	246.0
Total Cost	mil.P.	1,187.0	1,363.7	1,547.5	1,322.4	1,401.2

Table 4.4-2 COMPARISON OF ALTERNATIVE CASES OF DAM AND RESERVOIR

Item	Unit	Damsite									
		Ilog No.1 Upper Site			Ilog No.1 Lower Site					Hilabangan	
Catchment Area	km2	1,365			1,430					368	
High Water Level	EL. m	30	35	40	20	25	30	35	40	130	150
Storage Capacity	MCM	40	65	107	40	77	130	194	270	26	56
Effective Capacity	MCM	33	58	100	31	68	121	185	261	14	44
Sediment Volume	MCM	7	7	7	9	9	9	9	9	12	12
Dam Height	m	33.60	38.60	43.60	29.00	34.00	39.00	44.00	49.00	81.00	101.00
Dam Volume	MCM	0.60	0.70	0.84	0.55	0.82	1.12	1.80	2.32	2.35	4.30
Construction Cost *1	mil.P.	4,050	9,930	18,760	1,590	1,810	4,480	10,850	20,000	2,390	4,020
Dam	mil.P.	380	440	530	350	520	710	1,130	1,460	1,480	2,700
Spillway	mil.P.	750	770	800	740	790	850	1,000	1,110	910	1,320
Leakage Protection *2	mil.P.	2,420	8,220	16,930			2,420	8,220	16,930		
Sediment Control Dam *3	mil.P.	500	500	500	500	500	500	500	500		
House Evacuation	unit	195	225	265	85	150	220	255	300	10	15

Note *1 : Construction cost does not include compensation cost which is negligibly small compared with the total cost.

*2 : Concrete facing over the limestone zone up to the High Water Level.

*3 : Concrete gravity dam with a height of 30 m above the riverbed.

Table 4.5-1 CONTROLLED PEAK DISCHARGE FOR 100-YEAR RETURN PERIOD FLOOD
BY FLOOD CONTROL CAPACITY

(1) Ilog NO.1 Lower Dam

Item	Unit	Flood Control Capacity (MCM)					
		10	15	35	67	107	149
High Water Level of Reservoir	EL.m	15.4	16.5	20.4	24.7	28.6	32.0
Controlled Peak Discharge at Reference Point	m3/s	5,230	4,890	3,820	2,790	2,270	2,080
Discharge Cut by Dam at Reference Point	m3/s	220	560	1,630	2,660	3,180	3,370

(2) Ilog NO.1 Upper Dam

Item	Unit	Flood Control Capacity (MCM)				
		30	47	80	117	167
High Water Level of Reservoir	EL.m	27.0	31.0	36.0	41.0	46.0
Controlled Peak Discharge at Reference Point	m3/s	4,260	3,500	2,700	2,400	2,170
Discharge Cut by Dam at Reference Point	m3/s	1,190	1,950	2,750	3,050	3,280

(3) Hilabangan NO.1 Dam

Item	Unit	Flood Control Capacity (MCM)			
		9	18	28	40
High Water Level of Reservoir	EL.m	125.9	133.4	140.0	147.6
Controlled Peak Discharge at Reference Point	m3/s	5,270	4,900	4,640	4,500
Discharge Cut by Dam at Reference Point	m3/s	180	550	810	950

Table 4.6-1 UNIT COST

Unit : Peso

No.	Item of Work	Unit	Direct Cost	Indirect Cost	Unit Cost
1.	Excavation				
1.1	Common	m3	48.00	11.97	60.00
1.2	Dredging	m3	39.00	9.83	49.00
2.	Embankment	m3	35.00	9.07	44.00
3.	Revetment				
3.1	Sodding	m2	8.00	1.85	10.00
3.2	Top Concrete 1	m3	1,480.00	266.84	1,747.00
3.3	Wet Masonry	m2	187.00	34.35	221.00
3.4	Base Concrete	m3	1,480.00	266.84	1,747.00
3.5	Boulders	m2	49.00	9.33	58.00
3.6	Top Concrete 2	m3	2,250.00	403.61	2,654.00
3.7	Sheet Pile				
	- Concrete	m2	1,324.00	276.61	1,601.00
	- Steel	m2	4,393.00	775.01	5,168.00
3.8	Riprap	m2	50.00	9.59	60.00
4.	Sluice and Drainage Facility				
4.1	Gate				
	- Sluice Gate	m2	128,000.00	25,785.00	153,785.00
	- Flap Gate	m2	111,000.00	23,680.00	134,680.00
4.2	Culvert (Concrete)	m3	3,011.00	537.91	3,549.00
5.	Bridge	m2	11,084.00	2,184.70	13,269.00

Table 4.6-2 LABOR RATES

DESCREPTION	UNIT	PRICE (Peso)
1. Foreman	md	120.00
2. Common Labor	md	60.00
3. Operator	md	100.00
4. Assistant Operator	md	70.00
5. Mechanic	md	100.00
6. Assistant Mechanic	md	70.00
7. Welder	md	90.00
8. Electrician	md	100.00
9. Driver	md	70.00
10. Skilled Labor	md	80.00
11. Dredger Master	md	140.00
12. Dredging Crew	md	100.00

Table 4.6-3 MATERIAL PRICE

DESCREPTION		UNIT	PRICE (Peso)
1. Cement	Normal Portland	ton	2,200.00
2. Reinforcement Bar		ton	15,000.00
3. Fuel	Diesel	ltr.	6.50
4. Gasoline	Premium	ltr.	9.50
5. Gear Oil		ltr.	35.00
6. Grease		gal.	70.00
7. Bitumen		ton	9,500.00
8. Timber	Support	bf.	13.00
	Plank	bf.	18.00
9. Plywood	(1/4"*4'*8')	sheet	170.00
10. Wire		kg	20.00
11. Nail		kg	25.00
12. Concrete Aggregate	Fine	m3	130.00
	Coarse	m3	140.00
13. Crusher-run		m3	110.00
14. Asphalt Mixture		ton	800.00

Table 4.6-4 BREAKDOWN OF PROJECT COST

Work Item	Feature	Unit	Unit Cost (Peso)	Quantity	Total * (mil.P.)	Remarks
1. Construction Cost					892.65	
a. Phase 1					512.57	
(a) Preparatory Works					66.86	15% of (b)
(b) Main Construction Cost					445.71	
Excavation	Common	m3	60	2,831,400	169.88	
	Dredging	m3	49	1,551,300	76.01	
Embankment		m3	44	966,700	42.53	
Revetment		m2	800	102,100	81.68	
Sodding		m2	10	530,200	5.30	
Sluice	Type A	unit	700,000	3	2.10	
	Type B	unit	10,000,000	1	10.00	
Drainage Facility		unit	500,000	6	3.00	
Bridge		m2	13,300	4,150	55.20	
b. Phase 2					380.09	
(a) Preparatory Works					49.58	15% of (b)
(b) Main Construction Cost					330.51	
Excavation	Common	m3	60	3,870,400	232.22	
	Dredging	m3	49	1,172,400	57.45	
Embankment		m3	44	0	0.00	
Revetment		m2	800	51,050	40.84	
Sodding		m2	10	0	0.00	
Sluice	Type A	unit	700,000	0.0	0.00	
	Type B	unit	10,000,000	0.0	0.00	
Drainage Facility		unit	500,000	0.0	0.00	
Bridge		m2	13,300	0.0	0.00	
2. Administration Cost					44.63	5% of 1.
3. Engineering Survices					142.82	
Detailed Design					53.56	6% of 1.
Supervision					89.27	10% of 1.
4. Physical Contingency					108.01	10% of 1+2+3
Sub Total (1+2+3+4)					1,188.12	
5. Compensation					64.41	
Land Acquisition	Fishpond	ha	230,000	37.7	8.67	
	Sugercane	ha	110,000	177.6	19.54	
	Residential Area	ha	3,800,000	5.8	22.04	
House Evacuation		unit	40,000	354.0	14.16	
Grand Total					1,252.53	

Note *: Figures may not add up to totals due to rounding.
**: Excavated material is employed for embankment material.

Table 4.6-5 BREAKDOWN OF OPERATION AND MAINTENANCE COST

Work Item		Unit	Unit Cost (Peso)	Quantity	Total * (mil.P.)	Remarks **
1. Construction Cost					4.4	
(a) Preparatory Works (15% of (b))					0.6	
(b) Main Construction Cost					3.8	
Excavation	Common	m3	60	33,500	2.0	0.5 %
	Dredging	m3	49	27,200	1.3	1.0 %
Embankment		m3	44	2,400	0.1	0.25%
Revetment		m2	800	500	0.4	0.5 %
Sodding		m2	10	0	0.0	
Sluice	Type A	unit	700,000	0	0.0	
	Type B	unit	10,000,000	0	0.0	
Drainage Facility		unit	500,000	0	0.0	
Bridge		m2	13,300	0	0.0	
2. Administration Cost (5% of 1.)					0.2	
Grand Total					4.6	

Note * : Figures may not add up to totals due to rounding
** : Proportion of construction works.

Table 4.7-1(1/6) DETAILED MESH DATA OF THE FLOOD PRONE AREA

NO.	X	Y	SC (ha)	WP (ha)	CN (ha)	OC (ha)	FR (ha)	RS (ha)	UU (ha)	RC (ha)	FP (ha)	HS (no.)	NB (no.)	NR (m)	PR (m)	BR (m)	RW (m)	IC (m)
1	2	13	0.3	1.2	2.8	0.0	0.0	13.0	3.2	0.2	4.3	165	33	240	530	1,180	0	0
2	3	12	2.2	0.0	11.0	0.0	0.0	0.6	10.5	0.0	0.7	49	7	0	500	0	0	0
3	3	13	0.0	0.0	6.6	0.0	0.0	0.0	2.0	2.1	14.3	19	3	0	0	0	0	0
4	3	14	1.5	2.1	6.2	0.0	0.0	0.5	1.2	0.0	13.5	7	2	0	550	0	0	0
5	3	15	0.0	0.0	5.1	0.0	0.0	1.8	0.4	0.0	17.7	5	3	0	520	0	0	400
6	4	10	0.0	0.0	0.8	0.0	0.0	0.0	17.2	0.0	7.0	0	0	0	0	0	0	0
7	4	11	0.0	0.0	5.8	0.0	0.0	0.0	4.4	11.2	3.6	24	4	0	0	0	0	0
8	4	12	0.0	0.0	10.9	0.0	0.0	0.0	0.7	0.0	13.4	31	12	0	0	0	0	0
9	4	13	0.0	0.0	0.7	0.0	0.0	0.0	1.2	0.9	22.2	0	2	0	0	0	0	0
10	4	14	0.0	0.0	6.2	0.0	0.0	0.0	0.0	1.9	16.9	8	1	0	0	0	0	0
11	4	15	0.9	0.5	13.1	0.0	0.0	1.2	0.0	0.0	9.3	10	5	0	0	260	0	240
12	4	16	15.9	4.0	2.9	0.0	0.0	1.5	0.0	0.0	0.7	21	13	0	0	1,240	0	0
13	4	17	0.0	24.1	0.0	0.0	0.0	0.2	0.0	0.0	0.7	12	4	520	430	0	0	0
14	4	18	1.8	23.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	0	520	0	0	0	880
15	4	19	2.6	22.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9	0	510	0	0	0	180
16	5	9	0.0	0.0	0.5	0.0	0.0	0.0	20.0	0.0	4.5	0	0	0	0	0	0	0
17	5	10	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.0	21.1	2	1	0	0	0	0	0
18	5	11	0.0	0.0	9.0	0.0	0.0	0.0	0.0	7.4	8.6	0	0	0	0	0	0	0
19	5	12	0.0	0.0	13.8	0.0	0.0	0.0	0.3	0.0	10.9	2	0	0	0	0	0	0
20	5	13	0.0	0.0	7.3	0.0	0.0	0.0	0.0	0.0	17.7	0	0	0	0	0	0	0
21	5	14	0.0	0.0	16.9	0.0	0.0	0.0	0.0	4.1	4.0	7	0	0	0	0	0	0
22	5	15	0.3	0.4	10.3	0.0	0.0	0.0	1.6	0.0	12.4	0	0	0	0	540	0	0
23	5	16	5.3	2.2	15.5	0.0	0.2	0.0	0.0	0.0	1.8	1	2	0	0	360	0	0
24	5	17	5.8	15.7	3.3	0.0	0.0	0.0	0.0	0.0	0.2	13	6	0	600	0	0	700
25	5	18	0.4	24.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	0	0	0	0	0	660
26	5	19	8.5	15.9	0.0	0.0	0.0	0.6	0.0	0.0	0.0	7	0	0	0	140	0	620
27	5	20	5.8	12.9	0.2	0.0	0.0	6.1	0.0	0.0	0.0	97	19	520	0	280	0	880
28	6	9	0.0	0.0	3.1	0.0	0.0	0.0	0.0	4.7	17.2	0	0	0	0	0	0	0
29	6	10	0.0	0.0	2.1	0.0	0.0	0.0	0.1	2.0	20.8	1	2	0	0	0	0	0
30	6	11	0.0	0.0	10.1	0.0	0.0	0.0	1.3	8.3	5.3	0	0	0	0	0	0	0
31	6	12	0.0	0.0	17.4	0.0	0.0	0.0	0.0	6.3	1.3	4	0	0	0	0	0	0
32	6	13	0.0	0.0	11.6	0.0	0.0	0.0	0.0	1.5	11.9	16	1	0	0	0	0	0
33	6	14	0.0	0.0	18.3	0.0	0.0	0.0	0.0	3.2	3.5	9	0	0	0	0	0	0
34	6	15	0.0	0.0	21.2	0.0	0.0	0.0	0.0	3.8	0.0	0	0	0	0	0	0	0
35	6	16	8.7	1.1	12.8	0.0	0.0	1.8	0.0	0.0	0.6	34	5	0	0	740	0	0
36	6	17	6.7	13.3	1.1	0.0	0.0	3.9	0.0	0.0	0.0	52	20	0	580	0	0	220
37	6	18	0.0	23.7	1.1	0.0	0.0	0.2	0.0	0.0	0.0	6	0	0	0	0	0	1,040
38	6	19	11.0	12.2	0.0	0.0	0.0	1.8	0.0	0.0	0.0	40	2	0	0	0	0	1,660
39	6	20	1.4	0.4	0.4	0.0	0.0	22.8	0.0	0.0	0.0	258	41	940	0	0	0	0
40	7	8	0.0	0.0	0.0	0.0	0.0	0.0	8.8	0.0	16.2	0	0	0	0	0	0	0
41	7	9	0.0	0.0	0.9	0.0	0.0	0.0	0.7	3.6	19.8	0	0	0	0	0	0	0
42	7	10	0.0	0.0	1.9	0.0	0.0	0.0	1.6	1.9	19.6	0	0	0	0	0	0	0
43	7	11	0.0	0.0	14.6	0.0	0.0	0.0	0.0	2.2	8.2	0	2	0	0	0	0	0
44	7	12	0.0	0.0	17.0	0.0	0.0	0.0	0.0	7.9	0.1	13	1	0	0	0	0	0
45	7	13	0.0	0.0	19.8	0.0	0.0	0.0	0.5	3.0	1.7	15	0	0	0	0	0	0
46	7	14	0.0	0.0	6.6	0.0	0.0	0.0	0.0	0.4	18.0	0	0	0	0	0	0	0
47	7	15	0.0	0.0	10.7	0.0	0.0	0.0	0.0	0.0	14.3	3	0	0	0	0	0	0
48	7	16	6.4	0.0	15.5	0.0	0.0	0.0	0.0	1.1	2.0	5	0	0	0	700	0	0
49	7	17	3.2	7.7	11.5	0.0	0.0	2.6	0.0	0.0	0.0	51	14	0	360	300	0	0
50	7	18	1.7	18.6	0.0	0.0	0.0	3.3	0.0	1.4	0.0	59	5	700	0	0	0	300
51	7	19	19.2	0.0	0.0	0.0	0.0	4.7	0.0	1.1	0.0	37	5	620	360	280	0	0
52	7	20	23.5	1.2	0.0	0.0	0.0	0.0	0.0	0.3	0.0	4	0	0	540	0	0	760
53	7	21	9.4	1.7	0.0	0.0	2.8	0.0	11.1	0.0	0.0	0	0	0	0	0	0	100
54	8	6	0.0	0.0	0.0	0.0	0.0	0.0	15.8	0.0	9.2	0	0	0	0	0	0	0
55	8	7	0.0	0.0	1.9	0.0	0.0	0.0	1.6	0.0	21.5	0	0	0	0	0	0	0
56	8	8	0.0	0.0	3.7	0.0	0.0	0.0	1.8	0.0	19.5	0	0	0	0	0	0	0
57	8	9	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.9	21.5	0	0	0	0	0	0	0
58	8	10	0.0	0.0	1.3	0.0	0.0	0.0	0.2	0.0	23.5	0	0	0	0	0	0	0
59	8	11	0.0	0.0	4.0	0.0	0.0	0.0	7.9	0.0	13.1	3	0	0	0	0	0	0
60	8	12	0.8	0.0	5.8	0.0	0.0	0.0	0.4	5.7	12.3	25	0	0	0	0	0	0
61	8	13	4.5	0.0	13.2	0.0	0.0	2.2	0.0	5.1	0.0	31	8	0	0	560	0	0
62	8	14	0.0	0.0	11.9	0.0	0.0	0.7	0.0	4.4	8.0	29	5	0	0	500	0	0
63	8	15	0.0	0.0	11.4	0.0	0.0	0.0	1.4	1.5	10.7	8	0	0	0	0	0	0
64	8	16	3.3	0.0	14.4	0.0	1.3	0.0	3.8	1.8	0.4	1	0	0	0	200	0	0
65	8	17	10.3	8.0	5.8	0.0	0.0	0.9	0.0	0.0	0.0	23	2	100	160	640	0	0
66	8	18	7.0	15.9	0.0	0.0	0.0	1.6	0.0	0.5	0.0	18	0	0	0	180	0	540
67	8	19	13.6	10.5	0.0	0.0	0.0	0.0	0.4	0.5	0.0	9	0	0	0	0	0	440
68	8	20	23.7	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0	7	0	0	500	0	0	0
69	8	21	17.6	0.0	0.6	0.0	0.0	0.0	6.8	0.0	0.0	5	0	0	540	0	0	0
70	9	6	0.0	0.0	0.2	0.0	0.0	0.0	1.5	3.2	20.1	2	3	0	0	0	0	0
71	9	7	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	24.1	0	0	0	0	0	0	0
72	9	8	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	24.1	0	0	0	0	0	0	0
73	9	9	0.0	1.6	0.0	0.0	0.0	0.0	0.7	3.3	19.4	0	0	0	0	0	0	0
74	9	10	4.4	0.0	0.0	0.0	0.0	0.0	6.9	0.6	13.1	1	0	0	0	0	0	0
75	9	11	11.7	0.0	0.0	0.0	0.0	0.0	8.9	0.0	4.4	0	0	0	0	0	0	0
76	9	12	14.2	0.0	0.5	0.0	0.0	0.0	0.2	2.1	8.0	6	0	0	0	660	0	140
77	9	13	22.1	0.0	2.4	0.0	0.0	0.0	0.1	0.0	0.4	0	0	0	0	960	0	0
78	9	14	12.5	0.0	6.7	0.0	0.0	1.1	0.4	4.3	0.0	24	3	0	220	280	0	0
79	9	15	5.5	12.2	4.8	0.0	0.0	2.2	0.0	0.3	0.0	11	5	0	280	0	0	420
80	9	16	11.1	5.8	6.0	0.0	0.0	0.0	0.6	0.8	0.7	7	1	0	180	0	0	0
81	9	17	14.1	0.0	6.7	0.0	0.0	3.6	0.0	0.6	0.0	0	0	540	660	340	0	0
82	9	18	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	360	340	0	120
83	9	19	13.4	9.9	0.5	0.0	0.0	0.0	1.2	0.0	0.0	0	0	0	360	0	0	140
84	9	20	4.0	20.6	0.0	0.0	0.0	0.0	0.4	0.0	0.0	7	0	0	0	0	0	460
85	10	5	0.0	0.0	0.0	0.0	0.0	0.0	12.2	0.0	12.8	0	0	0	0	0	0	0

Note SC:Sugarcane WP:Wet Paddy CN:Coconut,Nipa OC:Orchard FR:Forest
RS:Residential UU:Unused RC:River Channel FP:Fishpond HS:House
NR:Non-residential Building NR:National Road NR:National Road PR:Provincial Road
BR:Barangay Road RW:Railway IC:Irrigation Channel

Table 4.7-1(2/6) DETAILED MESH DATA OF THE FLOOD PRONE AREA

NO.	X	Y	SC (ha)	WP (ha)	CN (ha)	OC (ha)	FR (ha)	RS (ha)	UU (ha)	RC (ha)	FP (ha)	HS (no.)	NB (no.)	NR (m)	PR (m)	BR (m)	RW (m)	IC (m)
86	10	6	0.0	0.0	4.3	0.0	0.0	0.0	1.3	3.8	15.6	4	2	0	0	0	0	0
87	10	7	0.0	0.0	2.1	0.0	0.0	0.0	8.2	4.5	10.2	5	3	0	0	0	0	0
88	10	8	0.2	3.8	11.4	0.0	0.0	0.0	1.5	2.7	5.4	27	4	0	0	0	0	0
89	10	9	4.5	3.0	5.8	0.0	0.0	0.0	5.6	0.0	6.1	17	4	0	0	0	0	0
90	10	10	22.5	0.0	1.0	0.0	0.0	0.0	1.5	0.0	0.0	14	6	0	960	0	0	0
91	10	11	18.7	0.0	3.6	0.0	0.0	0.0	1.5	1.2	0.0	1	1	0	760	0	0	0
92	10	12	12.0	0.0	6.2	0.0	0.0	0.0	0.2	4.7	1.9	4	0	0	0	0	0	0
93	10	13	10.7	0.8	9.0	0.0	0.0	0.0	0.0	2.1	2.4	15	2	0	500	0	0	0
94	10	14	18.8	0.0	3.7	0.0	0.0	1.1	0.0	1.4	0.0	19	3	0	0	1,080	0	0
95	10	15	15.1	7.5	1.4	0.0	0.0	0.0	0.0	1.0	0.0	5	0	0	900	0	0	0
96	10	16	14.1	6.3	2.8	0.0	0.0	1.8	0.0	0.0	0.0	34	4	0	890	0	0	100
97	10	17	17.4	0.0	2.6	0.0	0.0	4.4	0.0	0.6	0.0	42	22	560	400	0	0	0
98	10	18	24.5	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	9	3	0	0	640	900	600
99	10	19	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	27	0	0	0	480	580	140
100	10	20	20.2	4.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4	0	0	0	680	0	500
101	11	4	0.0	0.0	0.0	0.0	0.0	0.0	15.2	0.0	9.8	0	0	0	0	0	0	0
102	11	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
103	11	6	0.0	0.0	0.8	0.0	0.0	0.0	1.0	1.8	21.4	0	0	0	0	0	0	0
104	11	7	0.0	0.0	1.9	0.0	0.9	0.0	0.1	0.0	22.1	3	0	0	0	0	0	0
105	11	8	4.5	0.0	14.1	0.0	0.0	0.0	0.0	0.8	5.6	21	3	0	0	620	0	0
106	11	9	0.0	0.0	23.4	0.0	0.0	0.0	0.1	1.5	0.0	32	10	0	0	680	0	0
107	11	10	0.0	0.0	16.7	0.0	0.0	0.0	3.6	1.8	2.9	52	11	0	0	840	0	0
108	11	11	8.9	0.0	0.0	0.0	0.0	0.0	0.7	0.3	15.1	12	0	0	0	740	0	0
109	11	12	19.9	0.0	2.4	0.0	0.0	0.0	0.6	2.1	0.0	5	0	0	0	0	0	0
110	11	13	21.8	0.0	0.3	0.0	0.0	2.4	0.0	0.5	0.0	59	7	0	500	260	0	0
111	11	14	22.5	0.0	0.0	0.0	0.0	2.5	0.0	0.0	0.0	40	3	0	740	320	540	0
112	11	15	16.7	5.0	1.3	0.0	0.0	0.0	0.2	1.8	0.0	5	0	0	150	700	0	0
113	11	16	22.3	2.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	12	3	0	240	980	0	0
114	11	17	24.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	8	2	280	80	660	460	0
115	11	18	15.8	8.7	0.3	0.0	0.0	0.0	0.0	0.2	0.0	0	0	0	0	520	180	0
116	11	19	15.5	6.0	0.4	0.0	0.0	3.1	0.0	0.0	0.0	27	0	0	0	880	0	0
117	11	20	24.3	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	0	0	0	1,700	0	0
118	12	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.3	20.7	0	0	0	0	0	0	0
119	12	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	21.6	0	0	0	0	0	0	0
120	12	6	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	23.4	0	0	0	0	0	0	0
121	12	7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
122	12	8	8.0	1.3	3.9	0.0	0.0	0.0	1.4	0.0	10.4	1	0	0	0	160	0	0
123	12	9	1.6	0.0	0.0	0.0	0.0	2.4	1.4	1.9	17.7	92	18	0	0	1,100	0	0
124	12	10	0.0	0.0	8.4	0.0	0.0	13.3	0.2	3.1	0.0	232	71	0	1,760	0	0	0
125	12	11	1.0	0.0	10.0	0.0	0.0	13.8	0.2	0.0	0.0	115	54	0	1,540	0	0	0
126	12	12	8.3	0.0	11.3	0.0	0.0	0.0	2.1	3.3	0.0	13	1	0	20	1,100	0	0
127	12	13	23.2	0.0	1.5	0.0	0.0	0.3	0.0	0.0	0.0	9	0	0	30	400	340	0
128	12	14	24.6	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	160	220	360
129	12	15	21.4	2.5	0.8	0.0	0.0	0.0	0.3	0.0	0.0	14	1	0	0	600	0	0
130	12	16	11.7	5.7	3.1	0.0	0.0	4.1	0.4	0.0	0.0	68	10	550	0	0	940	320
131	12	17	20.0	3.3	1.0	0.0	0.0	0.6	0.1	0.0	0.0	4	4	0	0	580	360	0
132	12	18	21.6	2.7	0.0	0.0	0.0	0.7	0.0	0.0	0.0	11	0	0	570	0	0	0
133	12	19	23.6	0.5	0.0	0.0	0.0	0.0	0.7	0.2	0.0	23	0	0	380	400	0	0
134	12	20	22.5	2.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	0	0	0	200	0	600
135	12	21	12.5	9.5	0.6	0.0	0.0	0.0	2.4	0.0	0.0	21	0	0	0	580	0	200
136	13	4	0.0	0.0	2.3	0.0	0.0	0.0	0.0	1.9	20.8	0	0	0	0	0	0	0
137	13	5	0.0	0.0	3.9	0.0	0.0	0.0	0.0	6.4	14.7	0	0	0	0	0	0	0
138	13	6	0.0	0.0	2.3	0.0	0.0	0.0	0.1	2.5	20.1	0	0	0	0	0	0	0
139	13	7	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.8	24.0	0	0	0	0	0	0	0
140	13	8	12.9	0.0	0.0	0.0	0.0	0.0	1.2	0.0	10.9	0	0	0	0	0	0	0
141	13	9	14.4	0.0	9.0	0.0	0.0	1.1	0.5	0.0	0.0	32	6	380	560	0	0	0
142	13	10	13.3	0.0	2.8	0.0	0.0	7.6	0.0	1.3	0.0	49	22	280	0	0	0	0
143	13	11	11.7	0.0	10.4	0.0	0.0	1.6	0.0	1.3	0.0	46	3	0	160	0	0	0
144	13	12	23.5	0.0	0.3	0.0	0.0	0.0	0.0	1.2	0.0	13	1	0	540	600	0	0
145	13	13	24.6	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	14	2	0	540	0	1,200	100
146	13	14	24.8	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	9	0	240	940	0	650
147	13	15	22.4	0.0	0.0	0.0	0.0	0.0	1.5	1.1	0.0	29	0	0	0	480	600	0
148	13	16	19.4	0.0	1.0	0.0	0.0	4.6	0.0	0.0	0.0	54	9	520	400	0	0	0
149	13	17	24.0	0.9	0.0	0.0	0.0	0.0	0.1	0.0	0.0	17	2	540	0	0	620	0
150	13	18	23.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	18	3	0	0	520	360	0
151	13	19	23.0	0.0	0.4	0.0	0.0	1.3	0.0	0.3	0.0	27	0	0	360	440	0	0
152	13	20	24.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	10	0	0	0	860	0	0
153	13	21	5.8	19.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	0	0	0	160	0	1,180
154	13	22	0.0	20.1	1.2	0.0	0.0	0.0	3.7	0.0	0.0	16	0	0	0	0	0	1,040
155	13	23	5.1	17.1	1.2	0.0	0.0	0.6	1.0	0.0	0.0	17	0	0	0	970	0	500
156	13	24	15.1	4.0	0.4	0.4	5.1	0.0	0.0	0.0	0.0	13	0	0	0	500	0	1,080
157	14	3	0.0	0.0	0.0	0.0	0.0	0.0	10.0	0.0	15.0	0	0	0	0	0	0	0
158	14	4	0.0	0.0	0.4	0.0	0.0	0.0	0.0	1.5	23.1	0	0	0	0	0	0	0
159	14	5	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.2	24.7	0	0	0	0	0	0	0
160	14	6	0.0	0.0	5.6	0.0	0.0	0.0	0.0	1.8	17.6	0	0	0	0	0	0	0
161	14	7	0.0	0.0	0.0	0.0	0.0	0.0	0.5	1.1	23.4	0	0	0	0	0	0	0
162	14	8	5.6	0.0	4.3	0.0	0.0	0.1	0.0	0.0	15.0	6	0	0	120	0	0	0
163	14	9	0.0	0.0	2.6	0.0	0.0	0.6	0.2	0.0	21.6	10	2	100	480	400	0	0
164	14	10	18.0	0.0	5.1	0.0	0.0	1.2	0.0	0.7	0.0	30	3	480	0	520	0	0
165	14	11	20.5	0.0	2.6	0.0	0.0	0.0	1.2	0.7	0.0	19	1	0	0	1,340	0	0
166	14	12	23.4	0.0	0.1	0.0	0.0	0.0	0.2	1.3	0.0	3	0	0	0	0	140	0
167	14	13	20.6	0.0	2.9	0.0	0.0	0.7	0.0	0.8	0.0	13	2	0	0	380	350	0
168	14	14	13.5	0.0	6.1	0.0	0.0	4.2	0.0	1.2	0.0	79	5	0	180	780	180	0
169	14	15	20.2	0.0	1.3	0.0	0.0	3.5	0.0	0.0	0.0	47	18	0	1,100	0	0	480
170	14	16	1.8	22.0	0.8	0.0	0.0	0.4	0.0	0.0	0.0	4	0	500	540	0	0	580

Note SC:Sugarcane WP:Wet Paddy CN:Coconut,Nipa OC:Orchard FR:Forest
RS:Residential UU:Unused RC:River Channel FP:Fish Pond HS:House
NR:Non-residential Building NR:National Road NR:National Road PR:Provincial Road
BR:Barangay Road RW:Railway IC:Irrigation Channel

Table 4.7-1(3/6) DETAILED MESH DATA OF THE FLOOD PRONE AREA

NO.	X	Y	SC (ha)	WP (ha)	CN (ha)	OC (ha)	FR (ha)	RS (ha)	UU (ha)	RC (ha)	FP (ha)	HS (no.)	NB (no.)	NR (m)	PR (m)	BR (m)	RW (m)	IC (m)
171	14	17	17.7	3.9	3.4	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0
172	14	18	20.1	1.5	0.0	0.0	0.0	3.4	0.0	0.0	0.0	48	8	0	280	600	0	0
173	14	19	23.7	0.6	0.0	0.0	0.0	0.5	0.0	0.2	0.0	17	0	0	540	180	0	0
174	14	20	13.1	10.0	0.5	0.0	0.0	0.0	0.0	1.4	0.0	36	0	0	420	0	0	240
175	14	21	11.9	11.5	0.0	0.0	0.0	0.0	0.0	1.6	0.0	10	0	0	280	0	0	540
176	14	22	12.1	12.6	0.0	0.0	0.0	0.3	0.0	0.0	0.0	7	0	0	420	0	0	680
177	14	23	19.5	2.1	0.2	0.0	0.0	3.2	0.0	0.0	0.0	38	6	1,040	0	0	0	1,000
178	14	24	13.8	0.0	0.0	2.2	0.0	2.7	4.6	1.7	0.0	56	3	0	1,220	260	0	0
179	15	2	0.0	0.0	0.8	0.0	0.0	0.0	17.5	0.0	6.7	0	0	0	0	0	0	0
180	15	3	0.0	0.0	0.5	0.0	0.0	0.0	0.0	2.1	22.4	0	0	0		0	0	0
181	15	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
182	15	5	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.8	22.6	0	0	0	0	0	0	0
183	15	6	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.2	24.1	1	1	0	0	0	0	0
184	15	7	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0	24.1	0	0	0	0	0	0	0
185	15	8	4.3	0.0	5.9	0.0	0.0	0.0	1.0	0.0	13.8	0	0	0	0	0	0	0
186	15	9	0.0	0.0	3.7	0.0	0.0	0.0	0.1	0.0	21.2	7	0	0	160	0	0	0
187	15	10	23.4	0.0	1.1	0.0	0.0	0.0	0.5	0.0	0.0	1	0	504	520	540	0	0
188	15	11	19.0	0.0	1.3	0.0	0.0	0.0	0.0	4.7	0.0	6	0	0	860	0	0	0
189	15	12	21.0	0.0	0.0	0.0	0.0	0.5	2.0	1.5	0.0	11	3	0	0	440	0	0
190	15	13	23.0	0.0	1.1	0.0	0.0	0.7	0.0	0.2	0.0	17	2	0	0	920	0	440
191	15	14	24.0	0.0	0.2	0.0	0.0	0.8	0.0	0.0	0.0	15	0	0	0	700	540	0
192	15	15	22.6	0.0	0.5	0.0	0.0	1.9	0.0	0.0	0.0	31	2	300	140	440	0	300
193	15	16	11.9	12.7	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0	0	22	0	340	0	160
194	15	17	22.2	2.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4	0	0	560	540	0	0
195	15	18	21.3	2.2	0.0	0.0	0.0	1.5	0.0	0.0	0.0	33	0	0	880	0	0	0
196	15	19	11.6	13.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	11	0	0	0	0	0	0
197	15	20	3.3	21.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	140	0	0	1,360
198	15	21	3.8	20.9	0.0	0.0	0.0	0.2	0.0	0.1	0.0	11	0	0	550	0	0	900
199	15	22	11.7	8.4	2.9	0.0	0.0	0.7	0.0	1.3	0.0	20	0	0	440	450	0	0
200	15	23	19.7	0.0	1.2	0.0	0.0	2.9	0.0	1.2	0.0	54	9	460	0	0	0	0
201	15	24	6.9	2.4	2.5	2.0	0.0	9.3	0.8	1.1	0.0	84	18	0	1,040	640	0	620
202	16	1	0.0	0.0	1.7	0.0	0.0	0.0	16.2	0.0	7.1	0	0	0	0	0	0	0
203	16	2	0.0	0.0	3.0	0.0	0.0	0.0	0.0	3.1	18.9	0	0	0	0	0	0	0
204	16	3	0.0	0.0	4.1	0.0	0.0	0.0	0.0	7.4	13.5	1	0	0	0	0	0	0
205	16	4	0.0	0.0	7.5	0.0	0.0	0.0	0.0	13.0	4.5	0	0	0	0	0	0	0
206	16	5	0.0	0.0	14.7	0.0	0.0	0.0	0.0	7.1	3.2	0	0	0	0	0	0	0
207	16	6	1.8	0.0	4.5	0.0	0.0	0.0	0.2	6.7	11.8	0	0	0	0	0	0	0
208	16	7	0.5	0.0	3.8	0.0	0.0	0.0	0.5	7.9	12.3	9	0	0	0	0	0	0
209	16	8	1.8	0.0	2.3	0.0	0.0	0.0	0.4	7.5	13.0	3	1	0	0	0	0	0
210	16	9	16.4	0.0	3.4	0.0	0.0	0.0	0.2	0.9	4.1	5	0	0	0	340	0	0
211	16	10	0.0	0.0	1.6	0.0	0.0	1.3	0.4	2.9	18.8	25	6	280	140	640	0	0
212	16	11	14.6	0.0	1.7	0.0	0.0	2.7	0.8	5.2	0.0	49	15	380	160	280	0	0
213	16	12	15.8	0.0	0.4	0.0	0.0	2.2	0.2	6.4	0.0	36	6	0	0	740	0	0
214	16	13	24.8	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0	0	0	0	840	160	440
215	16	14	24.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0	0	0	0	660	460	960
216	16	15	22.1	0.9	2.0	0.0	0.0	0.0	0.0	0.0	0.0	6	0	500	0	460	0	440
217	16	16	20.7	4.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1	0	0	0	400	0	940
218	16	17	23.4	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	0	0	0	500	0	240
219	16	18	20.9	2.4	1.3	0.0	0.0	0.4	0.0	0.0	0.0	14	4	0	520	540	140	0
220	16	19	6.7	14.0	2.3	0.0	0.0	2.0	0.0	0.0	0.0	23	2	0	400	0	0	0
221	16	20	0.0	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0
222	16	21	9.5	15.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	7	0	0	90	0	0	340
223	16	22	8.3	16.1	0.0	0.0	0.0	0.0	0.6	0.0	0.0	11	0	0	480	0	0	560
224	16	23	12.0	8.1	0.0	0.0	0.0	4.9	0.0	0.0	0.0	37	6	840	0	0	0	720
225	16	24	5.4	14.1	2.1	0.0	0.0	3.3	0.1	0.0	0.0	27	1	200	540	340	0	580
226	17	1	0.0	0.0	0.0	0.0	0.0	0.0	22.0	0.0	3.0	0	0	0	0	0	0	0
227	17	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	1	0	0	0	0	0	0
228	17	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
229	17	4	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	23.9	0	0	0	0	0	0	0
230	17	5	0.0	0.0	3.5	0.0	0.0	0.0	1.3	4.3	15.9	0	0	0	0	0	0	0
231	17	6	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.0	24.0	4	0	0	0	0	0	0
232	17	7	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	24.8	0	0	0	0	0	0	0
233	17	8	2.6	0.0	0.0	0.0	0.0	0.0	0.3	0.4	21.7	0	0	0	0	0	0	0
234	17	9	16.5	0.0	0.5	0.0	0.0	0.6	0.1	6.1	1.2	11	5	0	200	580	0	0
235	17	10	20.0	0.0	3.0	0.0	0.0	0.0	0.0	2.0	0.0	19	1	0	485	100	0	0
236	17	11	21.4	0.0	3.2	0.0	0.0	0.0	0.4	0.0	0.0	8	2	530	0	300	0	0
237	17	12	19.2	0.0	0.2	0.0	0.0	0.0	0.2	5.4	0.0	3	0	0	0	0	120	480
238	17	13	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	360	520	340
239	17	14	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	1,100	580
240	17	15	24.6	0.0	0.0	0.0	0.0	0.0	0.4	0.0	0.0	1	0	530	0	0	0	640
241	17	16	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	500	0	1,300
242	17	17	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	260	0	1,040
243	17	18	24.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	500	360	340	500	640
244	17	19	16.9	3.7	0.3	0.0	0.0	4.1	0.0	0.0	0.0	48	4	0	640	160	0	720
245	17	20	9.7	14.9	0.0	0.0	0.0	0.4	0.0	0.0	0.0	7	0	0	0	0	0	0
246	17	21	17.9	1.7	0.5	0.0	0.0	4.9	0.0	0.0	0.0	32	4	0	660	0	0	0
247	17	22	20.3	1.7	0.7	0.0	0.0	2.3	0.0	0.0	0.0	37	10	480	300	0	0	0
248	17	23	16.4	8.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	11	1	140	440	0	480	970
249	17	24	0.8	24.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	1	0	0	0	0	0	1,600
250	17	25	1.5	18.5	2.8	0.0	0.0	2.0	0.2	0.0	0.0	30	0	0	380	180	0	700
251	18	1	0.0	0.0	0.0	0.0	0.0	0.0	16.8	0.0	8.2	0	0	0	0	0	0	0
252	18	2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	24.4	0	0	0	0	0	0	0
253	18	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
254	18	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	23.0	0	0	0	0	0	0	0
255	18	5	0.0	0.0	0.3	0.0	0.0	0.0	0.5	0.0	24.2	1	1	0	0	0	0	0

Note SC:Sugarcane WP:Wet Paddy CH:Coconut,Nipa OC:Orchard FR:Forest
RS:Residential UU:Unused RC:River Channel FP:Fish Pond HS:House
NR:Non-residential Building NR:National Road NR:National Road PR:Provincial Road
BR:Barangay Road RW:Railway IC:Irrigation Channel

Table 4.7-1(4/6) DETAILED MESH DATA OF THE FLOOD PRONE AREA

NO.	X	Y	SC (ha)	WP (ha)	CN (ha)	OC (ha)	FR (ha)	RS (ha)	UU (ha)	RC (ha)	FP (ha)	HS (no.)	NB (no.)	NR (m)	PR (m)	BR (m)	RW (m)	IC (m)
256	18	6	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	23.9	2	2	0	0	0	0	0
257	18	7	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	24.0	0	0	0	0	0	0	0
258	18	8	0.2	2.0	0.0	0.0	0.0	0.0	1.1	0.0	21.7	1	0	0	560	0	0	0
259	18	9	17.1	0.0	5.1	0.0	0.0	0.0	0.0	0.0	2.8	41	10	0	1,000	0	0	0
260	18	10	6.3	0.0	18.6	0.0	0.0	0.0	0.1	0.0	0.0	3	3	0	320	0	0	0
261	18	11	24.8	0.9	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0	0	600	460	0	0	420
262	18	12	17.4	0.0	0.4	0.0	0.0	0.0	0.0	7.2	0.0	0	0	430	0	140	0	260
263	18	13	22.7	0.0	0.0	0.0	0.0	0.0	0.0	2.3	0.0	0	0	0	0	120	0	0
264	18	14	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	680	500	180
265	18	15	24.7	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0	0	660	0	0	0	840
266	18	16	24.2	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0	0	0	480	0	1,020	500
267	18	17	15.4	0.0	0.0	9.5	0.0	0.0	0.0	0.1	0.0	0	0	0	0	280	500	0
268	18	18	14.7	0.0	0.0	4.9	0.0	2.7	0.0	2.7	0.0	17	4	520	420	0	910	0
269	18	19	15.5	0.8	0.5	4.2	0.0	4.0	0.0	0.0	0.0	42	14	300	500	230	260	0
270	18	20	18.7	0.0	0.0	0.0	0.0	6.3	0.0	0.0	0.0	81	15	0	500	300	0	0
271	18	21	24.3	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	23	1	0	500	200	0	640
272	18	22	24.4	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	7	0	0	360	400	780	0
273	18	23	22.9	1.1	0.0	0.0	0.0	1.0	0.0	0.0	0.0	7	0	0	0	740	0	1,340
274	18	24	4.5	20.2	0.1	0.0	0.0	0.0	0.2	0.0	0.0	0	0	0	0	60	0	1,520
275	18	25	0.0	24.9	0.0	0.0	0.0	0.0	0.1	0.0	0.0	3	0	0	0	0	0	1,160
276	18	26	0.0	24.8	0.1	0.0	0.0	0.0	0.1	0.0	0.0	4	0	0	0	0	0	1,960
277	19	1	0.0	0.0	0.0	0.0	0.0	0.0	20.6	0.0	4.4	0	0	0	0	0	0	0
278	19	2	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	24.4	0	0	0	0	0	0	0
279	19	3	0.0	0.0	0.0	0.0	0.0	0.0	2.4	5.7	16.9	0	0	0	0	0	0	0
280	19	4	0.0	0.0	0.0	0.0	0.0	0.0	2.8	6.5	15.7	1	0	0	0	0	0	0
281	19	5	0.0	0.0	0.0	0.0	0.0	0.0	1.6	6.5	16.9	1	0	0	0	0	0	0
282	19	6	0.0	0.0	0.0	0.0	0.0	0.0	3.8	2.7	18.5	4	1	0	0	0	0	0
283	19	7	0.0	0.0	0.5	0.0	0.0	0.0	0.9	2.6	21.0	0	0	0	0	0	0	0
284	19	8	1.6	2.1	0.0	0.0	0.0	0.0	1.7	0.0	19.6	1	0	0	0	0	0	0
285	19	9	23.8	0.0	0.6	0.0	0.0	0.5	0.1	0.0	0.0	10	3	0	500	100	0	0
286	19	10	24.0	0.0	0.9	0.0	0.0	0.0	0.1	0.0	0.0	3	5	0	410	0	0	0
287	19	11	23.9	0.0	0.1	0.0	0.0	0.0	1.0	0.0	0.0	0	0	500	460	0	0	760
288	19	12	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0	2	240	460	0	380	1,300
289	19	13	15.3	0.0	0.0	0.0	0.0	2.8	0.0	6.9	0.0	28	6	500	240	180	0	80
290	19	14	20.1	0.0	0.0	0.0	0.0	3.1	0.4	1.4	0.0	24	5	540	0	480	660	0
291	19	15	18.1	0.0	0.0	0.0	0.0	0.0	1.1	5.8	0.0	0	0	0	0	0	580	0
292	19	16	17.1	0.0	0.8	0.0	0.0	0.0	1.0	6.1	0.0	0	0	0	0	0	160	0
293	19	17	14.6	0.0	2.6	2.0	0.0	0.9	0.0	4.9	0.0	15	0	0	0	240	120	0
294	19	18	13.6	0.0	1.1	0.0	0.0	0.3	4.6	5.4	0.0	5	0	0	0	0	0	0
295	19	19	7.6	0.0	0.7	11.5	0.0	0.7	0.0	4.5	0.0	1	2	360	0	380	360	980
296	19	20	21.2	0.0	0.2	2.3	0.0	1.3	0.0	0.0	0.0	29	0	580	310	0	1,100	0
297	19	21	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	100	500	0	0	1,100
298	19	22	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	480	0	900	1,280
299	19	23	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4	0	0	900	0	440	1,140
300	19	24	20.3	4.6	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0	0	0	0	570	0	1,360
301	19	25	3.9	21.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	21	0	0	0	0	0	1,100
302	19	26	0.0	24.9	0.0	0.0	0.0	0.0	0.1	0.0	0.0	3	0	0	0	0	0	1,620
303	19	27	5.9	13.0	0.0	0.0	0.0	6.0	0.1	0.0	0.0	64	14	0	540	220	0	1,070
304	20	2	0.0	0.0	0.0	0.0	0.0	0.0	15.5	0.0	9.5	0	0	0	0	0	0	0
305	20	3	0.0	0.0	0.0	0.0	0.0	0.0	1.7	7.8	15.5	0	0	0	0	0	0	0
306	20	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
307	20	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
308	20	6	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	24.5	0	0	0	0	0	0	0
309	20	7	0.0	0.0	3.5	0.0	0.0	0.0	0.0	0.0	21.5	0	0	0	0	0	0	0
310	20	8	0.0	5.1	2.5	0.0	0.0	0.0	0.0	0.0	17.4	5	0	0	0	0	0	0
311	20	9	11.2	10.2	1.1	0.0	0.0	2.0	0.2	0.0	0.3	38	9	0	860	0	0	0
312	20	10	24.8	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0	0	0	760	500	0	1,120
313	20	11	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	24.8	0	0	500	380	0	0	1,320
314	20	12	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	660	0	520	900
315	20	13	24.2	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	44	0	140	0	0	0	1,100
316	20	14	12.5	0.0	1.3	0.0	0.0	6.2	0.0	5.0	0.0	94	16	640	240	160	280	360
317	20	15	18.1	1.1	0.0	0.0	0.0	5.5	0.0	0.3	0.0	61	7	0	1,060	0	0	0
318	20	16	24.5	0.0	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	580	0	470	0
319	20	17	21.8	0.0	2.6	0.0	0.0	0.6	0.0	0.0	0.0	12	0	0	180	0	0	0
320	20	18	17.7	0.0	0.0	0.0	0.0	0.0	1.8	5.5	0.0	13	0	0	0	180	0	0
321	20	19	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	0	0	0	1,020	0	1,720
322	20	20	24.5	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0	0	0	0	0	1,090	440	1,440
323	20	21	24.0	0.0	0.0	0.0	0.0	0.6	0.4	0.0	0.0	9	1	520	720	340	560	510
324	20	22	23.8	0.0	0.0	0.0	0.0	0.6	0.6	0.0	0.0	11	0	520	240	0	740	1,250
325	20	23	24.4	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0	0	500	100	840	970	840
326	20	24	5.9	0.0	0.0	0.0	0.0	17.7	1.4	0.0	0.0	140	6	500	430	0	0	410
327	20	25	3.9	1.8	0.4	0.0	0.0	18.9	0.0	0.0	0.0	33	19	500	0	0	0	220
328	20	26	9.8	4.2	0.0	0.0	0.0	11.0	0.0	0.0	0.0	10	0	360	500	0	0	1,340
329	20	27	23.0	0.6	0.0	0.0	0.0	1.3	0.1	0.0	0.0	21	0	0	500	0	0	1,660
330	20	28	13.5	4.0	0.0	0.0	0.0	2.8	4.7	0.0	0.0	56	2	0	300	280	0	540
331	21	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
332	21	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	2	0	0	0	0	0	0
333	21	5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
334	21	6	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	24.8	2	0	0	410	0	0	0
335	21	7	0.0	2.9	1.7	0.0	0.0	2.3	0.0	0.0	18.1	77	6	0	200	160	0	0
336	21	8	11.0	3.9	3.5	0.0	0.0	1.0	0.1	0.0	5.5	41	9	0	540	0	0	0
337	21	9	12.5	3.5	7.5	0.0	0.0	1.5	0.0	0.0	0.0	24	6	0	420	380	0	0
338	21	10	22.1	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	6	0	0	1,100	0	0	580
339	21	11	24.4	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0	1	0	400	660	0	0	200
340	21	12	24.8	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	600	660	660

Note
SC:Sugarcane WP:Wet Paddy CN:Coconut,Nipa OC:Orchard FR:Forest
RS:Residential UU:Unused RC:River Channel FP:Fish Pond HS:House
NR:Non-residential Building NR:National Road NR:National Road PR:Provincial Road
BR:Barangay Road RW:Railway IC:Irrigation Channel

Table 4.7-1(5/6) DETAILED MESH DATA OF THE FLOOD PRONE AREA

NO.	X	Y	SC (ha)	WP (ha)	CN (ha)	OC (ha)	FR (ha)	RS (ha)	UU (ha)	RC (ha)	FP (ha)	HS (no.)	NB (no.)	NR (m)	PR (m)	BR (m)	RW (m)	IC (m)
341	21	13	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	540	600
342	21	14	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	0	20	500	0	510	360
343	21	15	16.2	0.0	2.1	0.0	0.0	6.4	0.3	0.0	0.0	74	13	680	1,200	0	430	500
344	21	16	24.7	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	6	1	70	220	0	720	0
345	21	17	20.0	0.0	2.1	0.0	0.0	2.9	0.0	0.0	0.0	15	6	0	840	0	0	0
346	21	18	9.3	0.0	0.0	0.0	0.0	7.8	0.4	7.5	0.0	106	24	400	280	0	0	0
347	21	19	19.5	0.0	0.0	0.0	0.0	5.5	0.0	0.0	0.0	62	16	0	520	60	0	0
348	21	20	24.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0	0	0	540	500	0	0
349	21	21	22.7	0.8	0.0	0.0	0.0	1.5	0.0	0.0	0.0	12	2	0	0	370	520	0
350	21	22	23.5	0.0	0.2	0.0	0.0	0.0	0.0	1.3	0.0	9	1	0	900	0	0	0
351	21	23	15.8	0.0	0.1	0.0	0.0	0.0	4.9	4.2	0.0	0	0	0	0	540	0	0
352	21	24	14.8	0.0	0.0	0.2	0.0	5.6	1.8	2.6	0.0	180	15	0	0	840	0	0
353	21	25	24.4	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.0	2	0	0	0	140	0	0
354	21	26	24.8	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	3	0	420	940	0	0	640
355	21	27	24.8	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	1	0	380	1,100	0	0	1,940
356	21	28	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	1,150	0	0	540
357	22	2	0.0	0.0	0.0	0.0	0.0	0.0	16.2	0.0	8.8	0	0	0	0	0	0	0
358	22	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
359	22	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
360	22	5	0.0	6.6	0.0	0.0	0.0	0.0	0.0	0.0	18.4	0	0	0	0	0	0	0
361	22	6	0.0	17.5	0.0	0.0	0.0	0.0	0.5	0.0	7.0	6	1	0	200	0	0	0
362	22	7	12.6	10.0	1.7	0.0	0.0	0.0	0.2	0.0	0.5	26	2	0	580	0	0	0
363	22	8	8.8	6.2	9.0	0.0	0.0	0.0	0.0	0.0	1.0	24	2	0	380	0	0	0
364	22	9	14.5	6.9	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	820	0	0	0
365	22	10	23.7	0.0	1.1	0.0	0.0	0.0	0.2	0.0	0.0	2	1	0	1,320	0	0	500
366	22	11	0.0	24.4	0.2	0.0	0.0	0.3	0.1	0.0	0.0	6	5	220	200	0	0	400
367	22	12	22.4	0.0	1.4	0.0	0.0	1.0	0.0	0.2	0.0	27	0	0	260	0	760	460
368	22	13	24.6	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	7	0	0	0	620	190	520
369	22	14	24.4	0.0	0.0	0.0	0.0	0.6	0.0	0.0	0.0	3	2	0	0	590	0	1,780
370	22	15	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	220	1,540
371	22	16	18.2	0.0	0.0	0.0	0.0	6.8	0.0	0.0	0.0	93	20	600	780	0	380	330
372	22	17	10.8	0.0	0.1	0.0	0.0	14.1	0.0	0.0	0.0	195	41	440	1,580	580	0	0
373	22	18	3.8	0.0	2.6	0.0	0.0	16.9	0.0	1.7	0.0	401	45	640	500	0	0	0
374	22	19	7.5	0.0	1.8	0.0	0.0	9.0	0.0	6.7	0.0	179	11	0	700	0	0	0.
375	22	20	24.8	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0	0	0	680	800	0	0
376	22	21	21.3	0.0	0.0	0.0	0.0	0.2	0.0	3.5	0.0	6	0	200	640	0	0	0
377	22	22	21.2	0.0	0.4	0.0	0.0	0.0	0.2	3.2	0.0	13	0	0	340	160	0	0
378	22	23	24.0	0.0	0.0	0.0	0.0	0.0	0.4	0.6	0.0	0	0	0	600	900	0	0
379	22	24	20.5	0.0	0.0	0.0	0.0	0.0	0.6	3.9	0.0	0	0	0	1,200	0	360	340
380	22	25	18.7	0.0	0.0	0.0	0.0	0.9	0.4	5.0	0.0	23	0	0	360	340	0	0
381	22	26	14.8	0.0	0.0	0.0	0.0	0.0	0.6	9.6	0.0	0	0	0	700	0	0	0
382	22	27	23.0	0.0	0.0	0.0	0.4	1.5	0.1	0.0	0.0	10	9	740	260	140	540	1,320
383	22	28	22.2	0.0	0.0	0.0	0.0	2.2	0.0	0.6	0.0	11	4	0	1,470	0	130	620
384	22	29	20.5	0.0	0.0	0.0	0.0	0.0	4.0	0.5	0.0	0	0	0	0	450	0	200
385	23	2	0.0	0.0	0.0	0.0	0.0	0.0	15.0	0.0	10.0	4	0	0	0	0	0	0
386	23	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
387	23	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
388	23	5	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	19.7	0	0	0	0	0	0	0
389	23	6	0.0	21.5	0.9	0.0	0.0	1.0	0.0	0.0	1.6	48	8	0	400	0	0	0
390	23	7	0.6	21.1	0.0	0.0	0.0	3.3	0.0	0.0	0.0	39	9	0	500	140	0	0
391	23	8	2.2	8.0	7.5	0.0	0.0	3.8	1.5	0.0	2.0	86	8	440	980	0	0	0
392	23	9	22.7	1.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0	1	1	300	500	600	0	0
393	23	10	24.2	0.7	0.0	0.0	0.0	0.0	0.1	0.0	0.0	3	1	0	220	0	0	90
394	23	11	22.4	0.0	1.8	0.0	0.0	0.8	0.0	0.0	0.0	6	4	500	320	0	0	0
395	23	12	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	580	0	1,240
396	23	13	24.1	0.0	0.3	0.0	0.0	0.6	0.0	0.0	0.0	34	0	0	0	60	500	900
397	23	14	24.2	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	14	0	200	0	940	0	1,200
398	23	15	20.7	0.3	0.2	0.0	0.0	3.6	0.2	0.0	0.0	60	8	540	0	580	100	720
399	23	16	12.0	1.1	0.0	0.0	0.0	11.9	0.0	0.0	0.0	124	28	600	0	0	500	640
400	23	17	0.9	0.4	0.1	0.0	0.0	23.6	0.0	0.0	0.0	374	62	1,000	0	0	580	0
401	23	18	2.2	0.9	0.0	0.0	0.0	21.9	0.0	0.0	0.0	412	32	0	0	0	0	0
402	23	19	3.7	0.0	0.0	0.0	0.0	19.7	0.0	1.6	0.0	339	30	0	0	0	0	0
403	23	20	16.8	0.0	0.0	0.0	0.0	0.0	1.3	6.9	0.0	9	0	0	400	100	0	0
404	23	21	20.6	0.0	0.2	0.0	0.0	0.0	1.3	2.9	0.0	1	0	0	0	860	0	260
405	23	22	24.0	0.0	0.2	0.4	0.0	0.0	0.0	0.4	0.0	11	1	0	0	800	0	440
406	23	23	24.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0	0	0	500	520	0	600
407	23	24	24.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0	0	0	0	740	560	600
408	23	25	23.0	0.0	0.0	0.0	0.0	0.8	0.0	1.2	0.0	23	1	0	460	160	0	700
409	23	26	16.8	0.0	0.0	0.0	0.0	0.0	3.3	4.9	0.0	0	0	0	0	0	0	0
410	23	27	17.2	0.0	0.0	0.0	0.0	0.0	0.9	6.9	0.0	0	0	0	300	420	0	300
411	23	28	22.0	0.0	0.0	0.0	0.0	0.0	0.5	2.5	0.0	2	0	0	620	0	90	500
412	23	29	23.5	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	5	0	0	0	250	320	0
413	24	2	0.0	0.0	0.0	0.0	0.0	0.0	13.5	0.0	11.5	1	0	0	0	0	0	0
414	24	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	25.0	0	0	0	0	0	0	0
415	24	4	0.0	0.8	0.0	0.0	0.0	0.0	0.3	0.0	23.9	1	0	0	0	0	0	0
416	24	5	0.0	13.7	0.0	0.0	0.0	0.0	2.2	0.0	9.1	18	1	0	0	0	0	80
417	24	6	0.0	20.4	0.0	0.0	0.0	0.0	0.0	0.0	4.6	0	0	0	0	0	0	0
418	24	7	5.4	11.2	1.5	0.0	0.0	3.1	0.0	0.3	3.5	62	5	0	0	0	0	0
419	24	8	4.4	0.0	3.8	0.0	0.0	0.9	1.1	3.2	11.6	12	1	0	0	120	0	0
420	24	9	16.8	0.0	1.1	0.0	0.0	0.0	0.0	4.0	3.1	12	5	0	260	840	0	200
421	24	10	9.4	3.0	3.9	0.0	0.0	1.0	0.2	0.0	7.5	16	1	0	520	0	0	0
422	24	11	3.5	1.9	3.8	0.0	0.0	15.8	0.0	0.0	0.0	178	69	80	820	0	0	0
423	24	12	12.2	12.1	0.5	0.0	0.0	0.0	0.2	0.0	0.0	21	2	0	540	0	0	0
424	24	13	22.8	0.0	0.0	0.0	0.0	2.2	0.0	0.0	0.0	25	4	540	340	0	870	0
425	24	14	19.9	2.9	0.0	0.0	0.0	1.9	0.3	0.0	0.0	16	3	240	500	0	530	820

Note SC:Sugarcane WP:Wet Paddy CN:Coconut,Nipa OC:Orchard FR:Forest
RS:Residential UU:Unused RC:River Channel FP:Fish Pond HS:House
NR:Non-residential Building NR:National Road NR:National Road PR:Provincial Road
BR:Barangay Road RW:Railway IC:Irrigation Channel

Table 4.7-1(6/6) DETAILED MESH DATA OF THE FLOOD PRONE AREA

NO.	X	Y	SC (ha)	WP (ha)	CN (ha)	OC (ha)	FR (ha)	RS (ha)	UU (ha)	RC (ha)	FP (ha)	HS (no.)	NB (no.)	NR (m)	PR (m)	BR (m)	RW (m)	IC (m)
426	24	15	24.2	0.0	0.2	0.0	0.0	0.4	0.0	0.2	0.0	12	0	0	820	0	440	1,940
427	24	16	23.5	0.0	0.3	0.0	0.0	0.3	0.0	0.9	0.0	12	0	420	0	380	0	1,100
428	24	17	10.6	2.7	0.4	0.0	0.0	9.9	0.3	1.1	0.0	49	11	520	0	2,520	0	960
429	24	18	20.7	0.4	0.0	0.0	0.0	3.5	0.4	0.0	0.0	96	7	470	360	0	460	0
430	24	19	22.2	1.8	0.0	0.0	0.0	1.0	0.0	0.0	0.0	31	0	980	460	0	500	0
431	24	20	24.3	0.3	0.0	0.4	0.0	0.0	0.0	0.0	0.0	2	0	660	360	0	500	480
432	24	21	24.8	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0	0	520	540	0	520	240
433	24	22	24.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0	0	560	440	0	540	200
434	24	23	24.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0	0	0	1,020	320	520	780
435	24	24	20.7	3.0	0.0	0.0	0.0	1.2	0.1	0.0	0.0	2	2	0	660	0	660	820
436	24	25	19.5	0.2	0.0	0.0	0.0	0.0	3.3	2.0	0.0	8	0	0	0	640	0	0
437	24	26	23.4	0.0	0.0	0.0	0.0	0.0	1.3	0.3	0.0	0	0	0	0	860	0	0
438	24	27	21.7	0.0	0.0	0.0	0.0	0.0	0.3	3.0	0.0	0	0	0	0	1,110	0	0
439	24	28	0.0	15.8	0.0	0.0	0.0	0.0	5.2	4.0	0.0	0	0	0	0	0	0	0
440	24	29	19.5	0.0	0.0	0.0	0.0	0.0	0.0	5.5	0.0	0	0	0	0	310	310	0
441	24	30	15.4	0.0	0.0	0.0	3.3	0.0	4.9	1.4	0.0	3	0	0	0	540	510	0
442	25	3	0.0	0.0	0.7	0.0	0.0	0.0	0.7	7.3	16.3	7	0	0	0	0	0	0
443	25	4	0.0	2.3	0.0	0.0	0.0	0.0	1.4	2.6	18.7	7	3	0	0	0	0	0
444	25	5	0.0	11.4	0.0	0.0	0.0	1.2	0.0	3.2	9.2	42	8	0	0	0	0	0
445	25	6	12.2	11.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	5	2	0	0	800	0	0
446	25	7	5.5	0.0	1.5	0.0	0.0	1.9	0.5	4.6	11.0	41	3	0	0	420	0	0
447	25	8	11.2	0.0	3.5	0.0	0.0	0.0	0.2	1.2	8.9	8	1	0	0	0	0	0
448	25	9	3.7	2.5	0.0	0.0	0.0	0.0	0.0	1.5	17.3	5	0	0	0	0	0	0
449	25	10	6.2	0.0	3.3	0.0	0.0	2.5	0.0	1.9	11.1	26	3	0	0	0	0	0
450	25	11	12.6	0.0	1.3	0.0	0.0	10.6	0.5	0.0	0.0	172	16	650	80	240	0	900
451	25	12	11.8	4.0	5.5	0.0	0.0	2.5	0.0	0.0	1.2	34	0	0	0	0	0	0
452	25	13	15.2	0.9	6.1	0.0	0.0	2.6	0.2	0.0	0.0	35	2	0	0	680	540	490
453	25	14	24.5	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0	0	0	420	0	0	360
454	25	15	12.1	11.8	0.0	0.0	0.0	0.3	0.0	0.9	0.0	10	0	0	0	0	0	920
455	25	16	13.2	10.8	0.8	0.0	0.0	0.2	0.0	0.0	0.0	14	0	560	180	0	0	820
456	25	17	7.9	13.7	2.4	0.0	0.0	0.0	0.1	0.9	0.0	12	2	0	300	0	0	440
457	25	18	3.1	20.7	0.9	0.0	0.0	0.0	0.0	0.3	0.0	5	0	0	0	80	0	0
458	25	19	4.8	20.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	3	0	0	0	220	0	820
459	25	20	2.4	22.5	0.0	0.0	0.0	0.0	0.1	0.0	0.0	19	0	0	480	320	0	680
460	25	21	22.1	2.8	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0	0	0	530	0	0	1,500
461	25	22	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	500	0	0	800
462	25	23	24.9	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0	0	540	500	0	0	980
463	25	24	20.4	0.6	0.2	0.4	0.0	3.0	0.4	0.0	0.0	34	3	0	900	420	1,510	960
464	25	25	12.3	0.0	0.4	0.0	0.0	0.0	7.8	4.5	0.0	0	0	0	0	180	0	0
465	25	26	24.3	0.0	0.2	0.0	0.0	0.0	0.2	0.3	0.0	1	0	0	1,580	0	0	200
466	25	27	21.2	0.0	0.0	0.0	0.0	0.0	3.8	0.0	0.0	3	0	0	0	800	130	900
467	25	28	0.0	17.6	7.4	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0
468	25	29	23.4	0.0	0.0	0.0	0.0	1.5	0.0	0.0	0.0	23	0	0	0	0	0	0
469	25	30	17.5	0.0	0.0	0.0	1.7	0.2	0.7	4.9	0.0	2	0	0	0	0	160	0
470	26	10	8.4	0.6	1.5	0.0	0.0	0.9	1.3	1.9	10.4	27	8	560	0	0	0	0
471	26	11	12.4	0.4	3.5	0.0	0.0	1.3	0.9	1.3	5.2	26	10	220	0	0	0	0
472	26	12	5.0	5.3	11.1	0.0	0.0	0.0	0.4	1.8	1.4	1	0	0	0	0	0	0
473	26	13	13.5	6.6	2.3	0.0	0.0	1.6	0.9	0.1	0.0	33	2	0	0	0	740	540
474	26	14	8.4	16.5	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0	0	0	0	0	520	1,460
475	26	15	4.4	19.6	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0	0	150	0	0	0	2,580
476	26	16	5.5	15.4	3.0	0.0	0.0	1.0	0.1	0.0	0.0	11	3	0	420	0	0	1,250
477	26	17	5.0	18.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	7	0	0	0	0	0	180
478	26	18	2.4	17.8	1.6	0.0	0.0	0.0	0.4	2.8	0.0	24	0	0	300	0	0	0
479	26	19	3.0	20.5	0.0	0.7	0.8	0.0	0.0	0.0	0.0	0	0	0	0	0	0	420
480	26	20	5.4	16.3	0.0	0.3	0.0	0.0	3.0	0.0	0.0	12	2	0	420	0	0	520
481	26	21	5.5	15.6	1.0	0.0	2.5	0.4	0.0	0.0	0.0	25	0	0	300	560	0	520
482	26	22	10.0	4.3	0.0	0.0	10.1	0.0	0.6	0.0	0.0	21	0	0	0	1,260	0	680
483	26	23	16.3	0.6	0.4	0.0	6.5	0.0	0.0	1.2	0.0	40	0	540	300	0	0	220
484	26	24	24.0	0.0	0.2	0.0	0.0	0.0	0.8	0.0	0.0	7	0	0	500	300	540	520
485	26	25	11.7	0.0	1.0	0.0	0.0	0.0	6.7	5.6	0.0	0	0	0	0	0	0	1,280
486	26	26	22.8	0.0	0.5	0.0	0.0	0.0	0.5	1.2	0.0	0	0	0	520	0	340	540
487	26	27	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	670	710	1,440
488	26	28	0.0	23.6	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0	0	0	0	0	0	1,040
489	26	29	22.7	1.4	0.0	0.0	0.0	0.9	0.0	0.0	0.0	18	0	0	0	0	0	0
490	26	30	19.7	0.6	0.0	0.0	0.5	3.5	0.7	0.0	0.0	27	4	0	0	0	0	0
491	27	12	6.5	10.1	7.0	0.0	0.0	0.0	0.6	0.8	0.0	8	0	0	0	0	600	200
492	27	13	4.9	15.6	3.3	0.0	0.0	1.2	0.0	0.0	0.0	27	0	0	350	0	480	1,900
493	27	14	1.0	17.3	0.2	0.0	0.0	1.0	5.5	0.0	0.0	14	0	0	0	0	0	620
494	27	24	9.5	0.0	0.4	0.0	0.0	1.9	6.8	6.4	0.0	62	4	280	1,020	0	660	0
495	27	25	19.0	0.0	0.0	0.0	0.0	0.0	1.5	4.5	0.0	0	0	0	540	1,000	0	0
496	27	26	20.8	0.0	0.2	0.8	0.0	3.0	0.0	0.2	0.0	27	8	0	640	340	540	1,220
497	27	27	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0	260	0	0	260	0
498	27	28	25.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	0	550	0	0	550	1,430
499	27	29	23.2	0.0	0.0	0.0	0.0	1.5	0.3	0.0	0.0	29	2	580	0	0	680	0
500	27	30	8.8	6.6	0.0	0.0	9.6	0.0	0.0	0.0	0.0	0	0	0	0	0	0	0

Note SC:Sugarcane WP:Wet Paddy CN:Coconut,Nipa OC:Orchard FR:Forest
RS:Residential UU:Unused RC:River Channel FP:Fish Pond HS:House
NR:Non-residential Building NR:National Road NR:National Road PR:Provincial Road
BR:Barangay Road RW:Railway IC:Irrigation Channel

Table 4.7-2 AVERAGE DAMAGEABLE VALUE OF PADDY

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                               ***********                       ******************************       ******************
                                            *                      *                            *       *
1. Cropping Pattern                           *                      *                            *       *
                                                *                       *                           *       *
                               ********************                      ******************************       **********
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I t e m		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2. Planted Area	1st Crop					25%	75%	100%	100%	75%	25%		
	2nd Crop	100%	75%	25%							25%	75%	100%
3. Accum. Cost	1st Crop					16%	38%	54%	74%	85%	100%		
	2nd Crop	74%	85%	100%							16%	38%	54%
4. Flood Frequency	(%)					4%	8%	25%	29%	13%	13%	8%	
5. 2 x 4	1st Crop	0%	0%	0%	0%	1%	6%	25%	29%	10%	3%	0%	0%
	2nd Crop	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	6%	0%
6. Damageable Value*	1st CROP	0	0	0	0	86	611	2,832	3,703	1,322	476	0	0
(P/ha)	2nd CROP	0	0	0	0	0	0	0	0	0	279	611	0

Average Damageable Value (P/ha) = 9,919 (9,900)

Remarks :

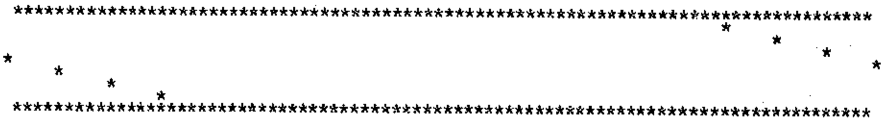
a. Production Cost (P/ha) =	7,200
b. Yield (ton/ha) =	3.0
c. Economic Price (P/ton) =	4,880
d. Net Income (P/ha) = (b. x c. - a.)	7,440

Note * : 5 x (3 x a + d)

Basic Source of Data :

- Price Prospects for Major Primary Commodities, 1988-2000, The World Bank
- Updated Costs and Returns 1985-1989, AEADIS, AASID
- Policy Implication of a Five Peso Support Price of Palay to Farmers' Incentives, Profitability and Economic Efficiency Under an Import Substitution Trade Regime: A Preliminary Analysis, L.A. Gonzales, International Food Policy Research Institute
- Interim Report for Study of Agno River Basin Flood Control, JICA

Table 4.7-3 AVERAGE DAMAGEABLE VALUE OF SUGARCANE

Item	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
1. Cropping Pattern												
2. Planted Area	---	---	---	---	---	---	---	---	---	10%	30%	50%
	70%	90%	100%	100%	100%	100%	100%	100%	100%	90%	70%	50%
	30%	10%	---	---	---	---	---	---	---	---	---	---
3. Accum. Cost	---	---	---	---	---	---	---	---	---	5%	11%	18%
	26%	36%	46%	52%	59%	65%	71%	78%	84%	89%	94%	97%
	99%	100%	---	---	---	---	---	---	---	---	---	---
4. Flood Frequency (%)					4%	8%	25%	29%	13%	13%	8%	
5. 2 x 4	---	---	---	---	---	---	---	---	---	1%	2%	0%
	0%	0%	0%	0%	4%	8%	25%	29%	13%	12%	6%	0%
	0%	0%	---	---	---	---	---	---	---	---	---	---
6. Damageable Value* (P/ha)	---	---	---	---	---	---	---	---	---	190	379	0
	0	0	0	0	1,016	2,128	6,950	8,468	3,952	3,674	1,814	0
	0	0	---	---	---	---	---	---	---	---	---	---

Average Damageable Value (P/ha) = 28,571 (= 28,600)

Remarks :

a. Production Cost (P/ha) =	20,000
b. Yield (ton/ha) =	70.0
c. Economic Price (P/ton) =	480
d. Net Income (P/ha) = (b x c - a)	13,600

Note * : 5 x (3 x a + d)

Basic Source of Data : - Price Prospects for Major Primary Commodities, 1988-2000, The World Bank
- Updated Costs and Returns 1985-1989, AEADIS, AASIO

Table 4.7-4 AVERAGE DAMAGEABLE VALUE OF FISHPOND

```
  I t e m                        Jan.  Feb.  Mar.  Apr.   May  Jun.  Jul.  Aug.  Sep.  Oct.  Nov.  Dec.

                               **********************          *****************************         *********
                                                      *         *                            *         *
1. Cultivation Calender                                 *        *                             *        *
                                                          *        *                             *        *
                               *****************************         *****************************        *
```

I t e m		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2. Cultivated Area	Bangus	85%	85%	85%	43%	---	43%	85%	85%	85%	43%	---	43%
	Prawn	15%	15%	15%	8%	---	8%	15%	15%	15%	8%	---	8%
3. Accum. Cost	Bangus	50%	70%	90%	100%	---	20%	50%	70%	90%	100%	---	20%
	Prawn	50%	70%	90%	100%	---	20%	50%	70%	90%	100%	---	20%
4. Flood Frequency	(%)					4%	8%	25%	29%	13%	13%	8%	
5. 2 x 4	Bangus	0%	0%	0%	0%	0%	3%	21%	25%	11%	6%	0%	0%
	Prawn	0%	0%	0%	0%	0%	1%	4%	4%	2%	1%	0%	0%
6. Damageable Value* (P/ha)	Bangus	0	0	0	0	0	0	3	4	2	1	0	0
	Prawn	0	0	0	0	0	1	6	8	4	2	0	0

Average Damageable Value (P/ha) = 32,497 (= 32,500)

Remarks :

	Bangus	Prawn
a. Production Cost (P.1000/ha) =	15.0	135.0
b. Yield (ton/ha) =	0.75	1.50
c. Unit Price (P1000/ton) =	30.0	150.0
d. Net Income (P.1000/ha) = (b x c - a)	7.5	90.0

Note * : 5 x (3 x a + d)

Basic Source of Data : - The Resource Base for Agrarian Reform and Development in Negros Occidental, Social Research Center, Bacolod
- Interview at the Site.

Table 4.7-5 ECONOMIC FARMGATE PRICE OF PADDY (Import Substitute)

(per ton)

Item	Financial Cost		Economic Cost	
1. FOB, Bangkok, 5% broken milled rice *1	$	285.0	$	285.0
2. Quality Discount (30%) [1 x 0.7]	$	199.5	$	199.5
3. Transportation Cost, Bangkok - Pulupandan	$	12.0	$	12.0
Sub-total [2+3]	$	211.5	$	211.5
Peso Equivalent *2	P	5,922	P	6,768
4. Port Handling & Warehouse Charge, etc. *3	P	1,270	P	1,361
Ex-warehouse Cost	P	7,192	P	8,129
5. Inland Transport, Pulupadan - Kabankalan *3	P	210	P	225
Price of Rice at Kabankalan	P	7,402	P	8,354
6. Milling Cost, etc. *3	P	(720)	P	(771)
Sub-total	P	6,682	P	7,582
7. Paddy Equivalent (65%)	P	4,343	P	4,928
8. Trasport Cost Farm to Mill	P	(43)	P	(43)
9. Economic Farmgate Paddy Price	P	4,300	P (=	4,885 4,880)

Basic Source of Data :
- Price Prospects for Major Primary Commodities 1988-2000 Updated, Including Quarterly Review of Commodity Markets, Fourth Quarter 1989, World Bank
- Policy Implication of a Five Peso Support Price of Palay to Farmers' Incentives, Profitability and Economic Efficiency Under an Import Substitution Trade Regime: A Preliminary Analysis, L.A. Gonzales, International Food Policy Research Institute
- Interview at the Site.

Note *1 : International price in 1990 in current Dollars.
*2 : Conversion rates are $1.00=P28.00 for the financial cost and $1.00=P32.00 for the economic cost.
*3 : Assuming a foreign exchange component of 50%.

Table 4.7-6 ECONOMIC FARMGATE PRICE OF SUGARCANE

(per ton)

Item	Financial Cost	Economic Cost
1. Export Price *1	$ 391	391
Peso Equivalent *2	P 10,948	12,512
2. Port Handling & Warehouse Charge, etc. *3	P (3,000)	(3,214)
Ex-warehouse Cost	P 7,948	9,298
3. Milling Cost, etc. *3	P (2,950)	(3,161)
Ex-mill Price	P 4,998	6,137
4. Allowance for Mollases (5%)	P (250)	(307)
Sub-total	P 4,748	5,830
5. Cane Price at Mill Gate (9%)	P 427	525
6. Trasport Cost Farm to Mill	P (43)	(43)
7. Economic Farmgate Cane Price	P 384 (= 380)	482 (= 480)

Basic Source of Data :
- Price Prospects for Major Primary Commodities 1988-2000 Updated, Including Quarterly Review of Commodity Markets, Fourth Quarter 1989, World Bank
- Linkages and Alternatives: The Philippine Sugar Industry in the 1990s, Joop Theunissen, Tilburg, July 1989
- Interview at the Site.

Note *1 : International price in 1990 in current Dollars.
*2 : Conversion rates are $1.00=P28.00 for the financial cost and $1.00=P32.00 for the economic cost.
*3 : Assuming a foreign exchange component of 50%.

Table 4.7-7 RELATION BETWEEN DAMAGE RATE AND INUNDATION DEPTH

Inundation Depth	Sugarcane	Paddy	Fishpond	House/ Building	Indooor Movables	Infra- Structure
Less than 0.5 m	27%	21%	90%	5.3%	8.6%	1.0%
0.5 m - 1.0 m	35%	24%	100%	7.2%	19.1%	3.0%
1.0 m - 2.0 m	51%	37%	100%	10.9%	33.1%	5.0%
More than 2.0 m	51%	37%	100%	15.2%	49.9%	10.0%

Table 4.7-8 POTENTIAL FLOOD DAMAGE IN THE TARGET YEAR 2020

Unit : Million Peso

	Items Vulnerable to Flood Damage	Flooding Scale in Return Period					
		2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
1.	Direct Damage	74.0	247.4	343.6	422.9	479.1	514.2
1.1	Agri-/Aquacultural Crops	54.1	100.8	126.7	141.1	147.7	151.0
	- Sugarcane	2.9	30.7	45.7	55.4	61.1	63.9
	- Paddy	0.4	2.0	3.8	4.4	4.8	5.0
	- Prawn/Bangus (Milkfish)	50.8	68.1	77.2	81.3	81.8	82.1
1.2	House/Building	19.8	144.0	213.0	276.2	324.7	355.4
	- Residential Houses	12.3	99.4	148.5	191.2	223.7	244.8
	- Non-residential Buildings	7.5	44.6	64.5	85.0	101.0	110.6
1.3	Infrastructure	0.1	2.6	3.9	5.6	6.7	7.8
	- National Road	0.0	0.6	0.9	1.4	1.7	2.0
	- Provincial Road	0.1	1.0	1.4	2.0	2.4	2.8
	- Barangay Road	0.0	0.5	0.8	1.1	1.3	1.4
	- Railway	0.0	0.3	0.4	0.6	0.7	0.9
	- Irrigation Channel	0.0	0.2	0.4	0.5	0.6	0.7
2.	Indirect Damage	1.4	8.7	12.1	13.9	14.6	14.7
	Total Damage	75.4	256.1	355.7	436.8	493.7	528.9

Table 4.7-9 CALCULATION OF ANNUAL AVERAGE BENEFIT OF THE MASTER PLAN

Unit : Million Peso

Return Period	Flood Damage		Damage Reduction	Average Damage Reduction	Expectation	Benefit
	w/o Project	w/ Project				
1.4 *	0.0	0.0	0.0			
				37.70	0.2143	8.08
2	75.4	0.0	75.4			
				165.75	0.3000	49.73
5	256.1	0.0	256.1			
				305.90	0.1000	30.59
10	355.7	0.0	355.7			
				396.25	0.0600	23.78
25	436.8	0.0	436.8			
				465.25	0.0200	9.31
50	493.7	0.0	493.7			
				511.30	0.0100	5.11
100	528.9	0.0	528.9			

Total (Annual Average Benefit) 126.59

Note * : Corresponds to the existing flow capacity.

Table 4.7-10 ANNUAL COST AND BENEFIT FLOW OF THE MASTER PLAN

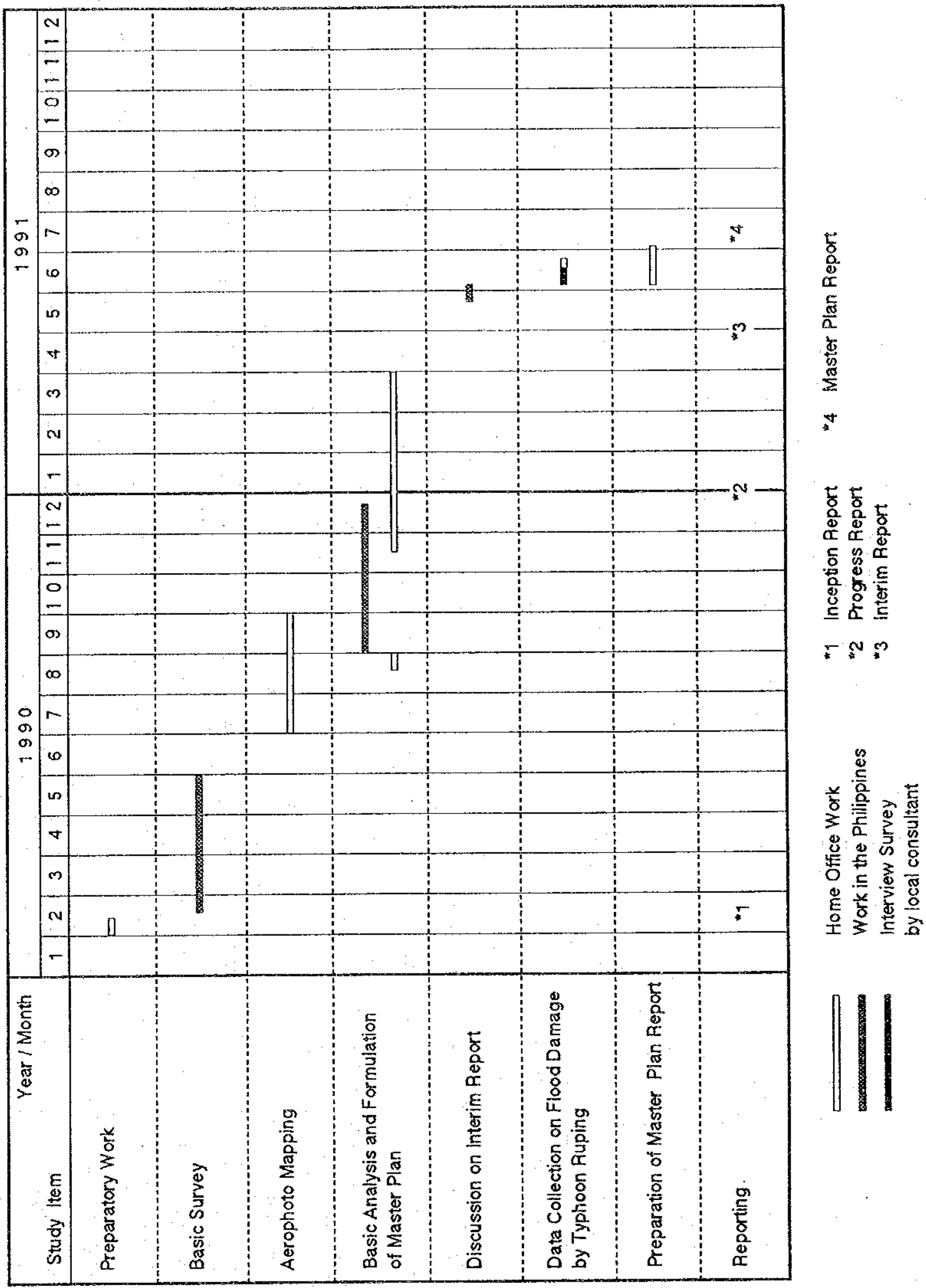
Unit : Million Peso

Year	Economic Cost							Benefit	Balance
	Const.	Admin.	E/S	Phy. Conti.	Land Acq.	O&M	Total		
1993							0.00	0.00	0.00
1994							0.00	0.00	0.00
1995			26.78	2.68			29.46	0.00	(29.46)
1996			26.78	2.68			29.46	0.00	(29.46)
1997							0.00	0.00	0.00
1998							0.00	0.00	0.00
1999							0.00	0.00	0.00
2000					8.05		8.05	0.00	(8.05)
2001	37.28	2.33	4.66	4.43	8.05		56.74	0.00	(56.74)
2002	37.28	2.33	4.66	4.43	8.05		56.74	10.59	(46.15)
2003	37.28	2.33	4.66	4.43	8.05		56.74	21.19	(35.56)
2004	37.28	2.33	4.66	4.43	8.05		56.74	31.78	(24.96)
2005	37.28	2.33	4.66	4.43	8.05		56.74	42.38	(14.37)
2006	37.28	2.33	4.66	4.43	8.05		56.74	52.97	(3.77)
2007	37.28	2.33	4.66	4.43	8.05		56.74	63.57	6.82
2008	37.28	2.33	4.66	4.43			48.69	74.16	25.47
2009	37.28	2.33	4.66	4.43			48.69	84.76	36.06
2010	37.28	2.33	4.66	4.43			48.69	95.35	46.66
2011	37.28	2.33	4.66	4.43			48.69	105.95	57.25
2012	33.79	2.11	4.22	4.01		2.26	46.39	116.54	70.15
2013	33.79	2.11	4.22	4.01		2.26	46.39	117.66	71.27
2014	33.79	2.11	4.22	4.01		2.26	46.39	118.77	72.39
2015	33.79	2.11	4.22	4.01		2.26	46.39	119.89	73.50
2016	33.79	2.11	4.22	4.01		2.26	46.39	121.01	74.62
2017	33.79	2.11	4.22	4.01		2.26	46.39	122.12	75.74
2018	33.79	2.11	4.22	4.01		2.26	46.39	123.24	76.85
2019	33.79	2.11	4.22	4.01		2.26	46.39	124.36	77.97
2020	33.79	2.11	4.22	4.01		2.26	46.39	125.47	79.09
2021						3.72	3.72	126.59	122.87
2022						3.72	3.72	126.59	122.87
2023						3.72	3.72	126.59	122.87
2024						3.72	3.72	126.59	122.87
2025						3.72	3.72	126.59	122.87
2026						3.72	3.72	126.59	122.87
2027						3.72	3.72	126.59	122.87
2028						3.72	3.72	126.59	122.87
2029						3.72	3.72	126.59	122.87
2030						3.72	3.72	126.59	122.87
2031						3.72	3.72	126.59	122.87
2032						3.72	3.72	126.59	122.87
2033						3.72	3.72	126.59	122.87
2034						3.72	3.72	126.59	122.87
2035						3.72	3.72	126.59	122.87
2036						3.72	3.72	126.59	122.87
2037						3.72	3.72	126.59	122.87
2038						3.72	3.72	126.59	122.87
2039						3.72	3.72	126.59	122.87
2040						3.72	3.72	126.59	122.87
2041						3.72	3.72	126.59	122.87
2042						3.72	3.72	126.59	122.87
2043						3.72	3.72	126.59	122.87
2044						3.72	3.72	126.59	122.87
2045						3.72	3.72	126.59	122.87
2046						3.72	3.72	126.59	122.87
2047						3.72	3.72	126.59	122.87
2048						3.72	3.72	126.59	122.87
2049						3.72	3.72	126.59	122.87
2050						3.72	3.72	126.59	122.87

Note : IRR = 12.6%

	Discount Rate	
	10%	15%
B/C =	1.266	0.825
NPV =	68.55	-26.06 (mil.P.)

FIGURES



THE STUDY ON ILOG-HILABANGAN RIVER BASIN
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Fig.1.4-1 MODIFIED STUDY SCHEDULE

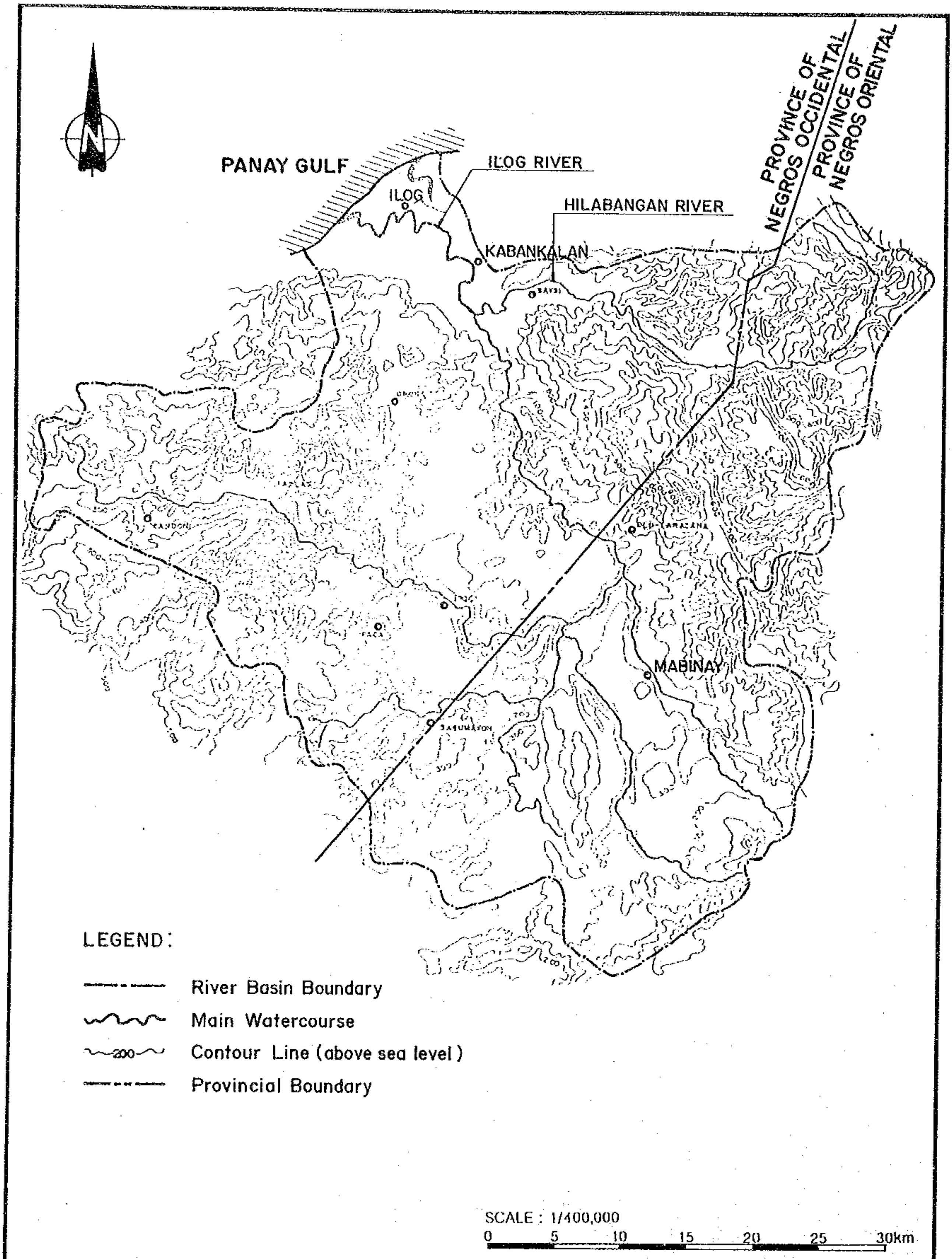

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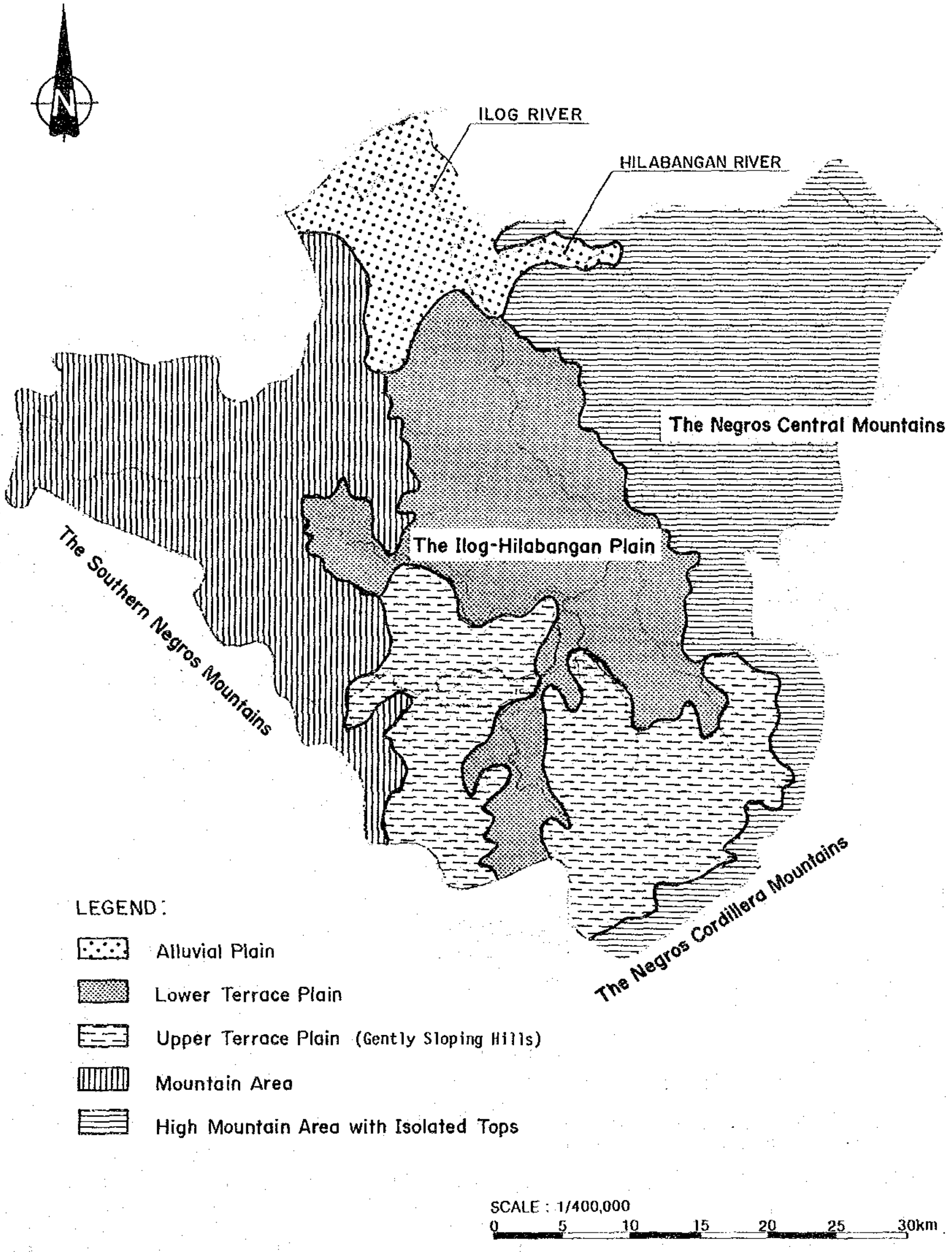
Fig.2.1-1 TOPOGRAPHIC MAP



THE STUDY ON ILOG-HILABANGAN RIVER BASIN FLOOD CONTROL PROJECT JAPAN INTERNATIONAL COOPERATION AGENCY	Fig.2.1-2 LANDFORM

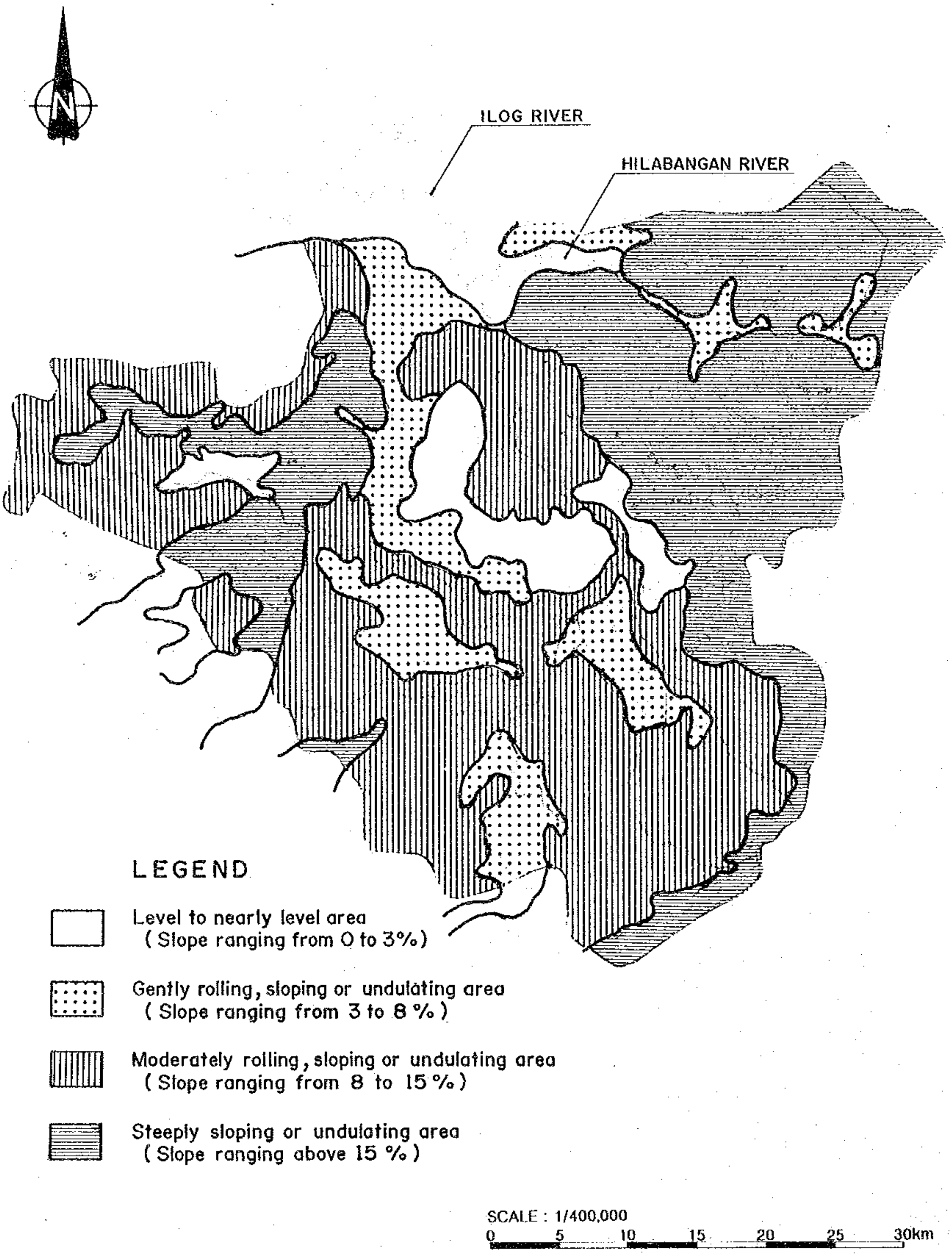


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Fig.2.1-3 GENERALIZED SLOPE

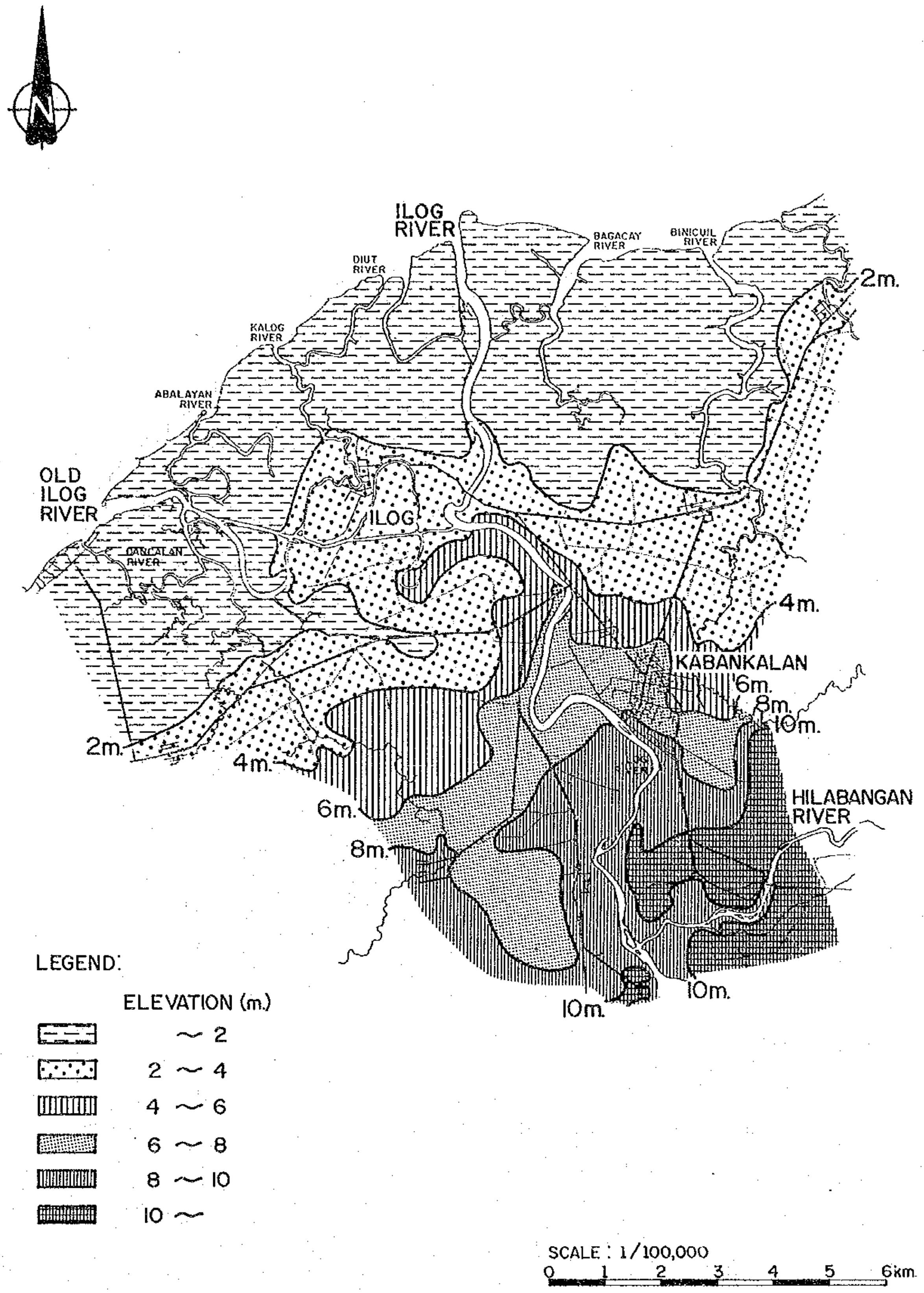

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Fig.2.1-4 ELEVATION CLASSIFICATION OF THE LOWER REACHES

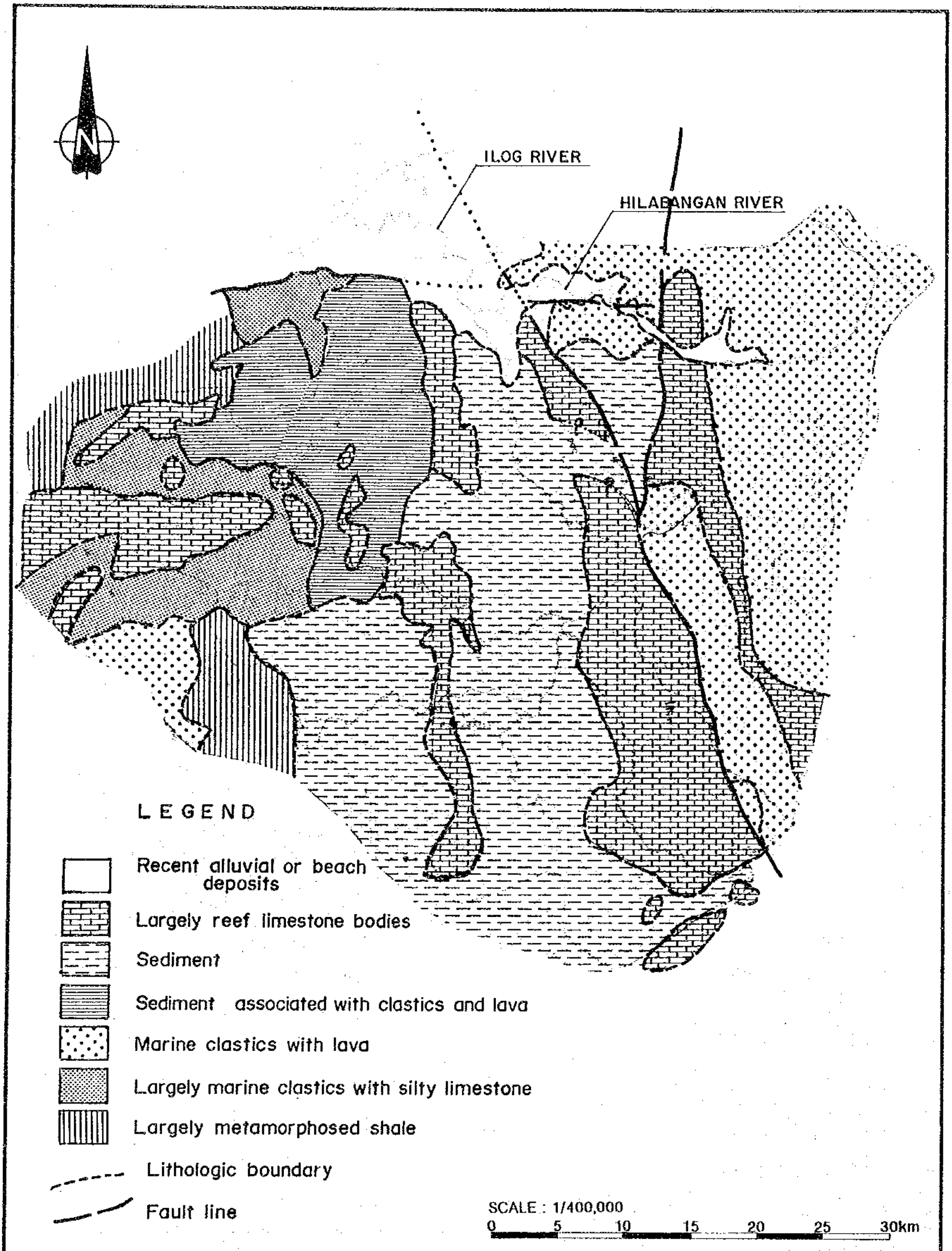

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Fig.2.1-5 LITHOLOGICAL MAP

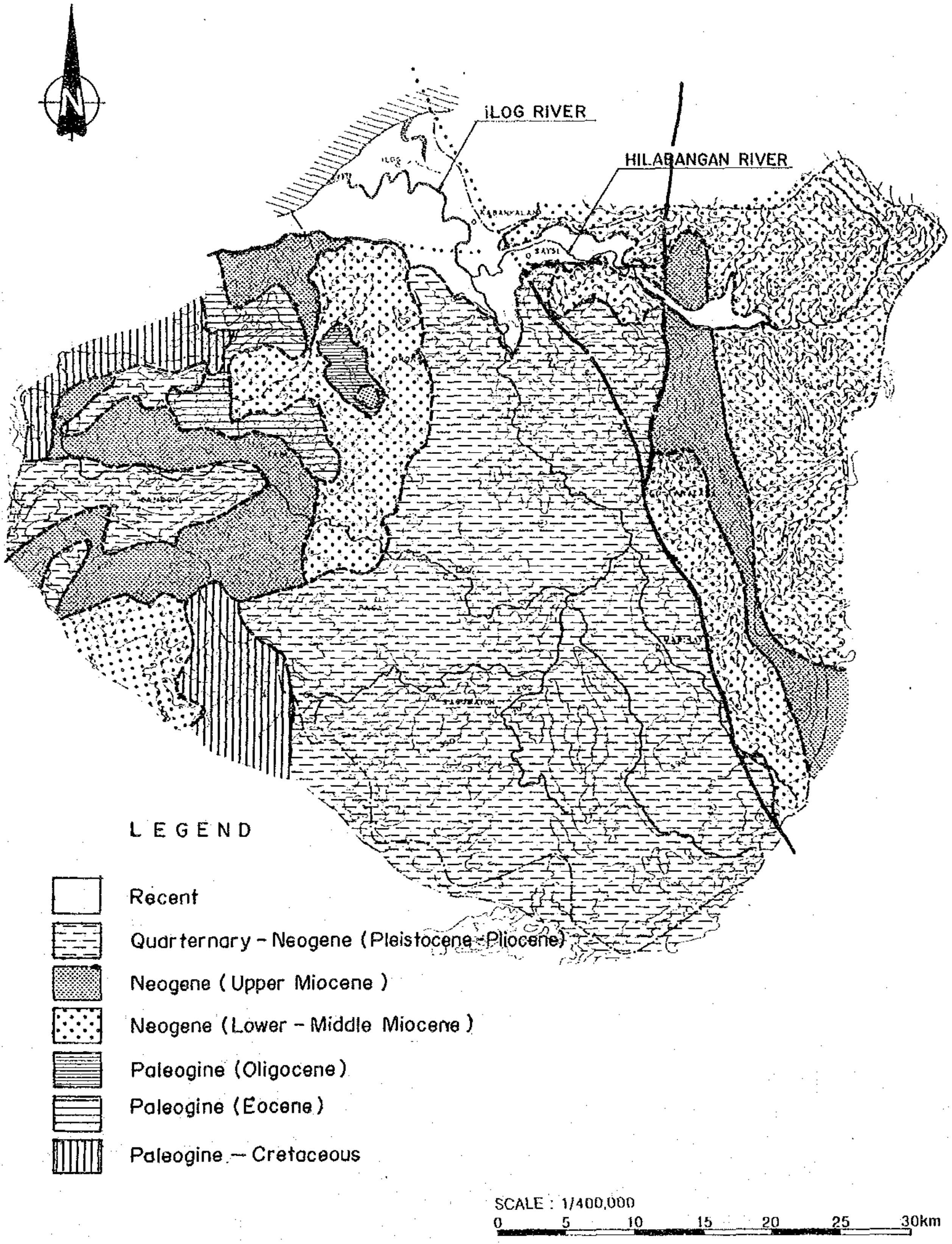

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Fig.2.1-6 GEOLOGIC MAP

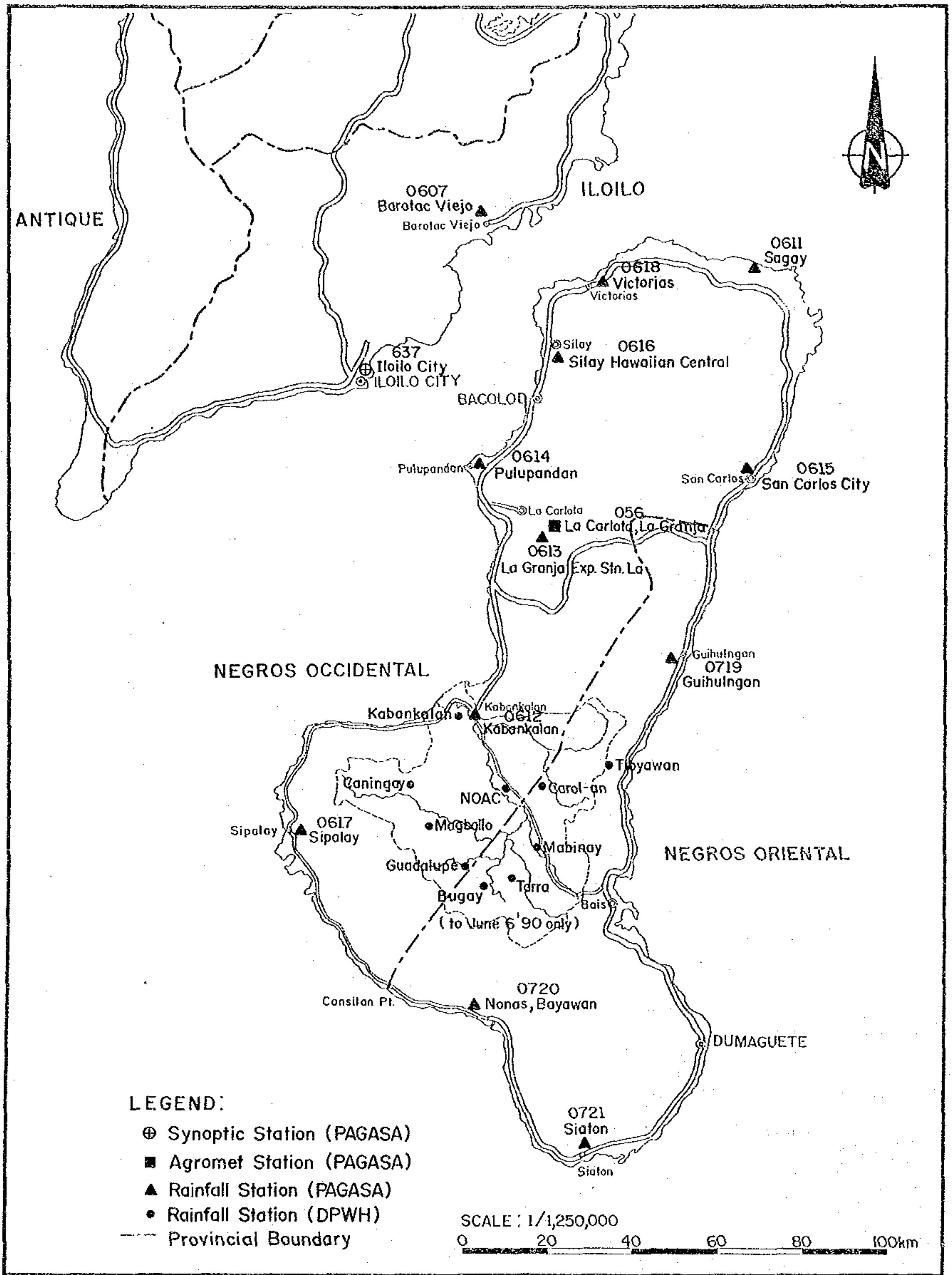

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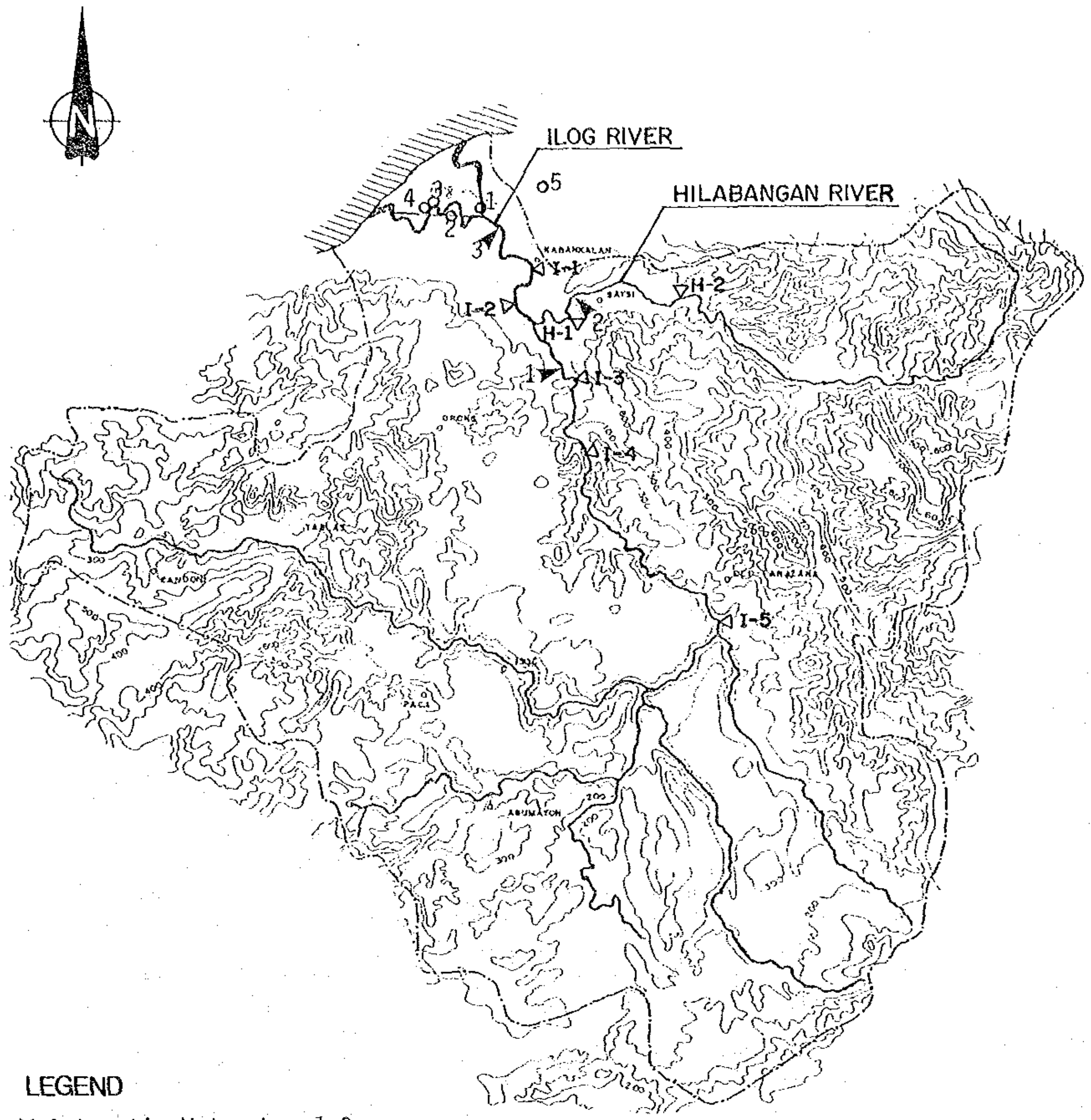
Fig.2.2-1 LOCATION MAP OF METEOROLOGICAL AND RAINFALL STATIONS



LEGEND

▼ Automatic Water Level Gauge
  1. Orong, Ilog River
  2. Overflow, Hilabangan River
  3. Talubangi Bridge, Ilog River

o Water Level Staff Gauge
  1. Malabon Div. Channel, Ilog River
  2. Cutoff Channel, Ilog River
  3. Old Ilog No.1, Ilog River
  4. Old Ilog No.2, Ilog River
  5. Binicuil River

▽ Water Level Staff Gauge (NWRB)
  I-1 Camugao, Ilog River
  I-2 San Juan, Ilog River
  I-3 Orong, Ilog River
  I-4 Dahile, Ilog River
  I-5 Inapoy, Ilog River
  H-1 Pangsud, Hilabangan River
  H-2 Tagbac, Hilabangan River

SCALE : 1/400,000

0 5 10 15 20 25 30km

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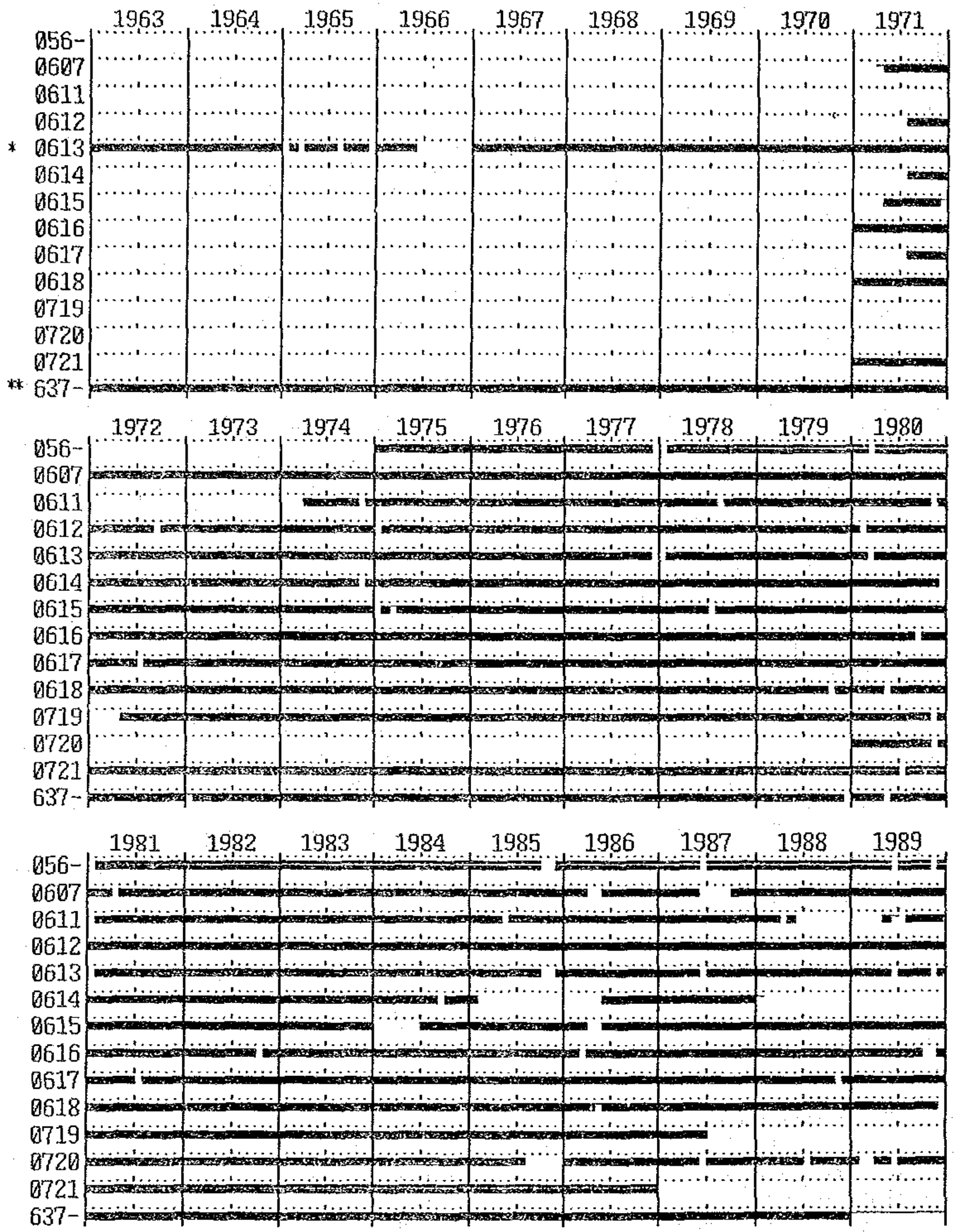
Fig.2.2-2 LOCATION MAP OF STREAMWATER GAUGING STATIONS



056- : La Granja, La Carlota, Negros Occ.
0607 : Barotac Viejo, Iloilo
0611 : Sagay, Negros Occ.
0612 : Kabankalan, Negros Occ.
0613 : La Granja 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.
0719 : Guihulngan, Negros Oriental
0720 : Nonas, Bayawan, Negros Oriental
0721 : Siaton, Negros Oriental
637- : Iloilo City, Iloilo

NOTE * : Observation Started in 1956
** : Observation Started in 1949

THE STUDY ON ILOG-HILABANGAN RIVER BASIN FLOOD CONTROL PROJECT

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Fig.2.2-3 AVAILABLE DATA PERIOD CHART OF DAILY RAINFALL