No.

DEPARTMENT OF PUBLIC
WORKS AND HIGHWAYS
THE REPUBLIC OF THE
PHILIPPINES

THE STUDY
ON
THE NATIONWIDE FLOOD RISK ASSESSMENT
AND
THE FLOOD MITIGATION PLAN
FOR THE SELECTED AREAS
IN
THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

VOLUME I
-SUMMARY REPORT-

MARCH 2008

JICA JAPAN INTERNATIONAL COOPERATION AGENCY

CTI CTI Engineering International Co., Ltd.

PP0
JR
08-002

DEPARTMENT OF PUBLIC
WORKS AND HIGHWAYS
THE REPUBLIC OF THE
PHILIPPINES

THE STUDY
ON
THE NATIONWIDE FLOOD RISK ASSESSMENT
AND
THE FLOOD MITIGATION PLAN
FOR THE SELECTED AREAS
IN
THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

VOLUME I
-SUMMARY REPORT-

MARCH 2008

JAPAN INTERNATIONAL COOPERATION AGENCY

CTI Engineering International Co., Ltd.

COMPOSITION OF FINAL REPORT

VOLUME I	SUMMARY REPORT
VOLUME II	MAIN REPORT
VOLUME III	SUPPORTING REPORT
VOLUME IV	DATA BOOK

Exchange Rate used in the Report is:

US$1.00 = PhP. 44.93 = Jp¥ 115.55
Jp¥ 1.00 = PhP. 0.3888

(as of 31st October 2007)

PREFACE

In response to a request from the Government of the Philippines, the Government of Japan decided to conduct the Study on the Nationwide Flood Risk Assessment and the Flood Mitigation Plan for the Selected Areas in the Republic of the Philippines and entrusted the Study to the Japan International Cooperation Agency (JICA).

JICA selected a study team of CTI Engineering International Co., Ltd. headed by Mr. Yoshiharu MATSUMOTO. The team was dispatched to the Philippines five times between September 2006 and March 2008.

The team held discussions with the officials concerned of the Government of the Philippines and conducted field surveys and studies in the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and also to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of the Philippines for their close cooperation extended to the Study.

March 2008

Norio MATSUDA
Resident Representative
Japan International Cooperation Agency Philippine Office

March 2008

Mr. Norio MATSUDA
Resident Representative
Japan International Cooperation Agency Philippine Office

LETTER OF TRANSMITTAL

Dear Sir,

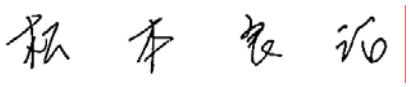
It is our great pleasure to submit to you the final report of "the Study on the Nationwide Flood Risk Assessment and the Flood Mitigation Plan for the Selected Areas in the Republic of the Philippines". The report contains the results of the Study undertaken by the study team of CTI Engineering International Co., Ltd. with the counterpart team of the Department of Public Works and Highways (DPWH) of the Government of the Philippines from the beginning of September 2006 through the middle of March 2008.

The report presents the selected prioritized areas based on the flood risk assessment and the prepared flood mitigation plans for these selected areas.

We hope that the results of our Study will contribute to the promotion of the nationwide flood risk assessment and the preparation of flood mitigation plans in the Philippines. We also deeply hope that the report will contribute to the enhancement of friendly relations between our two countries.

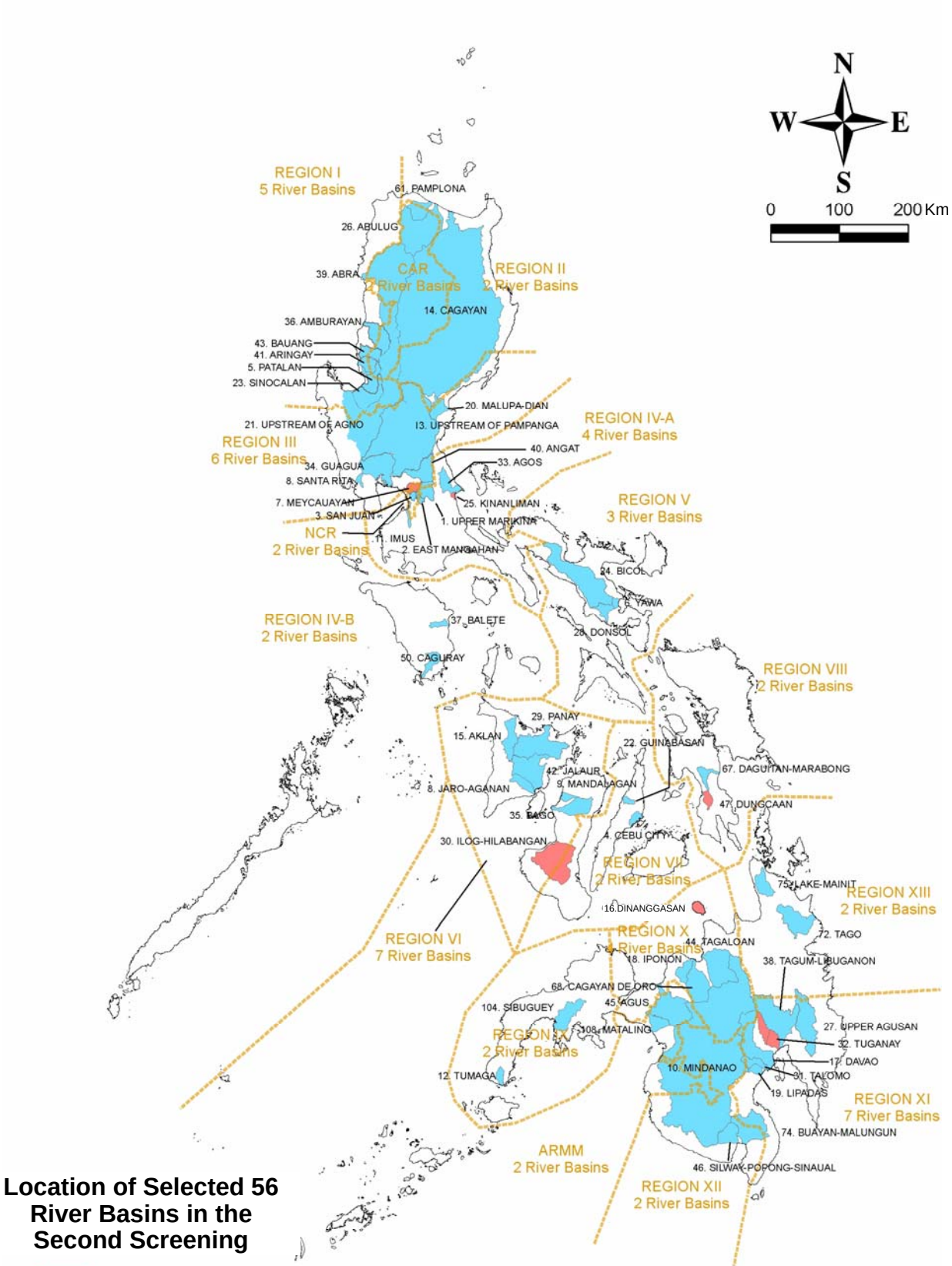
We wish to express our sincere gratitude to the personnel concerned of your Agency for the guidance and support given throughout the Study period. Our deep gratitude is also expressed to the DPWH and other concerned agencies of the Government of the Philippines, Japan Bank for International Cooperation (JBIC) and the Embassy of Japan in the Philippines for their close cooperation and assistance extended during the course of the Study.

Very truly yours,



Yoshiharu MATSUMOTO
Team Leader
The Study on the Nationwide Flood Risk Assessment and
the Flood Mitigation Plan for the Selected Areas
in the Republic of the Philippines

LOCATION MAP



Executive Summary

1. INTRODUCTION

1.1 Objectives of the Study

The objectives of the Study are:

(1) To select prioritized areas based on the flood risk assessment and to prepare flood mitigation plans for these selected areas.

(2) To conduct technology transfer to DPWH counterpart personnel during the course of the Study.

1.2 The Study Area

The Study covers the 947 flood-prone cities/municipalities identified by the National Disaster Coordinating Council.

1.3 The Study Schedule

The Study was started in the beginning of September 2006 in a manner of Home Work and continued until the middle of March 2008.

1.4 Basic Conditions for Conducting the Study

To conduct the Study, the following conditions were discussed and confirmed; (1) Target Year for Prioritization until 2034 and (2) Safety Level of 20-year Return Period for the Formulation of Flood Control Projects.

2. FIRST SCREENING OF RIVER BASINS

2.1 Procedure of the First Screening

2.1.1 Identification of River Basins

The objective river basins for the First Screening are identified, to which 947 flood prone cities/municipalities belong. As the results, it has been identified that the total number of river basins covering the flood prone areas is 1,164 river basins including major river basins as shown in the following table:

Table 2.1 Total Number of River Basins

River Basins	Number	Remarks
Independent Principal River Basins	376	Including 75 Tributaries of Major Rivers
Major River Basins	18	
Other River Basins	770	
Ground Total	1,164	Covering the Flood Prone Areas

Note: In this table, Principal River Basin and Major River Basin are based on the definition by NWRB and the river basins excluded from the definition are defined as Other River Basins.

2.1.2 Confirmation of Methodology of the First Screening

The methodology of the First Screening was confirmed considering the previous practices on similar undertakings. The proposed methodology was, in principle, the scoring of evaluation indexes, and a screening guideline where some other factors were taken into account was also provided.

2.1.3 Selection of Evaluation Indexes

Based on the confirmed methodology, evaluation indexes of 14, which represent flood damage potential from the view points of socio-economic and natural conditions, were selected.

2.2 Results of the First Screening

As the result of the First Screening, a total of 120 river basins were selected and designated as the objective river basins for the Second Screening.

3. SECOND SCREENING OF RIVER BASINS

3.1 Procedure of the Second Screening

3.1.1 Ranking of River Basins with Score

The prioritization of river basins for project implementation was in principle given by ranking with the total score based on the economic efficiency in addition to the score obtained in the First Screening.

3.1.2 Setting-up of Possible Investment Amount

For the above prioritization, the number of river basins was first be narrowed down considering the amount of possible investment by the DPWH in the target period of 26 years from 2009 to 2034 assuming the DPWH budget growth rate.

3.1.3 Consideration of Regional Distribution

Development of the country should be promoted equally for every region without any discrimination. From this point of view, it is necessary to arrange infrastructures such as flood control projects for every region. In this context, at least a few river basins for each of the 17 administrative regions were arranged in the list for the Second Screening.

3.1.4 Strategic Significant River Basins

Besides the above, some river basins, which are generally recognized as significant for the provision of flood control projects like the major river basins, were included in the list regardless of rank.

3.2 Results of the Second Screening

In accordance with the above-mentioned procedure, finally the following number of river basins was selected as the results of the Second Screening:

- Number of Selected River Basins : 56 river basins
- Investment Amount (2009-2034) : 236 billion pesos
- DPWH Budget Growth Rate : 8.2%

3.3 Prioritization and Arrangement of Implementation Schedule

For the selected 56 river basins, prioritization was examined and arranged in a manner of the implementation schedule dividing the river basins into two groups: (1) foreign-assisted projects and (2) locally funded projects.

4. GROUPING AND SELECTIOIN OF MODEL RIVER BASINS

4.1 Grouping

As mentioned in the previous section, 56 river basins have been selected as the results of the Second Screening. In this section, these 56 river basins are classified into several groups by flood damage type [Overflow (O), Flash Flood (F), Bank Erosion (B), Inland Flooding (I), and Lahar and/or Debris Flow (L)], and one model river basin is selected from each group.

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

Table 4.1 Model River Basins

Group	Name of River Basin	Region	Catchment Area (km^2)	Ranking
F+O+B, F+B Type	Ilog-Hilabangan	VI and VII (Visayas)	2,162	30
O+B Type	Dungcaan	VIII (Visayas)	176	47
F+O, O, F Type	Meycauayan	III and NCR (Luzon)	201	7
F+O+B+I, F+I Type	Kinanliman	IV-A (Luzon)	10	25
F+O+I, F+I+B, F+I Type	Tuganay	XI (Mindanao)	747	32
F+O+B+I+L Type	Dinanggasan	X (Mindanao)	29	16

** F: Flash Flood, O: Overflow, B: Bank Erosion, I: Inland Flooding, L: Lahar and/or Debris Flow*

5. FORMULATION OF FLOOD MITIGATION PLANS FOR MODEL RIVER BASINS

5.1 Basic Conditions for Formulation of Flood Mitigation Plan

Flood mitigation plans for the model river basins were formulated under the following conditions:

(1) Objective River Basins

The objective river basins for the formulation are the selected six (6) model river basins; namely, Ilog-Hilabangan, Dungcaan, Meycauayan, Kinanliman, Tuganay and Dinanggasan.

(2) Safety Level and Area to be Protected

In principle, flood control projects for these river basins were formulated with the safety level of 20-year return period. However, if previous plans were already prepared for certain river basins like the Ilog-Hilabangan, the safety level of the previous plan was applied.
As for the area to be protected, it was in principle based on the current flood damage area, which was finally adjusted in due consideration of economic efficiency, i.e., the ratio between benefit and cost.

(3) Applicable Measures and Selection of Optimum Measures

As the applicable measures, both structural and non-structural measures were examined. The optimum measures for the structural measures were selected through a comparison study for several alternatives prepared in principle with the combination of such structural measures. On the other hand, for the non-structural measures, their direction of improvement was examined independently among several conceivable measures.

(4) Project Evaluation

The adequacy of projects was evaluated considering the aspects of technical feasibility, economic viability, social acceptance and environmental acceptance. In this connection, economic viability was evaluated only for the structural measures, since the benefit of non-structural measures was preliminary estimated for flood warning system only for the direct damages to examine appropriate system for the target river basin.

(5) Accuracy of the Study

The study on the formulation of flood control plans for the six (6) model river basins was conducted in a very limited time (3 months), so that the accuracy is very rough and the level is supposed to be a pre-master plan. Therefore, for implementation of the flood control projects for the model river basins, further studies such as master plan and feasibility studies are absolutely necessary.

5.2 Results of Formulation of Flood Mitigation Plans for the Model River Basins

Although the level of the Study is very rough, the following results are in common obtained for the formulation of flood mitigation plans for the six (6) model river basins:

5.2.1 Flood Condition

As the flood condition for the model river basins, the following points are commonly specified while each river basin has individual flood problems:

- Floods habitually occur almost every year and severe ones are once every ten years.

- Flow capacity is very poor compared with the design discharge.
- Flood damage type which causes severe damages is in principle overflow and bank erosion type, while flash flood and/or debris flow causes casualties.
- Flood damages in every river basin are observed in built-up areas as well as agricultural areas and fishponds including casualties in some river basins.

5.2.2 Optimum Flood Control Measures

As the optimum flood control measures which are composed of structural and non-structural measures, the following measures are finally employed (refer to Tab.-1):

(1) Structural Measures

As the structural measures, river channel improvement including revetment and/or spur dike is commonly applied to cope with the flood type of overflow and bank erosion. In addition to river channel improvement, drainage facilities are applied to some river basins, which have flood problem of the inland flooding type, while sediment control facilities are introduced in some river basins to cope with the flood damage type of flash flood or debris flow.

(2) Non-structural Measures

As the non-structural measures, the following measures are in common applied:

- Flood warning system
- Watershed management
- Other measures such as enhancement of disaster management activities and preparation of hazard map

5.2.3 Project Evaluation

Project evaluation was made from the technical, economical, social and environmental points of view. As the conclusion, flood control projects for the model river basins were evaluated in principle as technically and economically feasible and identified as they will be socially and environmentally accepted.

6. CONCLUSION AND RECOMMENDATION

6.1 Conclusion

In due consideration of objectives of the Study, it is concluded that the selection and prioritization of the flood risk areas through the flood risk assessment and the preparation of flood mitigation plans for the selected model river basins are adequate for the implementation of flood control projects by the Philippine Government in the years to come.

6.2 Recommendation

The recommendations on the following points were specified:

1. To assure the 8.2% growth rate of DPWH budget to cover the flood control projects for selected 56 river basins.
2. To utilize the proposed implementation schedule for preparation of a medium-term plan as well as a long term plan in the flood control sector.
3. To review the adequacy of sharing 95% and 5% of investment amount between foreign assisted projects and locally funded projects.
4. To make a package for projects, the costs of which are expected to be small and classified into the group of locally funded projects, to facilitate early implementation with international funds.
5. To review the basin boundaries using more precisely scaled maps like 1/50,000.
6. To renew the evaluation of flood vulnerability of the 1,164 river basins updating flood damage data and other statistical data.
7. To make further discussions to clarify the definition of river basins and responsibility of administration by agencies concerned to realize more effective river basin management including flood control.
8. To enhance the accuracy of hydraulic analysis by applying more precise hydraulic model and satellite images in the future.
9. To renew the relation between design discharge and unit price for river channel improvement using additional data whenever the other studies on flood mitigation are conducted.
10. To review the cost and dimension of sediment facilities examined for some of the model river basins in the further project stage.
11. To renew rates such as damage rate and conversion rate from flood damage to benefit whenever the other studies on flood mitigation projects are examined in the future.
12. To maintain and upgrade GIS database and systems developed in this Study, so that DPWH including FCSEC can use them as more effective tools for policy-making in the flood control sector.
13. To utilize and reference the flood mitigation plans for model river basins considering the similarity of flood damage types and DPWH-FCSEC should support to develop the formulation of such plans.
14. To conduct further study with additional or more data to upgrade the accuracy of outputs for model river basins.
15. To review the necessity of sediment control facilities with enough dimensions to cope with the sediment disaster from the social view points in the future.

16. To request the dispatch of short-term experts to assure the continued transfer of knowledge used in the Study and to upgrade, modify/or adjust the outputs of the Study by DPWH counterpart personnel.

Tab. -1 Outline of Flood Control Plan for Model River Basin

Name of River Basin	Catchment Area (km^2)	Flow Capacity (m^3/s)	Design Discharge (m^3/s)	Safety Level (Return Period)	Major Flood Types	Flood Damage Area	Optimum Measures		Economic Evaluation			Overall Evaluation
							Structural Measures	Non-Structural Measures	Cost (mil. Pesos)**	Benefit (mil. Pesos/ year)	EIRR (%)	
Ilog-Hilabangan	2,162	250	3,690	25-year	Overflow and Bank Erosion	Built up Area, Agricultural Area and Fish Pond	River Channel Improvement*	Flood Warning System, Watershed Management and Others	1,537	208	18.9	At present, it is identified that the project is technically and economically feasible and will be accepted socially and environmentally.
Dungcaan	176	290	655	20-year	Overflow and Bank Erosion	Built up Area and Agricultural Area	River Channel Improvement*	Flood Warning System, Watershed Management and Others	154	21	18.8	At present, it is identified that the project is technically and economically feasible and will be accepted socially and environmentally.
Meycauayan	201	400	990	30-year	Overflow and Inland Flooding	Built up Area, Agricultural Area and Fish Pond	River Channel Improvement* and Drainage Facilities	Flood Warning System, Watershed Management and Others	4,985	850	23.3	At present, it is identified that the project is technically and economically feasible and will be accepted socially and environmentally.
Kinanliman	10	190	380	25-year	Flash Flood (Debris Flow) and Overflow	Built up Area	River Channel Improvement* and Sabo Dam	Flood Warning System, Watershed Management and Others	107	13	17.3	At present, it is identified that the project is technically and economically feasible and will be accepted socially and environmentally.
Tuganay	747	175	540	25-year	Overflow and Inland Flooding	Built up Area, Agricultural Area and Fish Pond	River Channel Improvement* and Retarding Basins	Flood Warning System, Watershed Management and Others	1,948	266	19.1	At present, it is identified that the project is technically and economically feasible and will be accepted socially and environmentally.
Dinanggasan	29	180	296	20-year	Flash Flood (Debris Flow) and Overflow	Built up Area and Agricultural Area	River Channel Improvement*, Sabo Dam and Sand Pocket	Flood Warning System, Watershed Management and Others	108	12	15.7	At present, it is identified that the project is technically and economically feasible and will be accepted socially and environmentally.

*: River channel improvement including provision of revetment, spur dyke or concrete wall. **: Cost means economic cost.

THE STUDY ON THE NATIONWIDE FLOOD RISK ASSESSMENT AND THE FLOOD MITIGATION PLAN FOR THE SELECTED AREAS IN THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT
VOLUME I
-SUMMARY REPORT-

Preface
Letter of Transmittal
Location Map
Executive Summary
Abbreviations and Acronyms
Measurement Units

Table of Contents

List of Tables

Tables

List of Figures

Figure

List of Tabs.

Tab.

List of Figs.

Fig.

ABBREVIATIONS AND ACRONYMS

A&D	:	Alienable and Disposable
AO	:	Administrative Order
ARC	:	Agrarian Reform Community
ARMM	:	Autonomous Region of Muslim Mindanao
B/C	:	Benefit/Cost Ratio
BRS	:	Bureau of Research and Standards, DPWH
BSWM	:	Bureau of Soils and Water Management
CAR	:	Cordillera Administrative Region
CBFEWS	:	Community-Based Flood Early Warning System
CDCC	:	City Disaster Coordinating Council
CHB	:	Concrete Hollow Block
CPI	:	Consumer Price Index
CR	:	Cross Section
DA	:	Department of Agriculture
DAO	:	Department Administrative Order
DAR	:	Department of Agrarian Reform
DCC	:	Disaster Coordinating Council
D/D	:	Detailed Design
DEM	:	Digital Elevation Model
DENR	:	Department of Environment and Natural Resources
DEO	:	District Engineering Office, DPWH
DND	:	Department of National Defense
DOF	:	Department of Finance
DOST	:	Department of Science and Technology
DPWH	:	Department of Public Works and Highways
DSWD	:	Department of Social Welfare and Development
ECA	:	Environmentally Critical Areas
ECC	:	Environmentally Compliance Certificate
ECP	:	Environmentally Critical Projects
EIA	:	Environmental Impact Assessment
EIRR	:	Economic Internal Rate of Return
EIS	:	Environmental Impact Statement
EMB	:	Environmental Management Bureau, DENR
FCSEC	:	Flood Control and Sabo Engineering Center

FMB	:	Forest Management Bureau, DENR
FMC	:	Flood Mitigation Committee
FVI	:	Flood Vulnerability Index
F/S	:	Feasibility Study
GDP	:	Gross Domestic Product
GIS	:	Geographic Information Systems
GNP	:	Gross National Product
GOJ	:	Government of Japan
GOP	:	Government of the Philippines
I/A (I/P)	:	Implementing Arrangement (Implementing Program)
IEE	:	Initial Environmental Examination
JBIC	:	Japan Bank for International Cooperation
IWRM	:	Integrated Water Resources Management
JICA	:	Japan International Cooperation Agency
KAMANABA	:	Kaloocan, Malabon, Navotas and Valenzuela
L/A	:	Loan Agreement
LGU	:	Local Government Unit
MDCC	:	Municipal Disaster Coordinating Council
MGB	:	Mines and Geosciences Bureau, DENR
MHW	:	Mean Monthly Highest Water Level
MP	:	Master Plan
MPDC / MPDO	:	Municipal Planning and Development Coordinator / Municipal Planning and Development Office
MRB	:	Major River Basin
MTPDP	:	Medium Term Philippine Development Plan
MTPIP	:	Medium Term Public Investment Program, DPWH
NAMRIA	:	National Mapping and Resource Information Authority, DENR
NCR	:	National Capital Region
NDCC	:	National Disaster Coordinating Council
NEDA	:	National Economic and Development Authority
NFMC	:	National Flood Management Committee
NFMFP	:	National Flood Mitigation Framework Plan
NGO	:	Non-Government Organization
NHRC	:	National Hydraulic Research Center, UPERDFI
NIA	:	National Irrigation Administration

NPV	:	Net Present Value
NSCB	:	National Statistics Coordination Board
NSO	:	National Statistics Office
NWRB	:	National Water Resources Board, DENR
NWRC	:	National Water Resources Council
O&M	:	Operation and Management
OCD	:	Office of Civil Defense
ODA	:	Official Development Assistance
OECF	:	Overseas Economic Cooperation Fund
PAF	:	Project Affected Family
PAGASA	:	Philippine Atmospheric, Geophysical and Astronomical Services Administration, DOST
PAP	:	Project Affected People
PAR	:	Philippine Area of Responsibility
PCA	:	Philippine Coconut Authority
PD	:	Presidential Decree
PENRO	:	Provincial Environment and Natural Resources Office
PHIVOLCS	:	Philippine Institute of Volcanology and Seismology, DOST
PMO	:	Project Management Office
PRB	:	Principal River Basin
PRS	:	Philippine Reference System
PTM	:	Philippine Transverse Mercator
RDC	:	Regional Development Council
RA	:	Republic Act
ROW	:	Right-of-Way
RS&RDAD	:	Remote Sensing and Resource Data Analysis Department
SRTM	:	Shuttle Radar Topography Mission
STM	:	Stakeholder's Meeting
STW	:	Stakeholder's Workshop
TOR	:	Terms of Reference
TSP	:	Total Suspended Particulates
TWG	:	Technical Working Group
UDHA	:	Urban Development and Housing Act
UP	:	University of the Philippines
UPERDFI	:	U.P. Engineering Research and Development Foundation Inc.
USEPA	:	United States Environmental Protection Agency

UTM : Universal Transverse Mercator

VOM : Valenzuela, Obando and Meycauayan

MEASUREMENT UNITS

(Length)		(Time)	
mm	: millimeter(s)	s, sec	: second(s)
cm	: centimeter(s)	min	: minute(s)
m	: meter(s)	h, hr	: hour(s)
km	: kilometer(s)	d, dy	: day(s)
		y, yr	: year(s)

(Area)		(Volume)	
mm^2	: square millimeter(s)	cm^3	: cubic centimeter(s)
cm^2	: square centimeter(s)	m^3	: cubic meter(s)
m^2	: square meter(s)	l, ltr	: liter(s)
km^2	: square kilometer(s)	MCM	: million cubic meter(s)
ha	: hectare(s)		

(Weight)		(Velocity)	
kg	: kilogram(s)	m/s	: meter per second
ton	: ton(s)	km/h	: kilometer per hour

1. INTRODUCTION

1.1 Objectives of the Study

The objectives of the Study are:

(1) To select prioritized areas based on the flood risk assessment and to prepare flood mitigation plans for these selected areas.

(2) To conduct technology transfer to DPWH counterpart personnel during the course of the Study.

1.2 The Study Area

The Study covers the 947 flood-prone cities/municipalities identified by the National Disaster Coordinating Council.

1.3 The Study Schedule

The study schedule is as shown in Figure 1.1. The Study was started in the beginning of September 2006 in a manner of Home Work. The Field Survey Work was started in the middle of September 2006, and continued until the middle of March 2008.

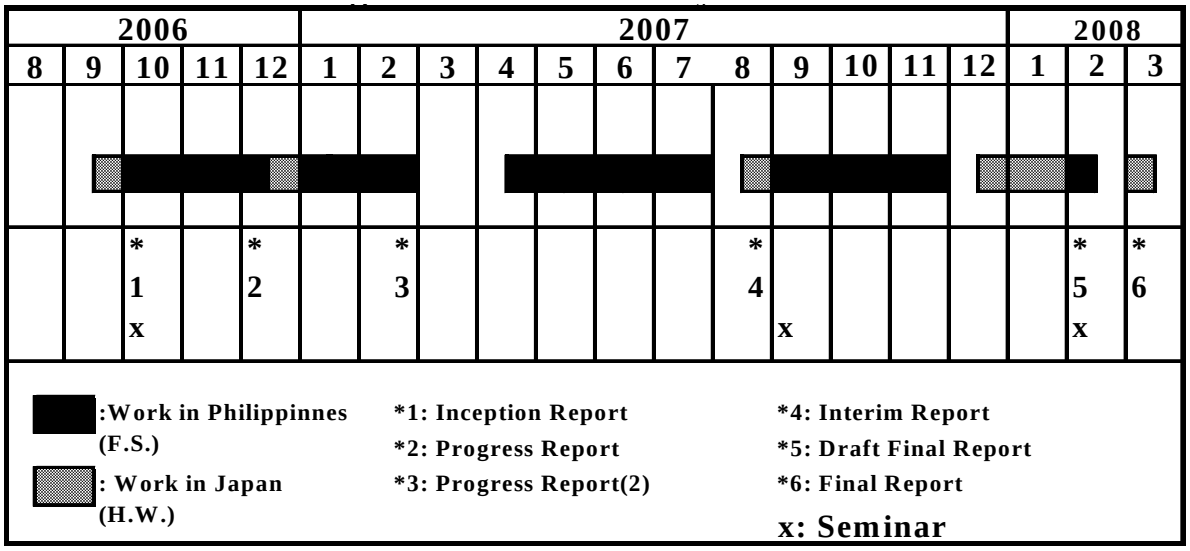


Figure 1.1 Study Schedule, JICA, 2006-2008

1.4 Basic Conditions for Conducting the Study

In order to conduct the Study, the following conditions were discussed and confirmed with the entities concerned; (1) Target Year for Prioritization and (2) Safety Level for the Formulation of Flood Control Projects.

1.4.1 Target Year

One of the main purposes for selecting of the prioritized areas was to narrow down the number of areas, where the flood control projects should be provided within a certain period. In this context, it was necessary to set up the target year to confirm that certain period.

Through the discussions at the First Steering Committee Meeting held in September 2006, the Philippine Side and the Study Team agreed that the target year should be 2034, which corresponds to the final year of the four Medium-Term Philippine Development Plans that will start from 2011 after the termination of current Medium-Term Plan.

1.4.2 Safety Level

For prioritization, it was necessary to examine and compare the economic efficiency of the flood control projects for several areas at the same level of safety. For this purpose, it was also necessary to set up the safety level for the comparison among these areas. Through the discussions at the First Steering Committee Meeting, it was also agreed that the safety level should be 20-year return period for the comparison of economic efficiency of the flood control projects.

2. FIRST SCREENING OF RIVER BASINS

2.1 Procedure of the First Screening

The procedure of the First Screening is as shown in the Figure 2.1.

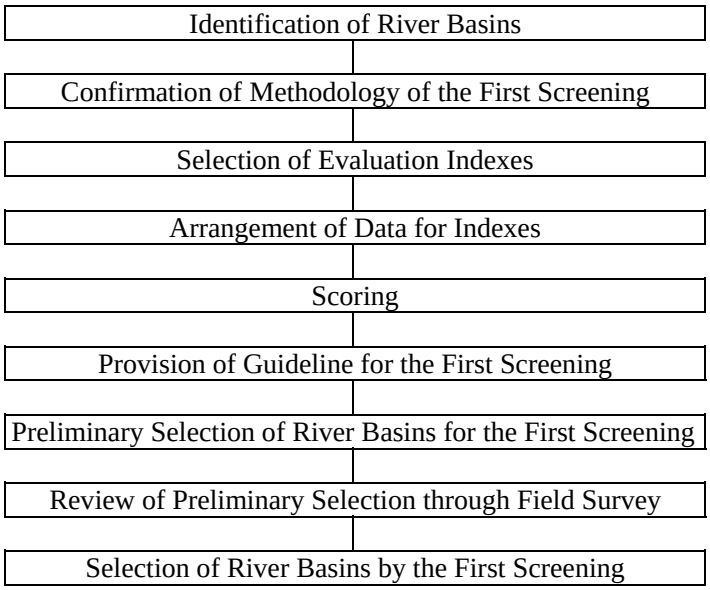


Figure 2.1 Procedure of First Screening

2.2 Identification of River Basins

The objective river basins for the First Screening are identified, to which 947 flood prone cities/municipalities belong. As the results, it has been identified that the total number of river basins covering the flood prone areas is 1,164 river basins including major river basins as shown in the following table:

Table 2.1 Total Number of River Basins

River Basins	Number	Remarks
Independent Principal River Basins	376	Including 75 Tributaries of Major Rivers
Major River Basins	18	
Other River Basins	770	
Ground Total	1,164	Covering the Flood Prone Areas

Note: In this table, Principal River Basin and Major River Basin are based on the definition by NWRB and the river basins excluded from the definition are defined as Other River Basins.

2.3 Confirmation of Methodology of the First Screening

The methodology of the First Screening was confirmed considering the previous practices on similar undertakings. The proposed methodology, in principle, was the scoring of evaluation indexes. A screening guideline where some other factors were taken into account was also provided.

2.4 Selection of Evaluation Indexes

Based on the confirmed methodology, evaluation indexes were selected. These evaluation indexes represent flood damage potential from the viewpoints of natural and socio-economic conditions, as shown in Table 2.2.

Table 2.2 List of Indexes and Allocated Scores

Category	Sub-Category	Index		Assessment Score and Range
Socio-Economic Conditions	Poverty	S1	Poverty Incidence	1-5
	Population	S2	Population	1-5
	Population	S3	Population Movement	1-5
	Assets	S4	Production	1-5
	Land Uses	S5	Forest Cover Ratio	1-5
	Land Uses	S6	Built-up Area ratio	1-5
	Flood Damage Records	S7	Flood Casualties	1-15
	Flood Damage Records	S8	Flood Damages	1-15
Natural Conditions	Meteorology	N1	Frequency of Typhoons	1-5
	Hydrology	N2	Rainfall Intensity	1-5
	Topography	N3	River Gradient	1-5
	Geology	N4	Ratio of Hazards Zone of Volcano	1-5
	Flood Frequency	N5-C	Flood Frequency based on Flood Casualties	1-5
		N5-D	Flood Frequency based on Flood Damages	1-5

2.5 Arrangement of Data for Indexes

For the selected evaluation indexes, the necessary data were collected, whose data consist of administrative division level data, such as provincial, city or municipality level, and GIS data. These administrative data were converted into river basin data using GIS, etc.

2.6 Scoring Results

In the First Screening, 1,164 river basins were prioritized based on the total score. The ranking of 100 river basins by the score is shown in the Main Report (Tab.3-10).

2.7 Provision of Guideline for the First Screening

For the First Screening, some other factors together with the ranking by score were considered and arranged as the guideline. The guideline thus arranged is as described below. Selected in the preliminary screening were 100 river basins.

- From the 100 river basins in the list, those already implemented or whose implementation was already scheduled by the DPWH, such as Laoag, Pampanga and Pasig are replaced by

river basins after the 100 rank, which are to be extracted from the "Water & Floods, March 2004" prepared by DPWH (GOJ Assisted Projects: 1971–Present).

- Major river basins and dangerous river basins on flood events which are also to be taken from "Water & Floods, March 2004," are to be selected regardless of rank.
- At least a few river basins of higher rank are to be included in each administrative region.
- For the remaining number of the river basins, 80% and 20% of river basins are to be allocated to "Principal River Basins" and "Other River Basins", respectively.

2.8 Preliminary Selection of River Basins for the First Screening

Preliminarily selected based on the guideline mentioned above were 100 river basins. The list of the selected 100 river basins is given in the Main Report (Tab. 3-12).

2.9 Review of Preliminary Selection through Field Survey

To confirm the adequacy of the preliminarily selected 100 river basins, a field survey was conducted. Through the field survey, two river basins were judged to have less flood damage potential and these were excluded from the 100 river basins. On the other hand, based on the discussion with the DPWH regional offices, 6 major river basins and 16 river basins newly identified as dangerous river basins were added to the 100 river basins.

2.10 Selection of River Basins by the First Screening

A total of 120 river basins (i.e., 100–2+6+16=120) were identified in the First Screening as the objective river basins for the Second Screening. Tab. 2-1 and Fig. 2-1 show the list and locations of these 120 river basins.

3. SECOND SCREENING OF RIVER BASINS

3.1 Objective and Procedure of the Second Screening

3.1.1 Objective of the Second Screening

The objective of the Second Screening was to further narrow down the 120 river basins selected in the First Screening to those that could be implemented within the target period of 26 years from 2009 to 2034.

3.1.2 Procedure of the Second Screening

(1) Key Points Considered for the Second Screening

For the Second Screening, the following key points were further considered:

- Ranking of river basins with newly obtained scores.
- Consideration of possible investment amounts.
- Regional distribution of flood control projects.
- Strategic significance of the river basins.

(2) Procedure of the Second Screening

In due consideration of the above key points, the Second Screening was done, as follows:

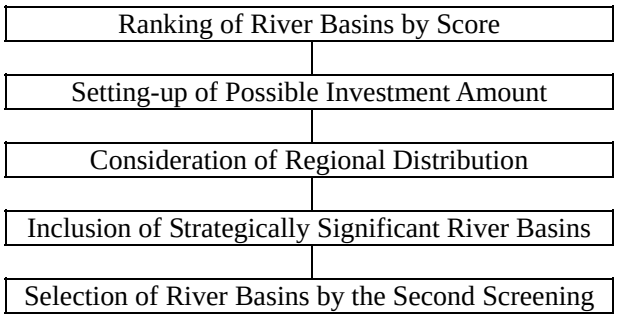


Figure 3.1 Procedure of the Second Screening

1) Ranking of River Basins by Score

The prioritization of river basins for project implementation was, in principle, given by ranking them based on the total score of the economic efficiency in addition to the score obtained in the First Screening.

2) Setting-up of Possible Investment Amount

For the above prioritization, the number of river basins was first be narrowed down considering the amount of possible investment from the DPWH in the target period of 26 years from 2009 to 2034.

3) Consideration of Regional Distribution

The development of the country should be promoted equally for every region without any discrimination. From this point of view, it is necessary to arrange infrastructures such as flood control projects for every region. To pursue this objective, at least a few river basins for each of the 17 administrative regions were included in the list for the Second Screening.

4) Strategically Significant River Basins

Besides the above, some river basins generally recognized as significant for the provision of flood control projects such as the major river basins were included in the list regardless of rank.

3.1.3 Scoring and Ranking of 120 River Basins

(1) General

For the scoring in the Second Screening, the scores on economic efficiency based on Cost (C) and Benefit (B) of the flood control project(s) for the 120 river basins were examined. Then, based on the total score on economic efficiency of each project in addition to the one obtained in the First Screening, ranking of the 120 river basins was arranged.

(2) Score on Economic Efficiency

1) Indexes to Evaluate Economic Efficiency

For the evaluation of economic efficiency, the following two indexes, generally applied to the economic evaluation of projects together with EIRR, were considered:

- Net Present Value [Benefit Index (B) - Cost Index (C)]
- Ratio between Benefit Index and Cost Index (B/C)

2) Maximum Score Given to Two Indexes

As the maximum score given to the two indexes, 90 points was applied from the following reasons:

- In the First Screening, the score of 90 points in total was given for the 14 indexes.
- Since the economic efficiency index is one of the very significant factors for decision-making on project implementation, the same score as the First Screening (90 points) was given to the economic efficiency index; namely, 90 points for [(B)–(C)] and 90 points for [(B)/(C)].

(3) Ranking Results of 120 River Basins

The rank of each of the 120 river basins by the total score is shown in Tab. 3-1.

3.1.4 Analysis for Investment Amount

(1) Comparison of Medium-Term Investment Program and Actual Investment Amount

It is virtually impossible to implement all of the flood control projects for the 120 river basins during the limited target period of 2009 to 2034 considering the availability of funds. Since funds for flood control projects are, in principle, provided from the DPWH budget, the expected budget for a flood control project was examined under several DPWH budgetary growth rates (hereinafter referred to as "growth rate"), considering the previous practices in the Medium-Term Investment Program prepared by DPWH, and the actual investment amounts.

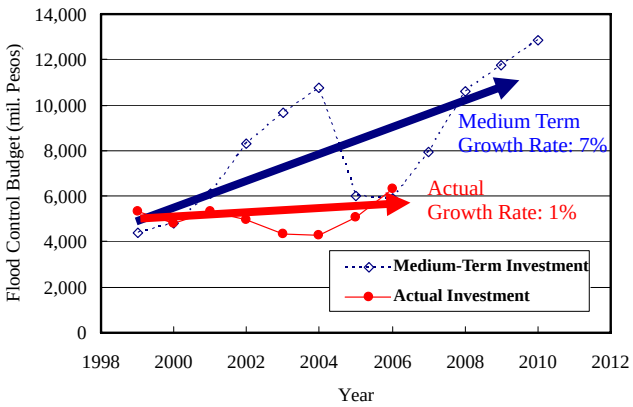


Figure 3.2 Comparison between Medium-Term Investment Program and Actual Investment Amount

A comparison between the Medium-Term Investment Program and the actual investment amount is shown in Figure 3.2. The growth rate of the Medium-Term Investment Program in 2006 was around 7% and that of the actual investment amount was around 1%。 In case of the Medium-Term Investment Program from 2006 to 2010, the average growth rate almost reached up to 29%.

(2) Expected Investment Amount

Based on the above comparison, expected are several cases of investment, i.e., between 1% and 29%. Fig. 3-1 shows the expected investment amounts under several growth rates as the example.

3.1.5 Selection of the River Basins through the Second Screening

(1) Prioritization by Ranking

The priority of river basins by ranking has been arranged, as shown in Tab. 3-1.

(2) Consideration of Possible Investment Cost

As discussed earlier, several scenarios of growth rate of the DPWH budget have been considered in terms of possible investment cost, as follows (refer to Table 3.1):

- 1% growth rate based on the actual investment amount from 1999 to 2006
- 7% growth rate based on the average of the Medium-Term Investment Program from 1999 to 2010
- 8% growth rate based on a higher Medium-Term Investment Program from 1999 to 2010
- 11% growth rate based on the recent actual investment amount from 2006 to 2008
- 29% growth rate based on Medium-Term Investment Program from 2006-2010

Among these growth rates, the 8% growth rate scenario is tentatively proposed from the following reasons:

- The 1% growth rate is not realistic, considering the significance of investment for flood control projects.
- Likewise, 29% is not also realistic considering the sustainability of long term investment covering 26 years, even though this figure has been applied to some previous Medium-Term Investment Program.
- It may be possible to apply 11%, which can cover almost all of the 120 river basins. However, it seems to be too high to sustain this growth rate, and it is not realistic to cover 120 river basins judging from the previous practices of implementation of flood control projects in the past 20 years during which those for only about 20 river basins have been implemented.
- Between the 7% and 8% scenarios, both are applicable, but 8% is preferable to fulfill the requirement of early implementation of flood control projects by the local side, considering the recurrence of recent natural disasters.

Table 3.1 Relationship among DPWH Growth Rates, Available Budget and Number of Achievable Projects

DPWH Growth Rate	Available Budget (mil. Pesos)	Number of Achievable Projects
1	82,006	13
3	108,569	13
5	145,235	23
7	196,117	33
8	228,718	47
9	267,257	111
11	367,035	more than 120

Assuming that 8% growth is applied, the total investment amount will be 228 billion pesos, by which flood control projects for 47 river basins can be implemented (refer to Table 3.1).

(3) Regional Distribution

From the viewpoint of regional distribution of flood control projects, it has been proposed that at least a few river basins for each of the 17 regions should be included in the list for the Second Screening.

However, among the above 47 river basins, only one river basin is allocated to five (5) regions (Region II, VI-B, VIII, IX and ARMM), while no river basin is included in one (1) region (Region XIII) (refer to Tab.3-1).

In the above situation, it is proposed that at least two (2) river basins in total should be allocated to the above six (6) regions. In order to fulfill this condition, it is necessary to add seven (7) river basins (47+7=54) with 6.4 billion pesos under the above 8% growth scenario of possible investment amount (refer to Tab.3-1).

(4) Strategic Significance of River Basins

In the Philippines, flood control projects have been implemented putting high priority on strategically significant river basins, especially, the 18 major river basins, considering the magnitude of regional socio-economic influence. Regarding this point, two (2) major river basins are not included in the list of the above 54 river basins.

In the above situation, it was proposed to include these two (2) major river basins (54+2=56) in the list for the Second Screening. In order to fulfill this condition, it is necessary to increase the investment amount by 1.3 billion pesos (refer to Tab.3-1).

(5) Selection of the River Basins through the Second Screening

Through these procedures, the selected river basins together with the investment amount are as shown below (refer to Tab. 3-2 and Fig. 3-2):

- Number of Selected River Basins : 56 river basins
- Investment Amount (2009-2034) : 236 billion pesos
- DPWH Budget Growth Rate : 8.2%

3.2 Prioritization and Arrangement of Implementation Schedule

For the selected 56 river basins, prioritization was examined considering not only ranking by score but also other factors and then the implementation schedule was arranged under the conditions described below.

3.2.1 Implementation Period

It is assumed that the implementation of flood control projects for these 56 river basins is completed within the target period of 2009-2034 and, for the implementation of one project it is assumed that 8 years are, in principle, required including the periods for feasibility study and detailed design.

However, it is also assumed that some projects that require a huge fund like the one in the Cagayan River Basin with the project cost of about 50 billion pesos will be implemented by dividing the period into several phases.

3.2.2 Classification of River Basins

For the prioritization and arrangement of implementation schedule, 56 river basins are classified considering the financial source of the project:

(1) Financial Source

For the project implementation, 236 billion pesos is proposed, which is composed of international funds and local funds.

(2) Classification of Projects

According to the Medium-Term Investment Program, the flood control projects are broadly classified into (1) foreign-assisted projects, which are financed by international funds and local funds, and (2) locally funded projects, which are financed by only local funds. The Study also classified the projects into these two groups.

(3) Allocation of Foreign-Assisted Projects and Local Fund Projects

According to the Medium-Term Investment Program, it has proposed that 95% of the total investment amount should be allocated to foreign-assisted projects and 5% is allocated to locally funded projects. In this Study, it is assumed that the same ratio of 95% and 5% would be applied for future investment.

Table 3.2 DPWH Mid-Term Investment Program (2005-2010)

Item	Amount (billion Pesos)	Ratio (%)
Foreign-Assisted Project	93.4	95.0
On-going	*38.6*	*39.3*
New Proposed	*54.8*	*55.7*
Locally Funded Project	4.9	5.0
Total	98.3	100.0

(4) Classification of River Basins

Under the above situations, the 56 river basins are arranged in order of the amount of the project costs. Finally, out of the 56 river basins, 26 river basins, of which project costs are more than 1.0 billion pesos, are classified as foreign-assisted projects; while 30 river basins are classified as locally funded projects (refer to Table 3.3).

The allocation from international funds amount to 223 billion pesos, and local funds account for 13 billion pesos.

Table 3.3 Classification of River Basins

Classification	No. of River Basins	Total Project Cost (billion Pesos)	Share (%)
Foreign-Assisted Project	26	223	95
Locally Funded Project	30	13	5

3.2.3 Prioritization

The prioritization which has been classified into two groups, foreign-assisted projects and locally funded projects, was arranged separately through the following procedure:

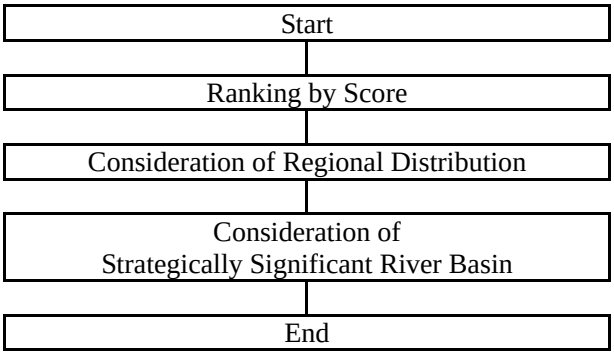


Figure 3.3 Procedure of Prioritization

(1) Ranking by Score

As the first step, the foreign-assisted projects of 26 river basins and the locally-funded projects of the 30 river basins were arranged according to score, as shown in Tab.3-3.

(2) Consideration of Regional Distribution

According to the ranking by score, most of the river basins located in Luzon could be placed on a higher rank (refer to Tab.3-3); however, complaints may be raised from the other regions. To avoid such a situation, the rotation of arrangement of river basins in each region, like the order of Luzon, Visayas and Mindanao, was considered. In case of river basins with foreign-assisted projects, the number of river basins in the three regions are: 15 in Luzon, 4 in Visayas and 7 in Mindanao; while those with locally funded projects are: 12 in Luzon, 6 in Visayas and 12 in Mindanao (refer to Tab.3-4).

Based on the above situations, the following rotations were arranged: 2 river basins in Luzon, 1 in Visayas and 1 in Mindanao for foreign-assisted projects, and 2 river basins in Luzon, 1 in Visayas and 2 in Mindanao for locally funded projects.

Tab.3-5 shows the arrangement of river basins considering regional distribution together with the ranking by score in each region.

(3) Consideration of Strategic River Basin

Before the Study was started, the DPWH Medium-Term Investment Program had listed for early implementation several strategic river basins with foreign-assisted projects or locally funded projects (refer to Tab.3-6). Since the early implementation of these river basin projects has already been announced and thus expected by the stakeholders, it was difficult to disregard them in the Study. The arrangement of river basins considering such strategic river basins as well as the score and regional distribution is shown in Tab.3-7.

(4) Prioritization

The prioritization for 56 river basins, which were classified into two groups; namely, foreign-assisted projects of 26 river basins and locally funded projects of 30 river basins, was set considering the ranking by score, regional distribution and strategic river basin as shown in Tab. 3-7.

3.2.4 Implementation Schedule

The implementation schedule of projects for the 56 river basins has been arranged for the period from 2009 to 2034 as shown in Fig.3-3.

4. GROUPING AND SELECTIOIN OF MODEL RIVER BASINS

4.1 General

In the previous section, 56 river basins have been selected as the results of the Second Screening. In this section, these 56 river basins are classified into several groups according to flood damage type; namely, [Overflow (O), Flash Flood (F), Bank Erosion (B), Inland Flooding (I) and Lahar (L)]. One model river basin is selected from each group, as shown in the following diagram.

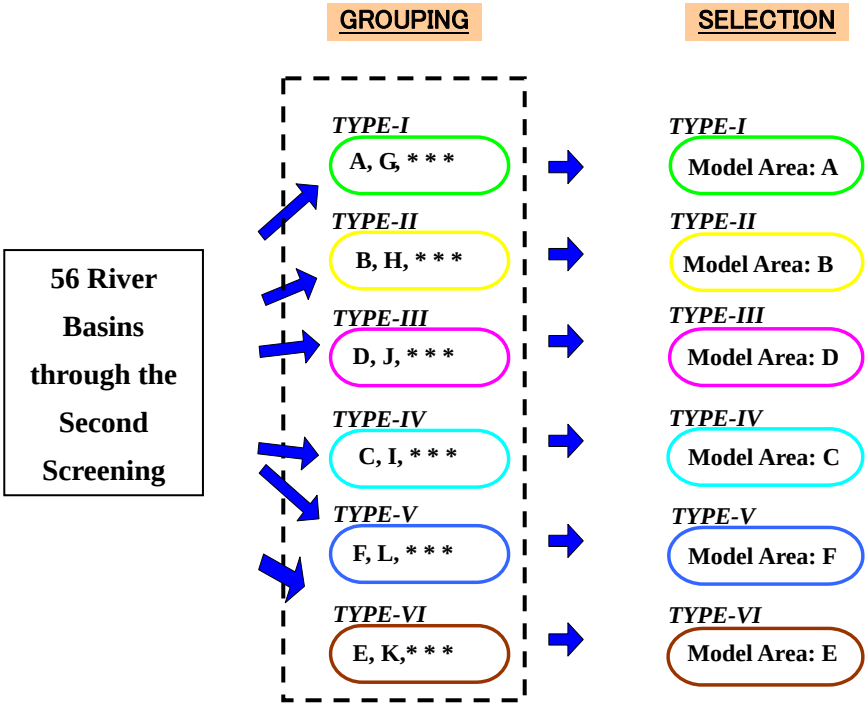


Figure 4.1 Grouping and Selection of Model River Basin

4.2 Grouping of 56 River Basins

In principle, grouping was made on the basis of the flood damage type. However, as identified in the field survey results, most of the river basins suffer from not only one flood damage type, but also a combination of plural flood damage types such as lahar or debris flow (L) and flash flood (F) in the upstream, bank erosion (B) and overflow (O) in the middle and downstream, and inland flooding (I) in the downstream. Finally, these combinations of plural flood damage types were classified into six groups (refer to Figure.4.2).

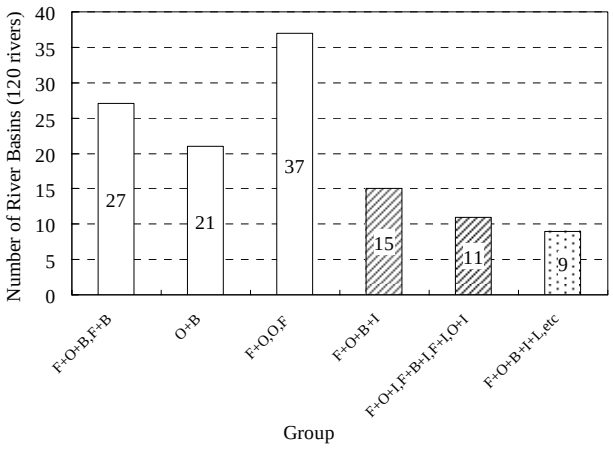


Figure 4.2 Classified 120 River Basins in terms of Flood Damage Types

4.3 Selection of Model River Basins

The model river basins were selected under the following principles, namely, one from each of the six groups:

- Two (2) model river basins are selected for each region (Luzon, Visayas and Mindanao).
- High priority is given to higher-ranking river basins.
- High priority is also given to river basins with enough data and information.

As a result, the following six river basins were selected as model river basins (refer to Table 4.1 and Tab.4-1):

Table 4.1 Model River Basins

Group	Name of River Basin	Region	Catchment Area (km^2)	Ranking
F+O+B, F+B Type	Ilog-Hilabangan	VI and VII (Visayas)	2,162	30
O+B Type	Dungcaan	VIII (Visayas)	176	47
F+O, O, F Type	Meycauayan	III and NCR (Luzon)	201	7
F+O+B+I, F+I Type	Kinanliman	IV-A (Luzon)	10	25
F+O+I, F+I+B, F+I Type	Tuganay	XI (Mindanao)	747	32
F+O+B+I+L Type	Dinanggasan	X (Mindanao)	29	16

** F: Flash Flood, O: Overflow, B: Bank Erosion, I: Inland Flood, L: Lahar and/or Debris Flow*

5. FORMULATION OF FLOOD MITIGATION PLANS FOR MODEL RIVER BASINS

5.1 Basic Procedure for Formulation

The basic procedure for formulation of flood mitigation plans for model river basins are, as follows:

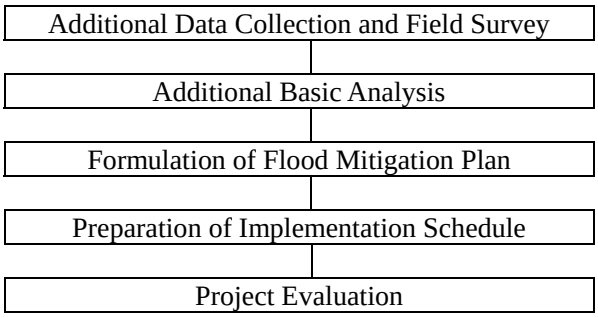


Figure 5.1 Procedure of Formulation of Flood Mitigation Plan

5.2 Basic Conditions for the Formulation of Flood Mitigation Plan

The flood mitigation plan for each of the model river basins has been formulated, as follows:

(1) Objective River Basins

The objective river basins for plan formulation are the selected six (6) model river basins; namely, Ilog-Hilabangan, Dungcaan, Meycauayan, Kinanliman, Tuganay and Dinanggasan.

(2) Safety Level and Area to be Protected

In principle, the flood mitigation projects for these river basins were formulated with the safety level of 20-year return period. However, if previous plans have already been prepared for a certain river basins like the Ilog-Hilabangan, the safety level of the previous plan was applied.
As for the area to be protected, it was in principle based on the current flood damage area, which was finally adjusted in due consideration of economic efficiency, i.e., the ratio between benefit and cost.

(3) Applicable Measures and Selection of Optimum Measures

As the applicable measures, both structural and non-structural measures were examined. The optimum measures for the structural measures were selected through a comparison study on several alternatives prepared in principle with the combination of such structural measures. On the other hand, the direction of improvement is examined on the non-structural measures independently among several conceivable measures.

(4) Implementation Schedule

The Implementation Schedule was prepared assuming that implementation will take eight (8) years including the feasibility and detailed design study periods.

(5) Cost Estimate

Project costs have been estimated for the optimum measures for the structural measures applying a very rough preliminary level design; while the costs for non-structural measures were estimated for the reference materials. The cost estimation was made under the following conditions:

1) Unit Cost

Unit costs applied in this Study are in principle derived from the previous related projects as provided by the DPWH.

2) Price Level

All the costs are estimated on the Philippine Peso basis using the currency conversion rates of USD1.00 = PHP44.93 = JY115.55 prevailing as of October 2007.

(6) Benefit Calculation

Benefits attributable to the proposed projects include direct and indirect flood damages as well as intangible flood damages. Direct damage refers to loss of building assets and private properties, while indirect flood damage includes interference of traffic and the resulting retail and industrial losses. Intangible flood damages are damage such as increase of health hazards and environmental degradation.

The benefit accrued from the structural measures is calculated based on the optimum structural measures for the direct and indirect flood damages (in 2006 price level). On the other hand, the benefit from the non-structural measures is preliminarily estimated only for the Community-Based Flood Early Warning System for the direct flood damages to examine appropriate system for the target river basin. While the benefits from the other non-structural measures are not estimated because of difficulty of their benefit quantification.

Intangible flood damage is not considered as part of the benefit due to the difficulty of quantification.

(7) Responsible Agencies for Implementation, Operation and Maintenance

In principle, it is considered that the following agencies have the responsibility for implementation, operation and maintenance for structural and non-structural measures:

Table 5.1 Responsible Agencies

Proposed Measures		Major Responsible Agency
Structural	River Channel Improvement	DPWH and LGUs
	Retarding Basin	DPWH and LGUs
	Sabo Dam	DPWH and LGUs
Non-Structural	Flood Warning	PAGASA and DCCs
	Watershed Management	DENR and LGUs
	Other Measures including Disaster Management	OCD and LGUs

(8) Initial Environmental Examination (IEE)

According to the Philippine legal framework of environmental impact assessment (EIA), the initial environmental examination (IEE) is not required in the master plan stage and since the planning Study was conducted before the master plan study, the IEE is in principle not necessary. However, in the Study, the IEE was made with reference to the JICA Guideline for Environmental and Social Considerations (April 2004).

(9) Project Evaluation

The adequacy of projects was evaluated considering the aspects of technical feasibility, economic viability, social acceptance and environmental acceptance. In this connection, economic viability was evaluated only for the structural measures from the reasons mentioned in the above Item (6), Benefit Calculation.

(10) Accuracy of the Study

The Study on the formulation of a flood control plans for the six (6) model river basins was conducted in a very limited time (3 months), so that the accuracy is very rough and the level is supposed to be a pre-master plan. Therefore, for the implementation of flood control projects for the model river basins, further studies such as master plan and feasibility studies are absolutely necessary.

5.3 Formulation of Flood Mitigation Plan for the Ilog-Hilabangan River Basin

5.3.1 River Basin Condition

The features of the river basin are as specified below:

(1) Floods and Flood Damage

The Ilog-Hilabangan River Basin with the catchment area of 2,162 km^2 has habitually experiences small-scale floods in almost every year and bigger ones in every ten years. The major causes of flood damage are the flash floods in the upstream tributaries, and the over-bank flow and bank erosion in the downstream. Flood damage especially in the downstream reaches is

severe, because the floodwaters that overflow from the river channel widely spread in the flat plain and inflict damage to agricultural and urban areas including the municipalities of Kabankalan and Ilog. In the 1984 flood, the inundation area reached up to about 125 km^2 (almost 70% of the flat plain in the downstream), because the channel flow capacity is only 250 m^3/s, while the design discharge of 25-year return period is 3,690 m^3/s, as illustrated in Figure 5.2.

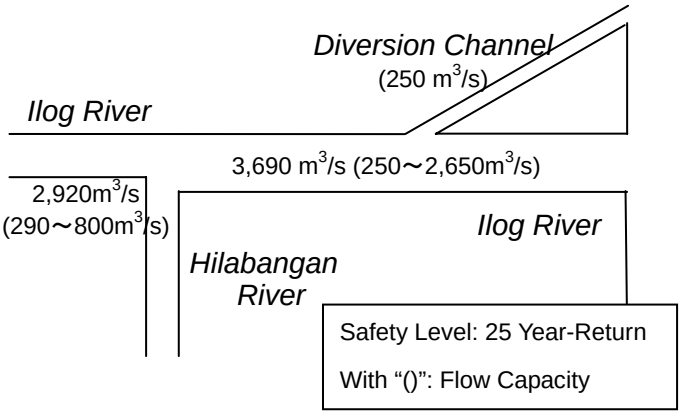


Figure 5.2 Design Discharge Distribution (Ilog-Hilabangan River Basin)

(2) Measures Undertaken and Previous Related Study

The agencies concerned like DPWH and the LGUs have been making efforts to alleviate flood damage within their financial affordability such as dredging works for the Old Ilog River in 1999, as well as revetment works around the bridges. Besides, a master plan for a flood control project was once formulated in 1991, but the plan was not implemented due to lack of funds.

5.3.2 Target Areas for Flood Damage Mitigation

Through the previous study results and the field survey conducted in this Study, it was confirmed that the target area for flood damage mitigation is the flat plain in the downstream near the confluence of the Ilog River and the Hilabangan River (refer to Fig. 5-1).

5.3.3 Countermeasures for Flood Mitigation

(1) Structural Measures

1) Applicable Measures

In the 1991 master plan study, several alternatives including dam and reservoir were examined and the river channel improvement of Ilog-Hilabangan River was selected as the optimum measure. Since then, flooding conditions have not changed so much except that the Old Ilog River was improved as the diversion channel of Ilog River. Therefore, as the applicable measure for flood mitigation, river channel improvement, which was proposed as the optimum measure in the aforesaid 1991 master plan, as well as diversion channel using the Old Ilog River, are conceived.

2) Alternative Cases

Under the above situations, the following alternative cases were examined in the Study:

- Case-1: River channel improvement of the Ilog River without improvement of the diversion channel (All design discharge will be distributed to the Ilog River without provision of any diversion facilities).
- Case-2: Improvement of the Old Ilog River as the diversion channel, without river channel improvement of the Ilog River (All design discharge will be distributed to the diversion channel without provision of any diversion facilities).
- Case-3: Improvement of the Ilog River and the Old Ilog River as the diversion channel providing diversion facilities to assure the distribution ratio of design discharge.

3) Optimum Measures

Through the cost comparison, Case-1, River Channel Improvement of the Ilog River without improvement of the diversion channel is selected, although there is not much difference in cost between Case-1 and Case-2 (refer to the following table and Fig. 5-2).

Table 5.2 Comparison of Alternative Cases (Ilog-Hilabangan)

Alternatives	Contents	Cost (mil. Pesos)
Case-1	River Channel Improvement of Ilog River	2,106
Case-2	Improvement of Old Ilog River as the Diversion Channel	2,290
Case-3	Improvement of Ilog River and Diversion Channel	12,944*

** Cost includes gate and facilities for diversion to assure the discharge distribution.*

(2) Non-Structural Measures

As the applicable non-structural measures among the conceivable ones, the following measures are proposed:

1) Recommended Flood Warning System

The Community-Based Flood Early Warning System (CBFEWS), now being introduced by PAGASA, is recommended. Regarding the installation of the inter-regional system in Region VI and Region VII, it is expected that there will be a difficulty on the communication among the related organizations (i.e., DCCs and others), so a gradual approach, such as starting the installation in Region VI at first, then installation in Region VII, may be effective.

2) Recommendation on Baseline Activities of Watershed Management

Since watershed management includes many aspects except flood mitigation, it is recommended, in the Study, that at least the following minimum necessary activities related to flood mitigation shall be implemented as the baseline activities of watershed management:

- Preparation of watershed characterization and watershed management plan.
- Reforestation with at least the same rate as the current national average.
- Support activities to the river basin council.

3) Recommendation on Other Measures

The following measures are recommended in a part of the non-structural measures:

- Preparation of flood hazard map
- Enhancement of communication among neighboring LGUs

5.3.4 Estimation of Project Cost and Benefit

(1) Project Cost

The project cost is composed of the cost for the Ilog River Channel Improvement including a part of the Hilabangan River Channel as shown below:

- Financial cost: 2,105.9 million pesos
- Economic cost: 1,537.3 million pesos

(2) Project Benefit

The annual project benefit under present conditions, which is assumed to increase in proportion to the growth of GNP per capita in the future, has been calculated at 207.8 million pesos per year.

5.3.5 Project Evaluation

(1) Technical Feasibility

The flood mitigation measures composed of structural and non-structural measures applied in this Study are all conventional ones and used in this country. Therefore, there will be no technical difficulty in the implementation of the project.

(2) Economic Viability

The economic viability of the project has been evaluated by means of EIRR, B/C and NPV applying the discount rate of 15%. The values in the following table show that the project is economically viable.

Table 5.3 Economic Evaluation (Ilog-Hilabangan)

Viability Index	
EIRR (%)	18.9
NPV (mil. Pesos)	268.6
B/C	1.31

(3) Social and Environmental Acceptance

1) Social Environmental Impacts

As the social environmental impacts, resettlement and the loss of agricultural land by the channel widening and construction of the bridge are to be expected. A resettlement framework,

public/stakeholder consultation, and a separate IEE for the bridge are needed to achieve social acceptability.

2) Natural Environmental Impacts

As to natural environmental impacts, the removal of plants along the river bank and mangroves in the river mouth is to be expected. A plan for the re-vegetation is needed to achieve natural acceptability.

3) Public Hazard

As to public hazard, the disposal of dredged materials and spoils is expected. Preparation of an appropriate disposal site is needed prior to the start of construction work.

4) Overall Evaluation

Overall, the environmental management and the mitigation plan shall be strictly enforced during the development phase of these major project components in order to minimize if not totally eradicated the negative environmental impacts.

The project plan has been explained and discussed with the stakeholders in the stakeholders' meetings at the end of each field survey and the workshop in the site. Through the experiences and activities, it is concluded that, at this stage, the implementation of this project is socially and environmentally accepted by the stakeholders.

5.4 Formulation of Flood Mitigation Plan for the Dungcaan River Basin

5.4.1 River Basin Condition

The features of the river basin are specified as follows:

(1) Floods and Flood Damage

The Dungcaan River Basin with the catchment area of 176 km^2 has habitually experiences severe flooding as evidenced by the floods in 1972 and 1994. In the 1972 flood, about 10,000 people were affected and 250 houses were completely destroyed. The major cause of floods is the heavy rain in the upstream bringing storm water that overflows in the downstream where the river channel flow capacity is very poor, and which eventually flows into the urban area. In addition, severe bank erosion also inflicts damage to the agricultural areas.

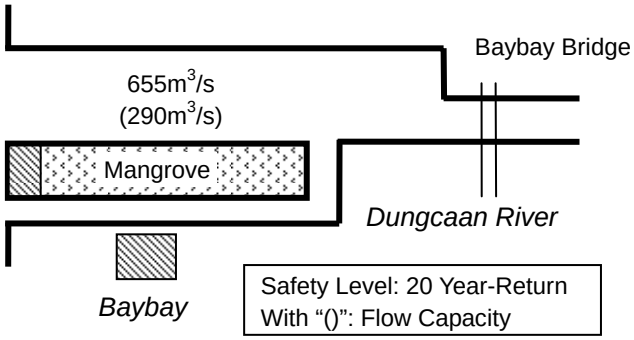


Figure 5.3 Design Discharge Distribution (Dungcaan River Basin)

In the downstream, the flow capacity of the river is only 290m^3/s, while design discharge is 655m^3/s, as shown in Figure 5.3.

(2) Measures so far Undertaken and Previous Related Study

The Dungcaan River divides into two channels near the river mouth after the Baybay Bridge: the northern main stream and the southern sub-stream where mangroves naturally grow nearby the urban areas (refer to Figure 5.4). To alleviate the flood damage in the urban areas, a concrete wall was once constructed at the bifurcation point to stop the flood flow into the southern sub-stream. However, the concrete wall has been broken in the 2006 flood and no restoration work has been undertaken since then. Regarding the previous-related studies, no specific study on a flood control project has been conducted, but the study on urban planning is ongoing.

5.4.2 Target Areas for Flood Damage Mitigation

Through the field survey and workshop, it was confirmed that the target area for flood damage mitigation are the urban areas in the downstream after the Baybay Bridge. As for the upstream of Baybay Bridge, there exists the flood damage to agricultural areas in a manner of bank erosion and overbank flow, but the area was excluded from the target areas since the damage is not so high while the cost for protection works is expected to be very high (refer to Fig.5-3).

5.4.3 Countermeasures for Flood Mitigation

(1) Structural Measures

1) Applicable Measures

In principle, several measures such as retarding basin and diversion channel are conceivable for the flood damage type. However, judging from the topographic conditions, there are no suitable sites to apply these measures. Consequently, river channel improvement and dam and reservoir remain as the conceivable measures. In this connection, the possibility of dam and reservoir was preliminarily examined before the preparation of alternative study cases and, as the result, it was identified that the dam and reservoir are less attractive from the economic point of view (refer to the Main Report, Subsection 5.3.4). Therefore, only the river channel improvement was examined to set up the alternative cases.

2) Alternative Cases

For the formulation of river channel improvement, there exist two major significant environmental issues as described below (refer to Figure 5.4):

- River channel improvement to protect of residential area (about 20 houses) situated in the river mouth may result in destruction of the mangrove area.

- Resettlement of the residential area in the river mouth is not avoidable, when river channel improvement is planned considering preservation of mangrove areas.

Under these circumstances, two alternative cases of river channel improvement were once examined:

- Case-1: Left bank alignment is set behind the mangrove area in order to preserve the mangrove area, but resettlement of the residential area is unavoidable.
- Case-2: Left bank alignment is set in front of the mangrove area in order to protect the residential area without resettlement, but the mangrove area may be damaged.

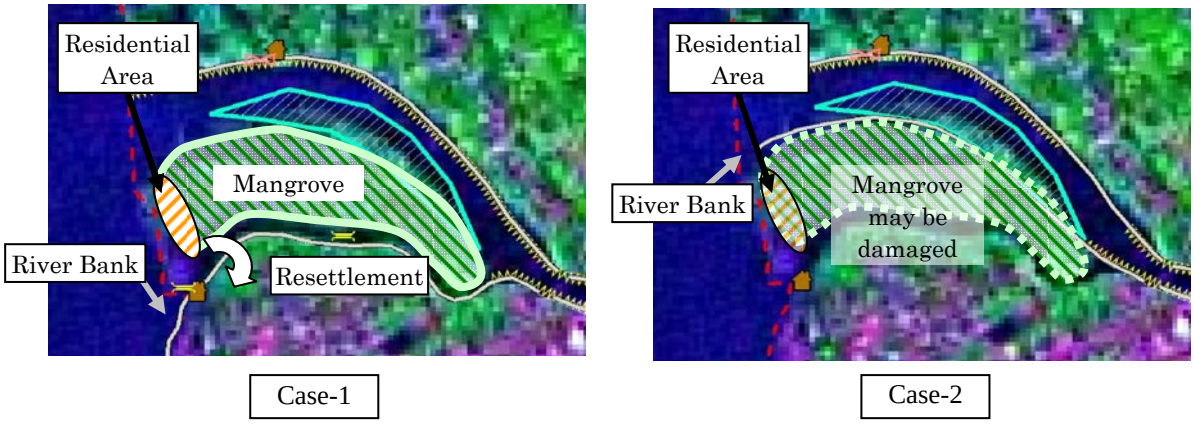


Figure 5.4 Features of River Condition (Dungcaan River Basin)

3) Optimum Measures

Based on the cost comparison for these alternatives, there is not so much difference in the costs between the two cases as shown in the following table.

Table 5.4 Comparison of Alternative Cases (Dungcaan)

Alternatives	Contents	Cost (mil. Pesos)
Case-1	Left bank alignment is set behind of the mangrove area, so that mangrove area can be preserved, while resettlement of residential area is not avoidable	211.1
Case-2	Left bank alignment is set in front of the mangrove area, so that residential area can be protected without resettlement, but mangrove area may be damaged	264.0

However, the optimum measure should be selected not only from the economic viewpoint, but also social and environmental acceptance points of view. This matter was brought to the attention of stakeholders in the last stakeholders' meeting, but no conclusion on the selection of optimum measures was obtained because these issues could not be resolved so easily.

Under this condition, at this stage, Case-1 is recommended for the following reasons, although further discussions and studies are required (refer to Fig.5-4):

- If the mangrove area is damaged, it may be impossible to restore it to a condition similar to the original in the future.
- Needless to say, it is not easy to resettle the residential area, but relocation may be acceptable to the residents if it will not cause adverse influence to their living circumstances, i.e., resettlement may be possible provided that the resettlement site is close to the present residential area.

(2) Non-Structural Measures

As the applicable non-structural measures among the conceivable ones, proposed are the following:

1) Recommended Flood Warning System

The Community-Based Flood Early Warning System (CBFEWS) similar to the system introduced by PAGASA may be applied, since the time of concentration of flood wave is very short (less than one hour). However, it may be very difficult to attain the expected reduction of tangible damage by the introduction of a flood warning system.

2) Recommendation on Baseline Activities of Watershed Management

Since watershed management includes many aspects except flood mitigation, it is recommended in this Study that at least the following minimum necessary activities related to flood mitigation shall be implemented as the baseline activities of watershed management:

- Preparation of watershed characterization and management plan
- Reforestation with at least the same rate as the current national average
- Support activities to the river basin council.

3) Recommendation on Other Measures

The following measures are recommended in a part of the non-structural measures:

- Enhancement of disaster management activities at the community level including periodical refinement of the plan
- Preparation and dissemination of hazard map
- Enhancement of evacuation system
- Information and educational campaign

5.4.4 Estimation of Project Cost and Benefit

(1) Project Cost

The project costs for the river channel improvement in the financial and economic aspects are, as follows:

- Financial Cost: 211.1 million pesos

- Economic Cost: 154.1 million pesos

(2) Project Benefit

Project benefit under the present basin conditions, which are expected to increase at the same rate as the GNP per capita growth rate, is as follows:

- Project benefit under present condition: 21.1 million pesos per year as of 2006

5.4.5 Project Evaluation

(1) Technical Feasibility

The flood mitigation measures composed of structural and non-structural measures applied in this Study are all conventional ones and used in this country. Therefore, there will be no technical difficulty in the implementation of the project.

(2) Economic Viability

The economic viability of the project has been evaluated by means of EIRR, B/C and NPV, applying the discount rate of 15%. The values in the following table show that the project is economically viable.

Table 5.5 Economic Evaluation (Dungcaan)

Viability Index	
EIRR (%)	18.8
NPV (mil. Pesos)	26.0
B/C	1.29

(3) Social and Environmental Acceptance

1) Social Environmental Impacts

As the social environmental impact, the resettlement due to the construction of dike is unavoidable. Therefore, the resettlement framework will need to satisfy the achievement of social acceptability. At this stage, it is understood that social acceptance can be obtained by providing a satisfactory resettlement framework carefully arranged through further discussions.

2) Natural Environmental Impacts

As to natural environmental impacts, the removal of a part of the mangrove in the river mouth is to be expected even though the bank alignment is set behind the mangrove area. Regarding this matter, it is concluded at this Study stage that the situation may be acceptable to the stakeholders if an action plan on forest management is provided to minimize the damage to the mangrove area.

3) Public Hazard

As to public hazard, the disposal of dredged materials and spoils is to be expected. Preparation of the appropriate disposal site is needed prior to the start of construction work.

4) Overall Evaluation

Overall, the environmental management and mitigation plan shall be strictly enforced during the development phase of these major project components in order to minimize if not totally eradicated the negative environmental impacts.

The project plan has been explained and discussed with the stakeholders in the stakeholders' meetings at each end of the field survey and workshop in the site. Through the experiences and activities, it is concluded that, at this stage, the implementation of the project is socially and environmentally accepted by the stakeholders.

5.5 Formulation of Flood Mitigation Plan for the Meycauayan River Basin

5.5.1 River Basin Condition

The features of the river basin are specified as follows:

(1) Floods and Flood Damage

The lowest reach of the Meycauayan River Basin with the catchment area of 201.0 km^2 is subjected to habitual inland floods caused by high tide and heavy rainfall. The frequency of flood is almost every year in the rainy season. Damage in the basin is rather concentrated to asset damage including houses and households and also damage to economic activities, but the number of casualties is relatively small according to the data provided by the Provincial Disaster Coordinating Council.

The flow capacity and design discharge of the Meycauayan and Marilao rivers are as shown in Figure 5.5. As for the safety level of the Meycauayan River, 30-year return period, which was adapted to the VOM project mentioned below, is applied.

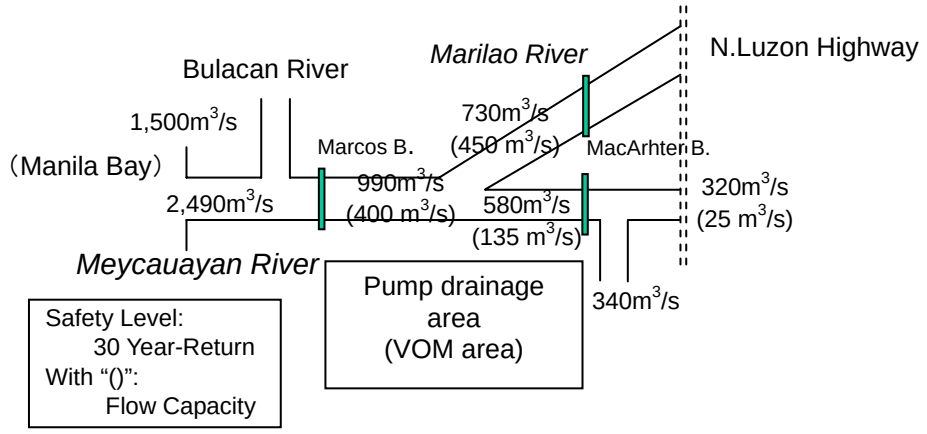


Figure 5.5 Design Discharge Distribution (Meycauayan River Basin)

(2) Measures so far Undertaken and Previous Related Study

For the above flood damage conditions, the agencies concerned have carried out the following flood protection works:

- Construction of dike along the Meycauayan River and the Marilao River (one of the tributaries)
- Construction of coastal dike in the Municipality of Obando
- Installation of drainage pumps and flood gates

However, it is said that the height of the dikes is not enough compared to the flood water level, and many pumps and gates have deteriorated.

The objective area is situated neighboring to the KAMANAVA (Kaloocan, Malabon, Navotas and Valenzuela) Area where construction of the flood control project called KAMANAVA Flood Control and Drainage System Improvement Project of DPWH is ongoing. As an extension of this project, the Feasibility Study on the VOM Area (Valenzuela, Obando and Meycauayan) Drainage System Improvement Project, in which a part of Meycauayan River Basin is included, was conducted in 2001 aiming at the alleviation of flood damage by inland floods. In this connection, the result of this Study is referred to as the VOM F/S results.

5.5.2 Target Areas for Flood Damage Mitigation

In principle, the target area for flood mitigation was narrowed down to the urban areas of Valenzuela, Obando and Meycauayan in the downstream from the North Luzon Expressway (NLEX) through the field survey and workshop (refer to Fig.5-5).

5.5.3 Countermeasures for Flood Mitigation

(1) Structural Measures

1) Applicable Measures

Among the conventional flood control measures and judging from the river basin conditions, the dam, retarding basin and diversion channel are not applicable to the basin. On the other hand, a drainage facility to reduce inland flooding is essential for the VOM area. Hence, the applicable measures are the river channel improvement and drainage facilities.

2) Alternative Cases

a) Alternative Cases for the Target Area for Flood Protection

As mentioned above, the target area for flood protection was narrowed down to the downstream areas. In the case of Meycauayan River Basin, the following alternative target areas were examined (refer to Fig. 5-6):

- Alternative Case-1: All areas downstream from North Luzon Expressway including the area submerged in seawater at the time of high tide.

- Alternative Case-2: The area downstream from North Luzon Expressway excluding the area submerged in seawater at the time of high tide, but including the VOM project areas.

b) Alternative Cases for Structural Measures

As for the measures for river channel improvement and drainage facilities, no alternative case is specified in this Study.

3) Selection of Optimum Cases for the Target Area

Among the alternatives for the target area of flood protection, Alternative Case-2 is selected from the following considerations (refer to Fig. 5-7):

- In Alternative Case-1, a huge cost for river improvement is to be expected (roughly 5,000 million pesos for only river improvement) in addition to the cost for Case-2.
- To fulfill the increase of such huge cost, it is necessary to guarantee the benefit from the submerged area.
- Under the present land use conditions such as fish pond and low productive agricultural land, benefit that can cover the cost is not expected unless the land use condition is changed to a highly urbanized area. However, at present, such a land use plan is not expected.

(2) Non-Structural Measures

As the applicable non-structural measures among the conceivable ones, the following measures are proposed:

1) Recommended Flood Warning System

The Community-Based Flood Early Warning System (CBFEWS), which PAGASA has been introducing, is recommended. In order to install the inter-regional system between Regions III and NCR, close communication such as regular meetings among the related organizations (i.e., DCCs and others) is necessary.

2) Recommendation on Baseline Activities of Watershed Management

Since watershed management includes many aspects except flood mitigation, it is recommended, in this Study, that at least the following minimum necessary activities related to flood mitigation shall be implemented as the baseline activities of watershed management:

- Preparation of watershed characterization and watershed management plan
- Support activities to the river basin council

3) Recommendation on Other Measures

The following measures are recommended in a part of the non-structural measures:

- Enhancement of disaster management activities at the community level including periodical refinement of the plan
- Preparation and dissemination of hazard map

- Resettlement of informal settlers
- Community-based environmental improvement along river channel including solid waste management
- Land use regulation
- Enhancement of communication between neighboring LGUs

5.5.4 Estimation of Project Cost and Benefit

(1) Project Cost

The project costs of the river channel improvement and drainage facilities in the financial and economic aspects are, as follows:

- Financial Cost: 6,828.1 million pesos
- Economic Cost: 4,984.5 million pesos

(2) Project Benefit

Project benefit under the present basin conditions which are expected to increase at the same rate as the GNP per capita growth rate, is as follows:

- Project Benefit under present condition: 850.0 million pesos per year as of 2006

5.5.5 Project Evaluation

(1) Technical Feasibility

The flood mitigation measures composed of structural and non-structural measures applied in this Study are all conventional ones and used in this country. Therefore, there will be no technical difficulty in the implementation of the project.

(2) Economic Viability

The economic viability of the project has been evaluated by means of EIRR, B/C and NPV, applying the discount rate of 15%. The values in the following table show that the project is economically viable.

Table 5.6 Economic Evaluation (Meycauayan)

Viability Index	
EIRR (%)	23.3
NPV (mil. Pesos)	1,874.6
B/C	1.67

(3) Social and Environmental Acceptance

1) Social Environmental Impacts

As the social environmental impacts, the resettlement due to the construction of dike is unavoidable. Therefore, the resettlement framework will need to satisfy the achievement of social acceptability. At this stage, it is understood that social acceptance can be obtainable by providing the satisfactory resettlement framework carefully arranged through further discussions.

2) Natural Environmental Impacts

As to natural environmental impacts, no significant issue is expected, since the project area is predominantly urbanized and nearly devoid of any wildlife habitat.

3) Public Hazard

As to public hazard, the disposal of dredged materials and spoils is expected. This issue can be settled through the preparation of an appropriate disposal site prior to the start of construction work.

4) Overall Evaluation

Overall, the environmental management and mitigation plan shall be strictly enforced during the development phase of these major project components in order to minimize if not totally eradicated the negative environmental impacts.

The project plan has been explained and discussed with the stakeholders in the stakeholders' meeting at each end of the field survey and workshop in the site. Through these experiences and activities, it is concluded that, at this stage, implementation of this project is socially and environmentally accepted by the stakeholders.

5.6 Formulation of Flood Mitigation Plan for the Kinanliman River Basin

5.6.1 River Basin Condition

The features of the river basin are specified as follows:

(1) Floods and Flood Damage

The Kinanliman River Basin with the catchment area of 10.0km^2 has habitually experiences severe flooding. The floods in 2004 caused by Typhoon Winnie and Yoyong are among the recent severe floods that claimed the life of 241 people in the Municipality

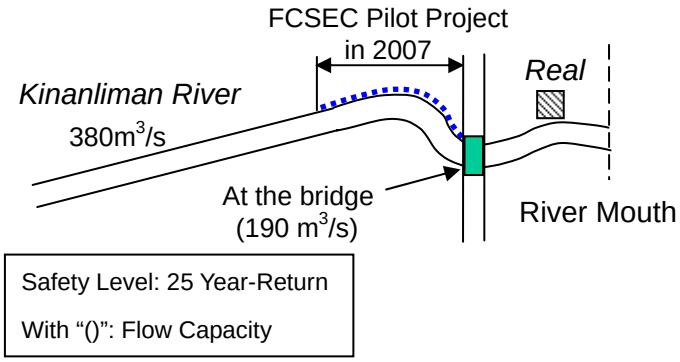


Figure 5.6 Design Discharge Distribution (Kinanliman River Basin)

of Real. The flood damage type in this river basin is the typical flash flood, sometimes together with debris flow due to heavy rain in the upstream, resulting in the overflow and bank erosion in the downstream.

Flood damage in this river basin includes those of houses, bridges and human life in the downstream. The flow capacity of the river at the bridge section is only 190m^3/s, while the design discharge is 380m^3/s, as shown in Figure 5.6.

(2) Measures so far Undertaken and Previous Related Study

For the above flood damage conditions, the agencies concerned have provided revetment works around the Kinanliman Bridge for the protection of the bridge and the surrounding residential areas. Besides, DPWH-FCSEC conducted the master plan and detailed design study for the pilot flood control project in a manner of river channel improvement in 2007, including the necessity of sabo dam. The implementation of river channel improvement is scheduled in 2008.

5.6.2 Target Areas for Flood Damage Mitigation

Through the field survey and workshop, the target area for flood damage mitigation was narrowed down to the built-up areas located in the downstream of the river, between the river mouth and around 660 m upstream of the Kinanliman Bridge (refer to Fig. 5-8).

5.6.3 Countermeasures for Flood Mitigation

(1) Structural Measures

1) Applicable Measures

Among the conventional flood control measures and judging from the river basin conditions, the dam, retarding basin and diversion channel are not applicable to the basin. To alleviate the flood damage by flash floods, sabo dam to control the sediment and woody debris and river channel improvement to confine the flash flood are to be considered.

2) Alternative Cases

As for the measures for river channel improvement and sabo dam, no alternative case was examined at this study stage, since the design condition such as design discharge and sediment volume are decided through hydrological analysis and the design features of river channel and sabo dam are preliminary decided based on the design condition.

3) Selection of Optimum Measures

In principle, the optimum measures for flood mitigation in the Kinanliman River Basin are those in combination with river channel improvement and sabo dam. However, the construction of sabo dams to control the expected design sediment volume will take considerable cost. In this regard, one (1) sabo dam is preliminary proposed in this Study in order to catch the front of sediment flow and control woody debris. Therefore, the damage

caused by sediment flow will not be mitigated completely. However, the damage caused by only flood discharge will be mitigated with the proposed river channel improvement (refer to Fig. 5-9).

(2) Non-Structural Measures

As the applicable non-structural measures among the conceivable ones, the following measures are proposed:

1) Recommended Flood Warning System

The Community-Based Flood Early Warning System (CBFEWS), which PAGASA has introduced, is recommended, but it is very difficult to get benefit with the reduction of tangible damage by the introduction of a flood warning system.

2) Recommendation on Baseline Activities of Watershed Management

Since watershed management includes many aspects except flood mitigation, it is recommended, in this Study, that at least a minimum of the following necessary activities related to flood mitigation shall be implemented as the baseline activities of watershed management:

- Preparation of watershed characterization and watershed management plan
- Reforestation with at least the same rate as the current national average
- Support activities to the river basin council

3) Recommendation on Other Measures

The following measures are recommended in a part of the non-structural measures:

- Enhancement of disaster management activities at the community level including periodical refinement of the plan
- Preparation and dissemination of hazard map

5.6.4 Estimation of Project Cost and Benefit

(1) Project Cost

The project costs for the river channel improvement and sabo dam in the financial and economic aspects are, as follows:

- Financial Cost: 146.4 million pesos
- Economic Cost: 106.9 million pesos

(2) Project Benefit

Project benefit under the present basin conditions, which are expected to increase at the same rate as the GNP per capita growth rate, is as follows:

- Project benefit under present condition: 12.9 million pesos per year as of 2006

5.6.5 Project Evaluation

(1) Technical Feasibility

The flood mitigation measures composed of structural and non-structural measures applied in this Study are all conventional ones and used in this country. Therefore, there will be no technical difficulty in the implementation of the project.

(2) Economic Viability

The economic viability of the project has been evaluated by means of EIRR, B/C and NPV, applying the discount rate of 15%. The values in the following table show that the project is economically viable.

Table 5.7 Economic Evaluation (Kinanliman)

Viability Index	
EIRR (%)	17.3
NPV (mil. Pesos)	10.9
B/C	1.18

(3) Social and Environmental Acceptance

1) Social Environmental Impacts

As the social environmental impacts, transportation will be disturbed for a certain period due to the construction of Kinanliman Bridge. However, this environmental issue can be settled through coordination with the local authorities, as well as the stakeholders.

2) Natural Environmental Impacts

As to natural environmental impacts, no significant issue is expected except the minor cutting of vegetation, which can be accepted judging from the magnitude of impact.

3) Public Hazard

As to public hazard, the disposal of dredged materials and spoils for the channel improvement is expected. This issue can be settled through the preparation of an appropriate disposal site prior to the start of construction work.

4) Overall Evaluation

Overall, the environmental management and mitigation plan shall be strictly enforced during the development phase of these major project components in order to minimize if not totally eradicated the negative environmental impacts.

The project plan has been explained and discussed with the stakeholders in the stakeholders' meetings at the end of each field survey and the workshop in the site. Through these experiences and activities, it is concluded that, at this stage, implementation of this project is socially and environmentally accepted by the stakeholders.

5.7 Formulation of Flood Mitigation Plan for the Tuganay River Basin

5.7.1 River Basin Condition

The features of the river basin are specified as follows:

(1) Floods and Flood Damage

The Tuganay River Basin with the catchment area of 747 km^2 is featured with an agricultural land developed in the low flat land in the downstream reaches of Tuganay River where the Tuganay, Anibongan and New Ising rivers pass through as trunk channels. Inundation by floods in this low flat land occurs 2 to 3 times a year and continues from 1 to 7 days.

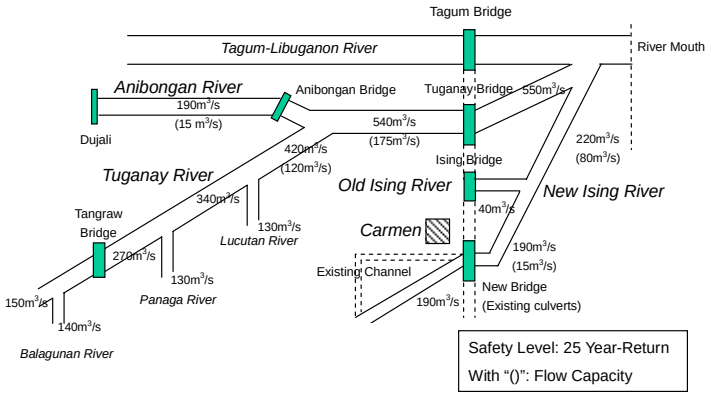


Figure 5.7 Design Discharge Distribution (Tuganay River Basin)

As presumed from the above flooding conditions, flood damage in this river basin is on agriculture and infrastructures, but casualties are minimal. The major cause of floods is the overflow from the Tuganay River, Anibongan River and New Ising River, although some other minor damages due to the poor drainage system of the flat land are observed.

The flow capacity of these river channels are as shown in the Figure 5.7.

(2) Measures so far Undertaken and Previous Related Study

For the above flood damage conditions, no specific flood control project and studies have been provided except the works related to the Tagum-Libuganon River Dike Extension which passes through the area neighboring the Tuganay River Basin.

5.7.2 Target Areas for Flood Damage Mitigation

Through the field survey and workshop, the target area for flood damage mitigation was narrowed down to the low flat land expanding in the downstream reaches of Tuganay River (refer to Fig. 5-10).

5.7.3 Countermeasures for Flood Mitigation

(1) Structural Measures

1) Applicable Measures

Judging from the river basin conditions, among the conventional flood control measures, the dam is not so attractive in this basin (refer to the Main Report Subsection 5.6.4). To alleviate the flood damage in the low flat land caused by overflow from the three rivers, river channel improvement, retarding basin and diversion channel, etc. are to be considered.

2) Alternative Cases

As the alternative cases for the three rivers (Tuganay, Anibongan and Ising), the following considerations were made:

- Measures for Tuganay River, which will affect the flood control of Anibongan River in a manner of influence of backwater, should be firstly examined and, based on the results the measures for the Anibongan River are then examined.
- The Ising River (i.e., the Old and New Ising River), which will not be affected by the measures for Tuganay River, can be examined independently.

Under the above considerations, the alternative cases were set as follows:

Table 5.8 Alternative Case (Tuganay)

River	Alt. Cases	Contents
Tuganay	Case T-1	River Channel Improvement only
	Case T-2	River Channel Improvement + Retarding Basin
Anibongan	Case A-1	River Channel Improvement Without Gate
	Case A-2	River Channel Improvement With Gate and Retarding Basin
	Case A-3	River Channel Improvement With Gate and Diversion Channel
	Case A-4	River Channel Improvement With Gate and Drainage Pump
Ising	Case I-1	River Channel Improvement only
	Case I-2	River Channel Improvement + Retarding Basin

Note) Measures for Anibongan are subject to the measures for Tuganay.

3) Selection of Optimum Measures

The optimum measures for flood mitigation in Tuganay River Basin have been selected through the cost comparison study (refer to Table 5.9). As the results, the following measures were selected as optimum ones (refer to Fig. 5-11) at this stage judging from the economic advantage, though there may not be a remarkable difference in the cost among some of the alternatives:

- Tuganay River: River Channel Improvement + Retarding Basin
- Anibongan River: River channel Improvement Without Gate
- Ising River: River Channel Improvement + Retarding Basin

Table 5.9 Comparison of Alternative Cases (Tuganay)

River	Alt. Cases	Contents	Cost (mil. Pesos)
Tuganay	Case T-1	River Channel Improvement only	1,668
	Case T-2	River Channel Improvement + Retarding Basin	1,537
Anibongan	Case A-1	River Channel Improvement Without Gate	674
	Case A-2	River Channel Improvement With Gate and Retarding Basin	782
	Case A-3	River Channel Improvement With Gate and Diversion Channel	879
	Case A-4	River Channel Improvement With Gate and Drainage Pump	7,322
Ising	Case I-1	River Channel Improvement only	476
	Case I-2	River Channel Improvement + Retarding Basin	457

Note) For details, refer to Main Report Subsection 5.6.4.

(2) Non-Structural Measures

As the applicable non-structural measures among the conceivable ones, the following measures are proposed:

1) Recommended Flood Warning System

The Community-Based Flood Early Warning System (CBFEWS), which PAGASA has introduced, is recommended.

2) Recommendation on Baseline Activities of Watershed Management

Since watershed management includes many aspects except flood mitigation, it is recommended, in this Study, that at least the following minimum necessary activities related to flood mitigation be implemented as baseline activities of watershed management:

- Preparation of watershed characterization and watershed management plan
- Reforestation with at least the same rate as the current national average
- Support activities to the river basin council

3) Recommendation on Other Measures

The following measures are recommended in a part of non-structural measures:

- Enhancement of disaster management activities at the community level including periodical refinement of the plan
- Preparation and dissemination of hazard map
- Assessment of existing dike system and hazard map showing the danger of breach of dike
- Land use regulation for banana plantation
- Enhancement of communication between neighboring LGUs

5.7.4 Estimation of Project Cost and Benefit

(1) Project Cost

The project costs for the river channel improvement and retarding basins in the financial and economic aspects are, as follows:

- Financial Cost: 2,669.0 million pesos
- Economic Cost: 1,948.4 million pesos

(2) Project Benefit

Project benefit under the present basin conditions, which are expected to increase at the same rate as the GNP per capita growth rate, is as follows:

- Project benefit under present condition: 266.3 million pesos per year as of 2006

5.7.5 Project Evaluation

(1) Technical Feasibility

The flood mitigation measures composed of structural and non-structural measures applied in this Study are all conventional ones and used in this country. Therefore, there will be no technical difficulty in the implementation of the project.

(2) Economic Viability

The economic viability of the project has been evaluated by means of EIRR, B/C and NPV, applying the discount rate of 15%. The values in the following table show that this project is economically viable.

Table 5.10 Economic Evaluation (Tuganay)

Viability Index	
EIRR (%)	19.1
NPV (mil. Pesos)	363.7
B/C	1.33

(3) Social and Environmental Acceptance

1) Social Environmental Impacts

As the social environmental impacts, resettlement and reconstruction of the bridge deck are expected. However, these environmental issues can be settled through the coordination with the concerned local authorities, as well as the stakeholders.

2) Natural Environmental Impacts

As to natural environmental impacts, no significant issue is expected except the cutting or removal of plants, which can be accepted judging from the magnitude of impact.

3) Public Hazard

As to public hazard, the disposal of dredged materials and spoils from the channel improvement is expected. This issue can be settled through the preparation of an appropriate disposal site prior to the start of construction work.

4) Overall Evaluation

Overall, the environmental management and mitigation plan shall be strictly enforced during the development phase of these major project components in order to minimize if not totally eradicated the negative environmental impacts.

The project plan has been explained and discussed with the stakeholders in the stakeholders' meetings at the end of each field survey and the workshop in the site. Through these experiences and activities, it is concluded that, at this stage, the implementation of this project is socially and environmentally accepted by the stakeholders.

5.8 Formulation of Flood Mitigation Plan for the Dinanggasan River Basin

5.8.1 River Basin Condition

The features of the river basin are specified as follows:

(1) Floods and Flood Damage

The Dinanggasan River Basin with the catchment area of 29.0 km^2 has habitually experiences severe flooding as evidenced by the flood in November 2001 when tropical typhoon "Nanang" passed through Northern Mindanao causing the death of 166 people aside from the 84 missing and 146 injured in the whole of Camiguin Island.

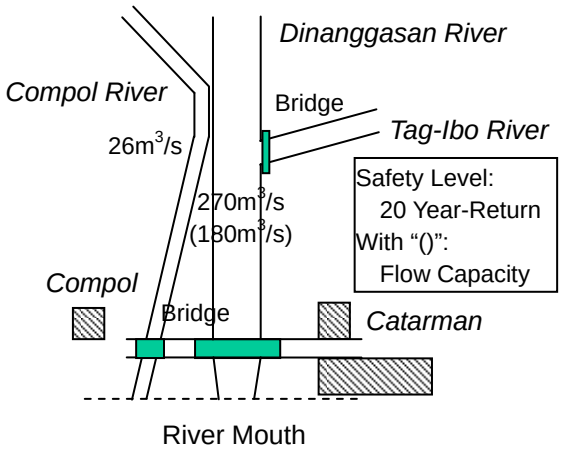


Figure 5.8 Design Discharge Distribution (Dinanggasan River Basin)

The Dinanggasan River Basin is underlain by volcanic rocks; hence, a large amount of sediment would easily rush into the downstream when flash floods occur due to heavy rainfall and causes severe flood damage. Flood damage due to flash floods and sediment mainly occurs at the agricultural and urban areas, as well as on infrastructures such as the road and a bridge in the downstream.

It has been noted that among the features of the Dinanggasan River Basin, the flood water of Compol River which runs neighboring to the Dinanggasan join the Dinanggasan River during severe flooding time and vice versa.

The flow capacity of Dinanggasan River is only 180m^3/s while the design discharge is 296m^3/s at maximum as illustrated in Figure 5.8.

(2) Measures Undertaken and Previous Related Study

For the above flood damage conditions, the agencies concerned have constructed the dike along the river course (650 m in length at the left bank and 80 m in length at the right bank).

As the related study, the "Basic Study on Disaster Prevention and Reconstruction Project for Camiguin Island, Mindanao, Philippines, December 2003, JICA" was carried out after the disaster by Typhoon Nanang. In the study report, no concrete plan for Dinanggasan River was proposed, but its characteristics were evaluated.

5.8.2 Target Areas for Flood Damage Mitigation

Through the field survey and workshop, it was confirmed that the target area for flood damage mitigation was narrowed down to the urban areas and agricultural land in the downstream. To assure the safety of the target area, the expected objective river channel stretch should be 1.6km from 0.0k to 1.6k (refer to Fig. 5-12).

5.8.3 Countermeasures for Flood Mitigation

(1) Structural Measures

1) Applicable Measures

Judging from the river basin conditions such as topography and flood damage, river channel improvement and sabo dam together with sand pocket are conceived.

2) Alternative Cases

As to the measures for river channel improvement and sabo dam together with sand pocket, no alternative case was examined at this study stage, since the design condition such as design discharge and sediment volume are decided through hydrological analysis and the design features of the river channel and sabo facilities are preliminary decided based on the design conditions.

However, as mentioned under the river basin condition, there is one issue on the treatment of Compol River whose floodwaters sometimes join the Dinanggasan River and vice versa bringing about severe flood damage to properties in the downstream.

In this connection, the following two alternatives are conceived (refer to Fig. 5-13):

- Case-1: Dinanggasan River and Compol River are treated jointly by providing a training dike to lead the floodwaters of Compol River into Dinanggasan River

- Case-2: Dinanggasan River and Compol River are treated separately by providing an embankment between the two rivers.

3) Selection of Optimum Measures

Through the cost comparison study, Case-1, i.e., Dinanggasan River and Compol River are treated jointly, was finally selected, although there is not much difference in cost between Case-1 and Case-2 (refer to Table 5.11).

As for the sabo dam and sand pocket to assure the safety against the damage due to sediment discharge, it may be difficult to provide enough capacity to fulfill the design sediment volume for the sabo dam and sand pocket in this basin from the economic point of view. In this connection, one (1) sabo dam and one (1) sand pocket with the total capacity to meet the economic viability (B/C=1.0) were designed (refer to Fig. 5-14).

Table 5.11 Comparison of Alternative Cases (Dinanggasan)

Alternatives	Contents	Cost (mil. Pesos)
Case-1	Dinanggasan River and Compol River are treaded jointly, providing training dike to lead the flood from Compol River to Dinanggasan River	147.5
Case-2	Dinanggasan River and Compol River are treated separately, providing embankment to divide the both rivers	149.8

(2) Non-Structural Measures

As the applicable non-structural measures among the conceivable ones, the following measures are proposed:

1) Recommended Flood Warning System

The Community-Based Flood Early Warning System (CBFEWS), which PAGASA has introduced, is recommended.

2) Recommendation on Baseline Activities of Watershed Management

Since watershed management includes many aspects except flood mitigation, it is recommended, in this Study, that at least the following minimum necessary activities related to flood mitigation shall be implemented as the baseline activities of watershed management:

- Revision of current watershed characterization and watershed management plan
- Reforestation with at least the same rate as the current national average
- Support activities to the river basin council

3) Recommendation on Other Measures

The following measures are recommended in a part of the non-structural measures:

- Enhancement of disaster management activities at the community level including periodical refinement of the plan
- Preparation and dissemination of hazard map

5.8.4 Estimation of Project Cost and Benefit

(1) Project Cost

The project costs for the river channel improvement and sabo facilities in the financial and economic aspects are, as follows:

- Financial Cost: 147.5 million pesos
- Economic Cost: 107.7 million pesos

(2) Project Benefit

Project benefit under the present basin conditions, which are expected to increase at the same rate as the GNP per capita growth rate, is as follows:

- Project benefit under present condition: 11.8 million pesos per year

5.8.5 Project Evaluation

(1) Technical Feasibility

The flood mitigation measures composed of structural and non-structural measures applied in this Study are all conventional ones and used in this country. Therefore, there will be no technical difficulty in the implementation of the project.

(2) Economic Viability

The economic viability of the project has been evaluated by means of EIRR, B/C and NPV, applying the discount rate of 15%. The values in the following table show that the project is economically viable.

Table 5.12 Economic Evaluation (Dinanggasan)

Viability Index	
EIRR (%)	15.7
NPV (mil. Pesos)	3.5
B/C	1.06

(3) Social and Environmental Acceptance

1) Social Environmental Impacts

As to social environmental impacts, resettlement and reconstruction of the bridge are expected. However, these environmental issues can be settled through the coordination with local authorities, as well as the stakeholders.

2) Natural Environmental Impacts

As to natural environmental impacts, no significant issue is expected except the cutting or removal of plants, which can be accepted judging from the magnitude of impact.

3) Public Hazard

As to public hazard, the disposal of dredged materials and spoils from the channel improvement is expected. This issue can be settled through the preparation of an appropriate disposal site prior to the start of construction work.

4) Overall Evaluation

Overall, the environmental management and mitigation plan shall be strictly enforced during the development phase of these major project components in order to minimize if not totally eradicated the negative environmental impacts.

The project plan has been explained and discussed with the stakeholders in the stakeholders' meeting at the end of each field survey and the workshop in the site. Through these experiences and activities, it is concluded that, at this stage, the implementation of the project is socially and environmentally accepted by the stakeholders.

6. CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

In the First Screening, flood risk areas have been firstly prioritized by applying the indexes derived from the statistical data on economic and natural conditions for the 1,164 river basins related to the cities or municipalities with 947 flood prone areas and, finally, 120 river basins have been selected. Then, in the Second Screening for the selected 120 river basins, these river basins have been arranged in accordance with the ranking by score considering the economic efficiency for flood control project implementation for each river basin and, finally, 56 river basins that could be accommodated by the budgetary amount for the target year have been selected in due consideration of the ranking and other factors.

For the selected 56 river basins, the prioritization and arrangement of the implementation schedule of flood control projects have been examined by dividing the projects into two groups; namely, foreign-assisted projects and locally funded projects. Furthermore, the flood mitigation plans for the six (6) model areas selected from the 56 river basins have been prepared.

Through these study procedure, it is concluded that the selection and prioritization of the flood risk areas and the preparation of flood mitigation plans are adequate for the implementation of flood control projects by the Philippines Government in the coming years.

6.2 Recommendations

1. The implementation schedules of the flood control projects for the selected 56 river basins have been arranged in this Study. The number of 56 river basins has been decided, considering the expected investment amount during the period of 26 years from 2009 to 2034 and assuming that the budgetary growth rate for the flood control sector of DPWH is 8.2%. In this connection, first of all, it is necessary to assure the 8.2 % of growth rate, and in case that the achievement of such growth rate is difficult, it is also necessary to review the number of river basins to be accommodated within the implementation schedule.
2. As well as the assurance of budgetary growth rate, it is recommended that the implementation schedule should be utilized by the agencies concerned, especially DPWH, to prepare a medium-term plan as well as a long-term plan in the flood control sector.
3. For the preparation of the implementation schedule, the 56 river basins have been classified into two groups; namely, 26 river basins under the foreign-assisted projects and 30 river basins under the locally funded projects. The classification was based on the share of 95% and 5% in previous practices under the DPWH Medium-Term Investment Program from 2005 to 2010. It is therefore necessary to further review the adequacy of such sharing, which will be affected by the availability of national funds and international funding sources.

4. In the above classification, river basins whose expected project costs may be above 1.0 billion pesos have been classified as river basins with foreign-assisted projects since international funds is, in general, applied to projects requiring a rather large amount of cost. However, some river basins like Agus and Tagoloan, which are classified under the locally funded project group, are already included in the request-list for foreign-assisted projects and thus require implementation of the flood control projects as early as possible. Under the circumstances, it is recommended that the request for funding of the river basins mentioned above shall be made into one package to facilitate the early implementation with international funds.
5. In the course of the Study, the 1,164 river basins, which are related to the cities or municipalities with 947 flood prone areas, have been identified by using the 1/250,000 topographic maps. Since the topographic map scale of 1/250,000 topographic maps is rather rough to identify the river basin boundaries, it is preferable to review the river basin boundaries using more precisely scaled maps like 1/50,000.
6. To evaluate the flood vulnerability of the 1,164 river basins, 14 indexes derived from the statistical data on economic and natural conditions have been employed. Among the 14 indexes, the most essential indexes are those related to flood damage such as casualties and flood damage amount. Since these flood damage data as well as the other statistical data have to be renewed year by year, it is recommended that evaluation of flood vulnerability of the 1,164 river basins should be renewed according to the updated flood damage data and other statistical data.
7. In this Study, the above 1,164 river basins are classified into three groups; namely, Major River Basins, Principal River Basins and Other River Basins. Among these, the definition of major river basins with more than 1,400 km^2 in the catchment area and the principal river basins with more than 40 km^2 in the catchment area are based on the definition of NWRB, while the rest are tentatively designated in this Study. However, it is pointed out that the definition of such river basins may not be clear as identified by the fact that some of river basins belonging to "Other River Basins" have more than 40 km^2 in the catchment area, and also there are several points to be improved on the institutional arrangement especially in the view point of administration of these river basins; namely, the responsibility on implementation, operation and maintenance. Since it is significant to clarify such definition of river basins and the responsibility of administration by the agencies concerned with the river basins from the effective river basin management point of views including flood control, further discussions regarding these matters should be made among the agencies concerned.
8. For the Second Screening, the economic efficiency based on the project cost and benefit has been examined and the results used as the indexes for scoring. In this procedure for calculation of cost and benefit, the flood inundation area was identified through hydraulic analysis applying the HEC-RAS and HEC-GeoRAS Model using satellite images of "Landsat 7". Since the accuracy of the HEC-RAS and HEC-GeoRAS Model and the satellite image is not so high, it is

preferable to enhance the accuracy of hydraulic analysis by applying a more precise hydraulic model and satellite images in the future.

9. For the Second Screening, the project cost in a manner of river channel improvement was based on the relation between design discharge and unit price for river channel improvement prepared by applying previous study results. This relation should be renewed using additional data, whenever the other studies on flood mitigation are conducted.
10. Regarding the above cost estimation, some of the river basins that have damages caused by sediment include the cost for sediment control facilities in addition to the cost for river channel improvement. The cost for sediment control facilities is based on rough calculation assuming the produced sediment amount and site for the facilities. In this connection, it is necessary to review the cost of such sediment facilities in the further project study stage.
11. For the benefit calculation in the Second Screening stage, several rates such as damage rate and conversion rate from damage to benefit, which were obtained from the previous studies, were used. Such rates also should be renewed whenever the other studies on flood mitigation projects are examined in the future.
12. The GIS database and system related to the First and the Second Screening have been set up in the computer at DPWH-FCSEC in this Study. These systems as well as the data itself should be updated and utilized to not only review or evaluate flood vulnerability but also policy-making in the flood control sector. Especially, DPWH-FCSEC, which is expected to play the important role as the source of the information on flood control, should maintain and upgrade these systems and database, so that DPWH as a whole can use them as more effective tools for policy-making in this flood control sector of the Philippines.
13. The flood control plans for the six (6) selected model river basins have been examined and prepared to show the formulation process for the different flood damage types. These plans should be utilized and referenced by the agencies concerned of the Philippine Government, especially DPWH, in the formulation of flood control plans for the other river basins considering the similarity of flood damage types and DPWH-FCSEC should provide support to develop the formulation of such plans.
14. The Study including the IEE survey for the formulation of flood control plans for the six (6) model river basins has been conducted within the limited time and data; therefore, the accuracy of outputs is rather rough. When the project proceeds to the next study stage, it is recommended that further study be conducted with additional or more data to upgrade the accuracy of the outputs.
15. Some of the six (6) river basins require not only flood control measures but also sabo facilities to mitigate the disaster caused by sediment emphasized especially in the lahar or debris flow damage type river basins. Unfortunately, the available measures for sediment control sometimes requires a huge cost, while the benefit is not enough to satisfy the economic viability. Under

these circumstances, the proposed sabo facilities in this Study, which were planned with less dimensions so as to satisfy the economic viability, are not enough to cope with the disasters caused by sediment. Therefore, it is recommended in the future to review the necessity of such sediment control facilities with enough dimensions to cope with the sediment disaster from the social view points in the future.

16. In the course of the Study, the technical knowledge, applied in this Study including the study procedures to conduct the above Items 5. to 14., has been transferred in a manner of on the job training, seminar and workshop that were held several times on the occasion of presentation of the study reports. Therefore, it is presumed that basic knowledge has been transferred successfully. However, compared with the volume of knowledge used in the Study, such opportunities were very short and limited. In this connection, it is recommended that the dispatch of short-term experts should be arranged to assure the continued transfer of knowledge used in the Study and thus enable the counterpart personnel of the Philippine Government particularly the agencies concerned like DPWH to update, modify and/or adjust the outputs of the Study on their own.

TABLES

Tab.2-1 Selected 120 River Basins by the First Screening

No.	River Name	Region	Basin Area (km2)	Category	1st Screening Result		No.	River Name	Region	Basin Area (km2)	Category	1st Screening Result	
					Score	Rank						Score	Rank
1	ABRA	I	4,951	M	52	7	61	SIBUGUEY	IX	994	P	29	349
2	AMBURAYAN	I	1,307	P(D)	55	3	62	MAPANGI	IX	1,306	P	28	485
3	SINOCALAN/MAROSOY(DAGUPAN)	I	1,023	P	53	6	63	TAGOLOAN	X	1,762	M	30	236
4	PATALAN/CAYANGA/ANGALACAN	I	656	P	51	10	64	CAGAYAN DE ORO	X	1,365	M	29	349
5	ARINGAY	I	421	P	51	10	65	DINANGGASAN(CATARMAN-1S)	X	25	O(D)	52	7
6	BARARO	I	192	P	37	59	66	MARANDING	X	634	P	28	485
7	BACARRA-VINTAR	I	627	P	36	69	67	IPONAN	X	412	P	27	607
8	BALINGCUGUIN/MABINI PANGSINAN	I	378	P	36	69	68	MANDULOG	X	780	P	26	721
9	SILAG-SANTA MARIA	I	310	P	35	81	69	BUAYAN-MALUNGUN	XI	1,400	M	31	170
10	BUAYA	I	246	P	33	101	70	DAVAO	XI	1,992	M	29	349
11	ALAMINOS/TAGOONG	I	221	P	32	125	71	TAGUM-LIBUGANON	XI	2,434	M	32	125
12	NANGALISAN/BAGGAO-PARED(CAGAYAN)	II	27,743	M	53	6	72	PADADA MAINIT	XI	1,216	P	30	236
13	PAMPLONA	II	698	P	37	59	73	HIJO	XI	642	P	30	236
14	PALANAN-PINACANAUAN	II	755	P	36	69	74	MACO	XI	30	O	30	236
15	BANURBOUR(LAL-LO1)	II	511	O	36	69	75	MINDANAO	XII	20,673	M	35	81
16	CLAVERIA(CABICUNGAN)	II	270	P	33	101	76	TRAN	XII	808	P	40	36
17	BAUA	II	118	P	33	101	77	SILWAY-POPONG-SINAUAL(POLOMOLOK)	XII	577	O	29	349
18	GUAGUA	III	1,605	O(D)	56	2	78	SIGUEL	XII	358	P	27	607
19	SANTA RITA/KALAKLAN(OLONGAPO CITY)	III	102	O(D)	32	125	79	SURIGAO	XIII	170	P(D)	30	236
20	SANTO TOMAS-GABOR	III	334	P(D)	31	170	80	TAGO	XIII	1,370	P	34	91
21	BUCAO	III	664	P(D)	31	170	81	LAKE MAINIT-TUBAY	XIII	473	P	32	125
22	ANGAT	III	917	P	51	10	82	BOSTON	XIII	43	O	32	125
23	MALUPA-DIAN(AGUANG)	III	666	P	36	69	83	AMNAY	IV-B	495	P(D)	30	236
24	NAYUM	III	229	P	31	170	84	MAG-ASAWANG TUBIG	IV-B	443	P(D)	28	485
25	AGOS	IV-A	483	P(D)	37	59	85	CAGURAY	IV-B	361	P	45	25
26	IMUS	IV-A	112	P(D)	35	81	86	BALETE	IV-B	132	P	40	36
27	CALUMPANG(KAPUMPONG)	IV-A	446	P(D)	31	170	87	BONGABONG	IV-B	574	P	39	44
28	IYAM/LUCENA	IV-A	158	P(D)	30	236	88	PULA	IV-B	245	P	35	81
29	DOMACAN/TAMBAK(TAYABAS)	IV-A	45	O(D)	29	349	89	ALAG(MALAYLAY-BACO)	IV-B	505	P	33	101
30	UMIRAY	IV-A	628	P	46	21	90	MAGBANDO/BUSWANGA	IV-B	466	P	33	101
31	KALIWA	IV-A	468	P	44	26	91	BAROC	IV-B	162	P	33	101
32	TIGNOAN	IV-A	87	P	37	59	92	POLA	IV-B	140	P	33	101
33	LALAVINAN(REAL-2)	IV-A	46	O	40	36	93	AGUS/BUAYAN	ARMM	1,898	M	31	170
34	KINANLIMAN(REAL-1)	IV-A	10	O	40	36	94	MATALING	ARMM	420	P	29	349
35	GENERAL NAKAR-2-(b)	IV-A	17	O	39	44	95	NITUAN	ARMM	365	P	28	485
36	GENERAL NAKAR-2-(a)	IV-A	37	O	38	52	96	MATABER	ARMM	197	P	26	721
37	KABILUGAN/VELASCO/BATO LAKE(BICOL)	V	2,999	M	57	1	97	ABULUG	CAR	2,766	M	52	7
38	YAWA/BASUD/QUIRANGAY(LEGAZPI CITY)	V	126	O(D)	36	69	98	BAUANG	CAR	510	P	49	15
39	DONSOL/MANLATO	V	413	P(D)	35	81	99	UPSTREAM of AGNO(include AMBAYAWAN, BANILA)	I	5722	P(D)	47	17
40	LABO	V	931	P	37	59	100	UPSTREAM of PAMPANGA(include RIO CHICO)	III	8122	P(D)	47	17
41	DAET-BASUD	V	277	P	35	81	101	MEYCAUAYAN	III	154	O(D)	46	21
42	QUINALE-B	V	182	P	33	101	102	UPPER MARIKINA	NCR	515	P(D)	46	21
43	RAGAY	V	176	P	33	101	103	EAST MANGAHAN	IV-A	84	P(D)	39	44
44	ILOG-HILABANGAN	VI	2,162	M	41	33	104	SAN JUAN	NCR	90	P(D)	34	91
45	JALAUR	VI	1,534	M	37	59	105	JARO-AGANAN	VI	464	P(D)	32	125
46	PANAY/MAMBUSAO	VI	2,311	M	38	52	106	CAIRAWAN	VI	71	P(D)	28	485
47	BAGO	VI	868	P	40	36	107	SIBALOM	VI	690	P(D)	32	125
48	AKLAN	VI	1,010	P	39	44	108	DALANAS	VI	184	P(D)	24	957
49	MANDALAGAN(BACOLOD CITY)	VI	187	O	35	81	109	TIBIAO	VI	72	P(D)	24	957
50	HIMOCAAN	VI	462	P	36	69	110	SIPALAY	VI	336	P(D)	30	236
51	CEBU/MANDAWE	VII	241	O(D)	31	170	111	MANANGA	VII	86	P(D)	29	349
52	COMBADO(BALAMBAN)	VII	237	P	31	170	112	GUINABASAN	VII	131	P(D)	27	607
53	SAPANG DAKO	VII	169	P	31	170	113	BANTAYAN	VIII	89	O(D)	29	349
54	SIPOCONG/STA.CATALINA/CAWITAN	VII	320	P	27	607	114	DALE	VIII	169	P(D)	30	236
55	CATARMAN	VIII	632	P(D)	31	170	115	CADAC-AN	VIII	523	P(D)	30	236
56	DUNGCAAN(PAGBANGANAN)	VIII	176	P	43	28	116	BALATUKAN	X	221	P(D)	25	831
57	DAGUITAN-MARABONG	VIII	292	P	36	69	117	TUGANAY	XI	747	P(D)	25	831
58	PAGSANGA-AN	VIII	511	P	34	91	118	LIPADAS	XI	163	P(D)	27	607
59	TUMAGA	IX	255	P(D)	22	1121	119	TALOMO	XI	279	P(D)	27	607
60	DISACAN-MANUKAN(JOSE DALMAN PONOT1)	IX	274	O	30	236	120	UPPER AGUSAN	XI	1745	P(D)	46	21

M : Major River Basin, P : Principal River Basin, O : Other River Basin, (D) : Dangerous River Basin

Tab.3-1 Ranking of 120 Selected River Basins

Ranking by Score	River Name	Basin Area (km^2)	Score				Project Cost (MP)	Total Amount (MP)	Region	Category		Group	
			1st	B-C	B/C	Total							
1	UPPER MARIKINA	515	46	90	85	221	13,469		NCR, IV-A	P(D)	u	O	3
2	EAST MANGAHAN	84	39	90	90	219	3,161	16,630	IV-A, NCR	P(D)	u	O+I	5
3	SAN JUAN	90	34	90	90	214	2,260	18,890	NCR	P(D)	u	O	3
4	CEBU/MANDAWE	241	31	90	90	211	2,368	21,257	VII	O(D)	u	F+O+I	5
5	PATALAN/CAYANGA/ANGALACAN	656	51	90	61	202	2,318	23,575	I, CAR	P	g	F+O+B	1
6	YAWA/BASUD/QUIRANGAY(LEGAZPI CITY)	126	36	56	90	182	475	24,050	V	O(D)	g	F+O+I+B+L	6
7	MEYCAUAYAN	201	46	90	30	166	7,180	31,231	III, NCR	O(D)	u	O	3
8	SANTA RITA/KALAKLAN(OLONGAPO CITY)	102	32	36	90	158	479	31,710	III	O(D)	g	F+O+I+B+L	6
9	MANDALAGAN(BACOLOD CITY)	187	35	32	90	157	214	31,924	VI	O	g	F+O	3
10	MINDANAO	20,673	35	90	29	154	15,870	47,794	XII, ARMM	M	g	F+O+I+B	4
11	IMUS	112	35	77	41	153	2,377	50,170	IV-A	P(D)	u	F+O	3
12	TUMAGA	255	22	40	90	152	483	50,653	IX	P(D)	g	F+B	1
13	UPSTREAM of PAMPANGA(include RIO CHICO)	8,122	47	72	6	125	21,856	72,510	III	P(D)	g	F+O+B	1
14	NANGALISAN/BAGGAO-PARED(CAGAYAN)	27,743	53	59	3	115	52,826	125,335	II, CAR	M	g	F+O+B	1
15	AKLAN	1,010	39	16	52	107	366	125,702	VI	P	g	F+B	1
16	DINANGGASAN(CATARMAN-1S)	29	52	6	48	106	117	125,819	X	O(D)	g	F+O+I+B+L	6
17	DAVAO	1,992	29	39	35	103	1,369	127,188	XI	M	g	F+O	3
18	IPONAN	412	27	17	54	98	357	127,545	X	P	g	O+B	2
19	LIPADAS	163	27	10	54	91	198	127,744	XI	P(D)	g	F+O+B	1
20	MALUPA-DIAN(AGUANG)	666	36	17	37	90	540	128,284	III	P	g	F+O+I+B	4
21	UPSTREAM of AGNO(include AMBAYAWAN, BANILA)	5,722	47	36	5	88	11,850	140,134	I	P(D)	g	F+O+B	1
22	GUINABASAN	131	27	16	45	88	433	140,567	VII	P(D)	u	F+O	3
23	SINOCALAN/MAROSOY(DAGUPAN)	1,023	53	22	8	83	3,890	144,458	I, CAR	P	g	F+O+B	1
24	KABILUGAN/VELASCO/BATO LAKE(BICOL)	2,999	57	14	3	74	12,095	156,553	V	M	g	F+O+B	1
25	KINANLIMAN(REAL-1)	10	40	2	31	73	32	156,585	IV-A	O	g	F+O+I+B	4
26	ABULUG	2,766	52	13	6	71	2,989	159,574	CAR, II	M	g	F+O+I+B	4
27	UPPER AGUSAN	1,745	46	15	10	71	2,013	161,586	XI	P(D)	g	F+O+B	1
28	DONSOL/MANLATO	413	35	3	27	65	82	161,668	V	P(D)	g	F+B	1
29	PANAY/MAMBUSAO	2,311	38	21	5	64	6,068	167,736	VI	M	g	F+O+B	1
30	ILOG-HILABANGAN	2,162	41	13	10	64	1,638	169,374	VI, VII	M	g	F+O+B	1
31	TALOMO	279	27	9	28	64	359	169,733	XI	P(D)	g	F+B	1
32	TUGANAY	747	25	25	13	63	2,563	172,296	XI	P(D)	g	O+I	5
33	AGOS	483	37	8	14	59	680	172,976	IV-A	P(D)	g	O+B+L	6
34	GUAGUA	1,605	56	1	1	58	31,715	204,691	III	O(D)	u	F+O+L	6
35	BAGO	868	40	6	12	58	595	205,287	VI	P	g	F+O+B+L	6
36	AMBURAYAN	1,307	55	1	1	57	676	205,963	I, CAR	P(D)	g	O+B	2
37	BALETE	132	40	4	13	57	259	206,222	IV-B	P	g	O	3
38	TAGUM-LIBUGANON	2,434	32	16	7	55	3,517	209,739	XI	M	g	O+I	5
39	ABRA	4,951	52	1	1	54	2,984	212,723	I, CAR	M	g	O+B	2
40	ANGAT	917	51	1	1	53	9,014	221,737	III	P	u	F+O+I	5
41	ARINGAY	421	51	1	1	53	822	222,560	I, CAR	P	g	F+O+I+B	4
42	JALAUR	1,534	37	10	5	52	3,249	225,809	VI	M	g	O	3
43	BAUANG	510	49	1	1	51	358	226,167	CAR, I	P	g	F+O+I+B	4
44	TAGOLOAN	1,762	30	9	11	50	980	227,147	X	M	g	O+B	2
45	AGUS/BUAYAN	1,898	31	7	12	50	681	227,828	ARMM, X	M	g	O	3
46	SILWAY-POPONG-SINAUAL(POLOMOLOK)	577	29	6	14	49	406	228,234	XII	O	g	F+O	3
47	DUNGCAAN(PAGBANGANAN)	176	43	2	4	49	89	228,323	VIII	P	g	O+B	2
48	UMIRAY	628	46	1	1	48	192	228,515	IV-A	P	g	F+O+I+B	4
49	DAET-BASUD	277	35	5	7	47	887	229,402	V	P	g	O	3
50	CAGURAY	361	45	1	1	47	794	230,196	IV-B	P	g	F	3
51	GENERAL NAKAR-2-(a)	37	38	2	7	47	17	230,213	IV-A	O	g	F+O+I	5
52	KALIWA	468	44	1	1	46	1,003	231,216	IV-A	P	u	O+B	2
53	TRAN	808	40	1	1	42	641	231,856	XII, ARMM	P	g	O	3
54	LALAVINAN(REAL-2)	46	40	1	1	42	20	231,876	IV-A	O	g	F	3
55	BONGABONG	574	39	1	1	41	523	232,399	IV-B	P	g	O+B	2
56	GENERAL NAKAR-2-(b)	17	39	1	1	41	50	232,450	IV-A	O	g	F+O+I+B	4
57	HIMOGAAN	462	36	2	2	40	374	232,824	VI	P	g	O+B	2
58	LABO	931	37	1	1	39	1,715	234,538	V, IV-A	P	g	F+B	1
59	SIPALAY	336	30	3	6	39	379	234,917	VI	P(D)	g	F+O+B	1
60	BARARO	192	37	1	1	39	319	235,236	I	P	g	O	3
61	PAMPLONA	698	37	1	1	39	280	235,516	II, CAR	P	g	F+B	1
62	TIGNOAN	87	37	1	1	39	28	235,544	IV-A	P	g	F+O+I+B	4
63	PALANAN-PINACANAUAN	755	36	1	1	38	1,447	236,991	II	P	g	F+O+I+B	4
64	BALINGCUGUIN/MABINI PANGSINAN	378	36	1	1	38	717	237,707	I	P	g	F+O+B	1
65	BACARRA-VINTAR	627	36	1	1	38	556	238,264	I	P	g	O+B	2
66	BANURBOUR(LAL-LO1)	511	36	1	1	38	328	238,592	II	O	g	O	3
67	DAGUITAN-MARABONG	292	36	1	1	38	308	238,901	VIII	P	g	F+O	3
68	CAGAYAN DE ORO	1,365	29	3	5	37	728	239,629	X	M	g	F+O+B	1
69	PULA	245	35	1	1	37	610	240,239	IV-B	P	g	O+B	2
70	SANTO TOMAS-GABOR	334	31	2	4	37	418	240,657	III	P(D)	g	F+O+L	6
71	SILAG-SANTA MARIA	310	35	1	1	37	355	241,012	I, CAR	P	g	F+O	3
72	TAGO	1,370	34	1	1	36	2,169	243,181	XIII	P	g	F+O+B	1
73	PAGSANGA-AN	511	34	1	1	36	879	244,060	VIII	P	g	O+B	2
74	BUAYAN-MALUNGUN	1,400	31	2	3	36	527	244,587	XI, XII	M	g	O	3
75	LAKE MAINIT-TUBAY	473	32	2	2	36	214	244,801	XIII	P	g	O	3
76	ALAG(MALAYLAY-BACO)	505	33	1	1	35	734	245,535	IV-B	P	g	O+B	2
77	MAGBANDO/BUSWANGA	466	33	1	1	35	632	246,167	IV-B	P	g	F+O+B	1
78	CLAVERIA(CABICUNGAN)	270	33	1	1	35	586	246,753	II, CAR	P	g	O	3
79	BUAYA	246	33	1	1	35	494	247,247	I	P	g	F+O+B	1
80	QUINALE-B	182	33	1	1	35	447	247,694	V	P	g	F+O+I+B+L	6
81	BAUA	118	33	1	1	35	325	248,019	II	P	g	F+I+B	5
82	POLA	140	33	1	1	35	306	248,325	IV-B	P	g	O	3
83	BAROC	162	33	1	1	35	225	248,550	IV-B	P	g	F+O+B	1
84	RAGAY	176	33	1	1	35	180	248,730	V	P	g	F	3
85	ALAMINOS/TAGOONG	221	32	1	1	34	998	249,728	I	P	g	F+O	3
86	JARO-AGANAN	464	32	1	1	34	755	250,484	VI	P(D)	u	O+B	2
87	SIBALOM	690	32	1	1	34	265	250,748	VI	P(D)	g	F+O+I+B	4
88	BOSTON	43	32	1	1	34	44	250,792	XIII, XI	O	g	O+B	2
89	CALUMPANG(KAPUMPONG)	446	31	1	1	33	3,693	254,485	IV-A	P(D)	u	O+I	5
90	COMBADO(BALAMBAN)	237	31	1	1	33	812	255,297	VII	P	u	O+B	2
91	BUCAO	664	31	1	1	33	508	255,805	III	P(D)	g	F+O+B+L	6
92	NAYUM	229	31	1	1	33	481	256,286	III, I	P	g	O	3
93	SAPANG DAKO	169	31	1	1	33	324	256,611	VII	P	u	F+O	3
94	CATARMAN	632	31	1	1	33	56	256,666	VIII	P(D)	g	O+B	2
95	AMNAY	495	30	1	1	32	1,149	257,816	IV-B	P(D)	g	O	3
96	IYAM/LUCENA	158	30	1	1	32	670	258,485	IV-A	P(D)	g	F	3
97	HIJO	642	30	1	1	32	566	259,052	XI	P	g	F+O+B	1
98	PADADA MAINIT	1,216	30	1	1	32	480	259,532	XI, XII	P	g	O+B	2
99	CADAC-AN	523	30	1	1	32	461	259,993	VIII	P(D)	g	F+O+B	1
100	SURIGAO	170	30	1	1	32	318	260,311	XIII	P(D)	g	O	3
101	DALE	169	30	1	1	32	134	260,445	VIII	P(D)	g	O	3
102	DISACAN-MANUKAN(JOSE DALMAN PONOT1)	274	30	1	1	32	70	260,515	IX	O	g	F+I	5
103	MACO	30	30	1	1	32	12	260,527	XI	O	g	F+O+B	1
104	SIBUGUEY	994	29	1	1	31	2,493	263,020	IX	P	g	F+I+B	5
105	DOMACAN/TAMBAK(TAYABAS)	45	29	1	1	31	269	263,289	IV-A	O(D)	g	F+O+I	5
106	BALATUKAN	221	25	2	4	31	165	263,454	X	P(D)	g	F	3
107	MANANGA	86	29	1	1	31	165	263,619	VII	P(D)	u	F+O	3
108	MATALING	420	29	1	1	31	109	263,729	ARMM	P	g	O+B	2
109	SIGUEL	358	27	2	2	31	83	263,812	XII	P	g	F+O	3
110	BANTAYAN	89	29	1	1	31	48	263,860	VIII	O(D)	g	F+O	3
111	MAPANGI	1,306	28	1	1	30	2,717	266,576	IX, X	P	g	O+B	2
112	MAG-ASAWANG TUBIG	443	28	1	1	30	1,048	267,625	IV-B	P(D)	g	O+B	2
113	MARANDING	634	28	1	1	30	626	268,251	X	P	g	O+B	2
114	NITUAN	365	28	1	1	30	188	268,439	ARMM	P	g	O	3
115	CAIRAWAN	71	28	1	1	30	155	268,595	VI	P(D)	g	F+O+I+B	4
116	SIPOCONG/STA.CATALINA/CAWITAN	320	27	1	1	29	315	268,910	VII	P	g	F+O+I+B	4
117	MANDULOG	780	26	1	1	28	1,347	270,257	X, ARMM	P	g	O	3
118	MATABER	197	26	1	1	28	187	270,444	ARMM	P	g	F+B	1
119	TIBIAO	72	24	1	1	26	78	270,523	VI	P(D)	g	F+O+I+B	4
120	DALANAS	184	24	1	1	26	63	270,586	VI	P(D)	g	F+O+I+B	4

Note: M: Major River Basin, P: Principal River Basin, O: Other River Basin, (D): Dangerous River Basin
Shaded row shows the selected 56 river basins

Tab. 3-2 Selected 56 River Basins by the Second Screening

No.	Ranking by Score	River Name	Basin Area (km^2)	Score				Project Cost (MP)	Total Amount (MP)	Region	Category		Group	
				1st	B-C	B/C	Total							
1	1	UPPER MARIKINA	515	46	90	85	221	13,469		NCR, IV-A	P(D)	u	O	3
2	2	EAST MANGAHAN	84	39	90	90	219	3,161	16,630	IV-A, NCR	P(D)	u	O+I	5
3	3	SAN JUAN	90	34	90	90	214	2,260	18,890	NCR	P(D)	u	O	3
4	4	CEBU/MANDAWE	241	31	90	90	211	2,368	21,257	VII	O(D)	u	F+O+I	5
5	5	PATALAN/CAYANGA/ANGALACAN	656	51	90	61	202	2,318	23,575	I, CAR	P	g	F+O+B	1
6	6	YAWA/BASUD/QUIRANGAY(LEGAZPI CITY)	126	36	56	90	182	475	24,050	V	O(D)	g	F+O+I+B+L	6
7	7	MEYCAUAYAN	201	46	90	30	166	7,180	31,231	III, NCR	O(D)	u	O	3
8	8	SANTA RITA/KALAKLAN(OLONGAPO CITY)	102	32	36	90	158	479	31,710	III	O(D)	g	F+O+I+B+L	6
9	9	MANDALAGAN(BACOLOD CITY)	187	35	32	90	157	214	31,924	VI	O	g	F+O	3
10	10	MINDANAO	20,673	35	90	29	154	15,870	47,794	XII, ARMM	M	g	F+O+I+B	4
11	11	IMUS	112	35	77	41	153	2,377	50,170	IV-A	P(D)	u	F+O	3
12	12	TUMAGA	255	22	40	90	152	483	50,653	IX	P(D)	g	F+B	1
13	13	UPSTREAM of PAMPANGA(include RIO CHICO)	8,122	47	72	6	125	21,856	72,510	III	P(D)	g	F+O+B	1
14	14	NANGALISAN/BAGGAO-PARED(CAGAYAN)	27,743	53	59	3	115	52,826	125,335	II, CAR	M	g	F+O+B	1
15	15	AKLAN	1,010	39	16	52	107	366	125,702	VI	P	g	F+B	1
16	16	DINANGGASAN(CATARMAN-1S)	29	52	6	48	106	117	125,819	X	O(D)	g	F+O+I+B+L	6
17	17	DAVAO	1,992	29	39	35	103	1,369	127,188	XI	M	g	F+O	3
18	18	IPONAN	412	27	17	54	98	357	127,545	X	P	g	O+B	2
19	19	LIPADAS	163	27	10	54	91	198	127,744	XI	P(D)	g	F+O+B	1
20	20	MALUPA-DIAN(AGUANG)	666	36	17	37	90	540	128,284	III	P	g	F+O+I+B	4
21	21	UPSTREAM of AGNO(include AMBAYAWAN, BANILA)	5,722	47	36	5	88	11,850	140,134	I	P(D)	g	F+O+B	1
22	22	GUINABASAN	131	27	16	45	88	433	140,567	VII	P(D)	u	F+O	3
23	23	SINOCALAN/MAROSOY(DAGUPAN)	1,023	53	22	8	83	3,890	144,458	I, CAR	P	g	F+O+B	1
24	24	KABILUGAN/VELASCO/BATO LAKE(BICOL)	2,999	57	14	3	74	12,095	156,553	V	M	g	F+O+B	1
25	25	KINANLIMAN(REAL-1)	10	40	2	31	73	32	156,585	IV-A	O	g	F+O+I+B	4
26	26	ABULUG	2,766	52	13	6	71	2,989	159,574	CAR, II	M	g	F+O+I+B	4
27	27	UPPER AGUSAN	1,745	46	15	10	71	2,013	161,586	XI	P(D)	g	F+O+B	1
28	28	DONSOL/MANLATO	413	35	3	27	65	82	161,668	V	P(D)	g	F+B	1
29	29	PANAY/MAMBUSAO	2,311	38	21	5	64	6,068	167,736	VI	M	g	F+O+B	1
30	30	ILOG-HILABANGAN	2,162	41	13	10	64	1,638	169,374	VI, VII	M	g	F+O+B	1
31	31	TALOMO	279	27	9	28	64	359	169,733	XI	P(D)	g	F+B	1
32	32	TUGANAY	747	25	25	13	63	2,563	172,296	XI	P(D)	g	O+I	5
33	33	AGOS	483	37	8	14	59	680	172,976	IV-A	P(D)	g	O+B+L	6
34	34	GUAGUA	1,605	56	1	1	58	31,715	204,691	III	O(D)	u	F+O+L	6
35	35	BAGO	868	40	6	12	58	595	205,287	VI	P	g	F+O+B+L	6
36	36	AMBURAYAN	1,307	55	1	1	57	676	205,963	I, CAR	P(D)	g	O+B	2
37	37	BALETE	132	40	4	13	57	259	206,222	IV-B	P	g	O	3
38	38	TAGUM-LIBUGANON	2,434	32	16	7	55	3,517	209,739	XI	M	g	O+I	5
39	39	ABRA	4,951	52	1	1	54	2,984	212,723	I, CAR	M	g	O+B	2
40	40	ANGAT	917	51	1	1	53	9,014	221,737	III	P	u	F+O+I	5
41	41	ARINGAY	421	51	1	1	53	822	222,560	I, CAR	P	g	F+O+I+B	4
42	42	JALAUR	1,534	37	10	5	52	3,249	225,809	VI	M	g	O	3
43	43	BAUANG	510	49	1	1	51	358	226,167	CAR, I	P	g	F+O+I+B	4
44	44	TAGOLOAN	1,762	30	9	11	50	980	227,147	X	M	g	O+B	2
45	45	AGUS/BUAYAN	1,898	31	7	12	50	681	227,828	ARMM, X	M	g	O	3
46	46	SILWAY-POPONG-SINAUAL(POLOMOLOK)	577	29	6	14	49	406	228,234	XII	O	g	F+O	3
47	47	DUNGCAAN(PAGBANGANAN)	176	43	2	4	49	89	228,323	VIII	P	g	O+B	2
48	50	CAGURAY	361	45	1	1	47	794	229,116	IV-B	P	g	F	3
49	61	PAMPLONA	698	37	1	1	39	280	229,397	II, CAR	P	g	F+B	1
50	67	DAGUITAN-MARABONG	292	36	1	1	38	308	229,705	VIII	P	g	F+O	3
51	68	CAGAYAN DE ORO	1,365	29	3	5	37	728	230,433	X	M	g	F+O+B	1
52	72	TAGO	1,370	34	1	1	36	2,169	232,602	XIII	P	g	F+O+B	1
53	74	BUAYAN-MALUNGUN	1,400	31	2	3	36	527	233,129	XI, XII	M	g	O	3
54	75	LAKE MAINIT-TUBAY	473	32	2	2	36	214	233,344	XIII	P	g	O	3
55	104	SIBUGUEY	994	29	1	1	31	2,493	235,837	IX	P	g	F+I+B	5
56	108	MATALING	420	29	1	1	31	109	235,946	ARMM	P	g	O+B	2

Note: M:Major River Basin, P:Principal River Basin, O:Other River Basin, (D):Dangerous River Basin

Tab. 3-3 Classification of River Basins (L: Luzon, V: Visayas, M: Mindanao)

Fund Type	Ranking by score	River Name	Basin Area (km^2)	Project Cost (MP)	Total Amount (MP)	Region	Area
Foreign Assisted Project	1	UPPER MARIKINA	515	13,469	13,469	NCR, IV-A	L
	2	EAST MANGAHAN	84	3,161	16,630	IV-A, NCR	L
	3	SAN JUAN	90	2,260	18,890	NCR	L
	4	CEBU/MANDAWE	241	2,368	21,257	VII	V
	5	PATALAN/CAYANGA/ANGALACAN	656	2,318	23,575	I, CAR	L
	7	MEYCAUAYAN	201	7,180	30,755	III, NCR	L
	10	MINDANAO	20,673	15,870	46,625	XII, ARMM	M
	11	IMUS	112	2,377	49,002	IV-A	L
	13	UPSTREAM of PAMPANGA(include RIO CHICO)	8,122	21,856	70,858	III	L
	14	NANGALISAN/BAGGAO-PARED(CAGAYAN)	27,743	52,826	123,684	II, CAR	L
	17	DAVAO	1,992	1,369	125,054	XI	M
	21	UPSTREAM of AGNO(include AMBAYAWAN, BANILA)	5,722	11,850	136,904	I	L
	23	SINOCALAN/MAROSOY(DAGUPAN)	1,023	3,890	140,794	I, CAR	L
	24	KABILUGAN/VELASCO/BATO LAKE(BICOL)	2,999	12,095	152,890	V	L
	26	ABULUG	2,766	2,989	155,878	CAR, II	L
	27	UPPER AGUSAN	1,745	2,013	157,891	XI	M
	29	PANAY/MAMBUSAO	2,311	6,068	163,959	VI	V
	30	ILOG-HILABANGAN	2,162	1,638	165,597	VI, VII	V
	32	TUGANAY	747	2,563	168,160	XI	M
	34	GUAGUA	1,605	31,715	199,875	III	L
	38	TAGUM-LIBUGANON	2,434	3,517	203,392	XI	M
	39	ABRA	4,951	2,984	206,376	I, CAR	L
	40	ANGAT	917	9,014	215,390	III	L
	42	JALAUR	1,534	3,249	218,640	VI	V
	72	TAGO	1,370	2,169	220,808	XIII	M
	104	SIBUGUEY	994	2,493	223,301	IX	M
Locally Funded Project	6	YAWA/BASUD/QUIRANGAY(LEGAZPI CITY)	126	475	475	V	L
	8	SANTA RITA/KALAKLAN(OLONGAPO CITY)	102	479	954	III	L
	9	MANDALAGAN(BACOLOD CITY)	187	214	1,168	VI	V
	12	TUMAGA	255	483	1,651	IX	M
	15	AKLAN	1,010	366	2,018	VI	V
	16	DINANGGASAN(CATARMAN-1S)	29	117	2,134	X	M
	18	IPONAN	412	357	2,492	X	M
	19	LIPADAS	163	198	2,690	XI	M
	20	MALUPA-DIAN(AGUANG)	666	540	3,230	III	L
	22	GUINABASAN	131	433	3,663	VII	V
	25	KINANLIMAN(REAL-1)	10	32	3,695	IV-A	L
	28	DONSOL/MANLATO	413	82	3,777	V	L
	31	TALOMO	279	359	4,136	XI	M
	33	AGOS	483	680	4,816	IV-A	L
	35	BAGO	868	595	5,411	VI	V
	36	AMBURAYAN	1,307	676	6,088	I, CAR	L
	37	BALETE	132	259	6,347	IV-B	L
	41	ARINGAY	421	822	7,169	I, CAR	L
	43	BAUANG	510	358	7,527	CAR, I	L
	44	TAGOLOAN	1,762	980	8,507	X	M
	45	AGUS/BUAYAN	1,898	681	9,188	ARMM, X	M
	46	SILWAY-POPONG-SINAUAL(POLOMOLOK)	577	406	9,594	XII	M
	47	DUNGCAAN(PAGBANGANAN)	176	89	9,683	VIII	V
	50	CAGURAY	361	794	10,477	IV-B	L
	61	PAMPLONA	698	280	10,757	II, CAR	L
	67	DAGUITAN-MARABONG	292	308	11,065	VIII	V
	68	CAGAYAN DE ORO	1,365	728	11,794	X	M
	74	BUAYAN-MALUNGUN	1,400	527	12,321	XI, XII	M
	75	LAKE_MAINIT-TUBAY	473	214	12,535	XIII	M
	108	MATALING	420	109	12,645	ARMM	M

Note: Shaded row shows river basins in the list of request for foreign assisted project in DPWH Medium-Term Public Investment Program

Tab. 3-4 Regional Distribution of River Basins (L:Luzon, V: Visayas, M: Mindanao)

Fund Type	Ranking by score	River Name	Basin Area (km^2)	Project Cost (MP)	Total Amount (MP)	Region	Area	Nos.
Foreign Assisted Project	1	UPPER MARIKINA	515	13,469	13,469	NCR, IV-A	L	Luzon: 15 River Basins
	2	EAST MANGAHAN	84	3,161	16,630	IV-A, NCR	L	
	3	SAN JUAN	90	2,260	18,890	NCR	L	
	5	PATALAN/CAYANGA/ANGALACAN	656	2,318	21,208	I, CAR	L	
	7	MEYCAUAYAN	201	7,180	28,388	III, NCR	L	
	11	IMUS	112	2,377	30,765	IV-A	L	
	13	UPSTREAM of PAMPANGA(include RIO CHICO)	8,122	21,856	52,621	III	L	
	14	NANGALISAN/BAGGAO-PARED(CAGAYAN)	27,743	52,826	52,826	II, CAR	L	
	21	UPSTREAM of AGNO(include AMBAYAWAN, BANILA)	5,722	11,850	64,676	I	L	
	23	SINOCALAN/MAROSOY(DAGUPAN)	1,023	3,890	68,566	I, CAR	L	
	24	KABILUGAN/VELASCO/BATO LAKE(BICOL)	2,999	12,095	80,662	V	L	
	26	ABULUG	2,766	2,989	83,650	CAR, II	L	
	34	GUAGUA	1,605	31,715	115,366	III	L	
	39	ABRA	4,951	2,984	118,350	I, CAR	L	
	40	ANGAT	917	9,014	127,364	III	L	
	4	CEBU/MANDAWE	241	2,368	129,732	VII	V	Visayas: 4 River Basins
	29	PANAY/MAMBUSAO	2,311	6,068	135,800	VI	V	
	30	ILOG-HILABANGAN	2,162	1,638	137,438	VI, VII	V	
	42	JALAUR	1,534	3,249	140,687	VI	V	
	10	MINDANAO	20,673	15,870	156,557	XII, ARMM	M	Mindanao: 7 River Basins
	17	DAVAO	1,992	1,369	157,926	XI	M	
	27	UPPER AGUSAN	1,745	2,013	159,939	XI	M	
	32	TUGANAY	747	2,563	162,502	XI	M	
	38	TAGUM-LIBUGANON	2,434	3,517	166,019	XI	M	
	72	TAGO	1,370	2,169	168,187	XIII	M	
	104	SIBUGUEY	994	2,493	170,680	IX	M	
Locally Funded Project	6	YAWA/BASUD/QUIRANGAY(LEGAZPI CITY)	126	475	475	V	L	Luzon: 12 River Basins
	8	SANTA RITA/KALAKLAN(OLONGAPO CITY)	102	479	954	III	L	
	20	MALUPA-DIAN(AGUANG)	666	540	1,495	III	L	
	25	KINANLIMAN(REAL-1)	10	32	1,527	IV-A	L	
	28	DONSOL/MANLATO	413	82	1,608	V	L	
	33	AGOS	483	680	2,288	IV-A	L	
	36	AMBURAYAN	1,307	676	2,964	I, CAR	L	
	37	BALETE	132	259	3,224	IV-B	L	
	41	ARINGAY	421	822	4,046	I, CAR	L	
	43	BAUANG	510	358	4,404	CAR, I	L	
	50	CAGURAY	361	794	5,198	IV-B	L	
	61	PAMPLONA	698	280	5,478	II, CAR	L	
	9	MANDALAGAN(BACOLOD CITY)	187	214	5,692	VI	V	Visayas: 6 River Basins
	15	AKLAN	1,010	366	6,058	VI	V	
	22	GUINABASAN	131	433	6,491	VII	V	
	35	BAGO	868	595	7,087	VI	V	
	47	DUNGCAAN(PAGBANGANAN)	176	89	7,176	VIII	V	
	67	DAGUITAN-MARABONG	292	308	7,484	VIII	V	
	12	TUMAGA	255	483	7,967	IX	M	Mindanao: 12 River Basins
	16	DINANGGASAN(CATARMAN-1S)	29	117	8,084	X	M	
	18	IPONAN	412	357	8,441	X	M	
	19	LIPADAS	163	198	9,719	XI	M	
	31	TALOMO	279	359	15,118	XI	M	
	44	TAGOLOAN	1,762	980	980	X	M	
	45	AGUS/BUAYAN	1,898	681	1,661	ARMM, X	M	
	46	SILWAY-POPONG-SINAUAL(POLOMOLOK)	577	406	3,450	XII	M	
	68	CAGAYAN DE ORO	1,365	728	5,057	X	M	
	74	BUAYAN-MALUNGUN	1,400	527	5,584	XI, XII	M	
	75	LAKE_MAINIT-TUBAY	473	214	21,524	XIII	M	
	108	MATALING	420	109	22,233	ARMM	M	

Note: Shaded row shows river basins in the list of request for foreign assisted project in DPWH Medium-Term Public Investment Program

Tab. 3-5 Regional Arrangement (L:Luzon, V: Visayas, M: Mindanao)

Fund Type	Ranking by score	River Name	Basin Area (km^2)	Project Cost (MP)	Total Amount (MP)	Region	Area
Foreign Assisted Project	1	UPPER MARIKINA	515	13,469	13,469	NCR, IV-A	L
	2	EAST MANGAHAN	84	3,161	16,630	IV-A, NCR	L
	4	CEBU/MANDAWE	241	2,368	18,998	VII	V
	10	MINDANAO	20,673	15,870	34,868	XII, ARMM	M
	3	SAN JUAN	90	2,260	37,127	NCR	L
	5	PATALAN/CAYANGA/ANGALACAN	656	2,318	39,445	I, CAR	L
	29	PANAY/MAMBUSAO	2,311	6,068	45,513	VI	V
	17	DAVAO	1,992	1,369	46,883	XI	M
	7	MEYCAUAYAN	201	7,180	54,063	III, NCR	L
	11	IMUS	112	2,377	56,440	IV-A	L
	30	ILOG-HILABANGAN	2,162	1,638	58,077	VI, VII	V
	27	UPPER AGUSAN	1,745	2,013	60,090	XI	M
	13	UPSTREAM of PAMPANGA(include RIO CHICO)	8,122	21,856	81,946	III	L
	14	NANGALISAN/BAGGAO-PARED(CAGAYAN)	27,743	52,826	134,772	II, CAR	L
	42	JALAUR	1,534	3,249	138,022	VI	V
	32	TUGANAY	747	2,563	140,585	XI	M
	21	UPSTREAM of AGNO(include AMBAYAWAN, BANILA)	5,722	11,850	152,435	I	L
	23	SINOCALAN/MAROSOY(DAGUPAN)	1,023	3,890	156,325	I, CAR	L
	38	TAGUM-LIBUGANON	2,434	3,517	159,842	XI	M
	24	KABILUGAN/VELASCO/BATO LAKE(BICOL)	2,999	12,095	171,938	V	L
	26	ABULUG	2,766	2,989	174,926	CAR, II	L
	72	TAGO	1,370	2,169	177,095	XIII	M
	34	GUAGUA	1,605	31,715	208,810	III	L
	39	ABRA	4,951	2,984	211,794	I, CAR	L
	104	SIBUGUEY	994	2,493	214,287	IX	M
	40	ANGAT	917	9,014	223,301	III	L
Locally Funded Project	6	YAWA/BASUD/QUIRANGAY(LEGAZPI CITY)	126	475	475	V	L
	8	SANTA RITA/KALAKLAN(OLONGAPO CITY)	102	479	954	III	L
	9	MANDALAGAN(BACOLOD CITY)	187	214	1,168	VI	V
	12	TUMAGA	255	483	1,651	IX	M
	16	DINANGGASAN(CATARMAN-1S)	29	117	1,768	X	M
	20	MALUPA-DIAN(AGUANG)	666	540	2,308	III	L
	25	KINANLIMAN(REAL-1)	10	32	2,340	IV-A	L
	15	AKLAN	1,010	366	2,706	VI	V
	18	IPONAN	412	357	3,064	X	M
	19	LIPADAS	163	198	3,262	XI	M
	28	DONSOL/MANLATO	413	82	3,344	V	L
	33	AGOS	483	680	4,024	IV-A	L
	22	GUINABASAN	131	433	4,457	VII	V
	31	TALOMO	279	359	4,816	XI	M
	44	TAGOLOAN	1,762	980	5,796	X	M
	36	AMBURAYAN	1,307	676	6,472	I, CAR	L
	37	BALETE	132	259	6,731	IV-B	L
	35	BAGO	868	595	7,327	VI	V
	45	AGUS/BUAYAN	1,898	681	8,008	ARMM, X	M
	46	SILWAY-POPONG-SINAUAL(POLOMOLOK)	577	406	8,414	XII	M
	41	ARINGAY	421	822	9,236	I, CAR	L
	43	BAUANG	510	358	9,594	CAR, I	L
	47	DUNGCAAN(PAGBANGANAN)	176	89	9,683	VIII	V
	68	CAGAYAN DE ORO	1,365	728	10,411	X	M
	74	BUAYAN-MALUNGUN	1,400	527	10,939	XI, XII	M
	50	CAGURAY	361	794	11,732	IV-B	L
	61	PAMPLONA	698	280	12,013	II, CAR	L
	67	DAGUITAN-MARABONG	292	308	12,321	VIII	V
	75	LAKE_MAINIT-TUBAY	473	214	12,535	XIII	M
	108	MATALING	420	109	12,645	ARMM	M

Note: Shaded row shows river basins in the list of request for foreign assisted project in DPWH Medium-Term Public Investment Program

Tab. 3-6 Proposed Project (DPWH Medium-Term Public Investment Program (2005-2010))

Fund	Name of River Basin	JBIC loan applied	Budget Allocation	Implementation schedule	Ranking	Remarks (Present Status)
Foreign Assisted Project	Mt Pinatubo (Phase III)	27th	2006	2008-2010	-	
	Pasig-Marikina (Phase II)	27th	2007	2007-2013	-	accepted
	Cagayan	27th	2006	2009-2011	39	
	Panay (1st Stage)	27th	2008	2009-2014	17	
	Bicol	-	2006	2008-2012	21	
	Agno & allied (Phase-III)	-	2008	2009-	27	
	VOM (Meycauayan)	-	2008	2009-2013	6	
	Mayon volcano	-	2008	2009-	7	
	Lower Cotabato	-	2008	2009-2011	11	
	Davao urban drainage	-	2008	2009-2010	14	
	Tagaloan	-	2008	2009-2010	40	
	Upper Agusan	-	2008	2008-2011	33	
	Tagum-Libuganon	-	2008	2009-2011	45	
	Agus	-	2008	2009-2011	48	
	Buayan-Malungun	-	2008	2009-2011	44	
	Tarlac	-	2008	2009-2013	27	
	Iloilo (Phase-II)	-	2008	2009-2014	-	
	Ilog-Hilabangan	-	2008	2009-2010	28	
	East-Mangahan	-	2009	2009-2014	2	
Locally-Funded Project	Kinanliman*	-	2008		25	Implementation will be started soon
	Yawa	-	2008		6	Updating of M/P and F/S is requested
	Agos*	-	2008		33	Detailed design is requested
	Dinalupihan-Hermosa-Lubao*	-	2008		-	Not included in 56 river basins

**: Not listed in the DPWH Medium-Term Public Investment Program (2005-2010)*

Tab.3-7 Prioritization of River Basins

Fund Type	Prioriti-zation	Ranking by score	River Name	Basin Area (km^2)	Project Cost (MP)	Total Amount (MP)	Region	Area
Foreign Assisted Project	1	2	EAST MANGAHAN	84	3,161	16,630	IV-A, NCR	L
	2	7	MEYCAUAYAN	201	7,180	54,063	III, NCR	L
	3	29	PANAY/MAMBUSAO	2,311	6,068	45,513	VI	V
	4	10	MINDANAO	20,673	15,870	34,868	XII, ARMM	M
	5	14	NANGALISAN/BAGGAO-PARED(CAGAYAN)	27,743	52,826	134,772	II, CAR	L
	6	21	UPSTREAM of AGNO(include AMBAYAWAN, BANILA)	5,722	11,850	152,435	I	L
	7	30	ILOG-HILABANGAN	2,162	1,638	58,077	VI, VII	V
	8	17	DAVAO	1,992	1,369	46,883	XI	M
	9	24	KABILUGAN/VELASCO/BATO LAKE(BICOL)	2,999	12,095	171,938	V	L
	10	34	GUAGUA	1,605	31,715	208,810	III	L
	11	4	CEBU/MANDAWE	241	2,368	18,998	VII	V
	12	27	UPPER AGUSAN	1,745	2,013	60,090	XI	M
	13	1	UPPER MARIKINA	515	13,469	13,469	NCR, IV-A	L
	14	3	SAN JUAN	90	2,260	37,127	NCR	L
	15	42	JALAUR	1,534	3,249	138,022	VI	V
	16	38	TAGUM-LIBUGANON	2,434	3,517	159,842	XI	M
	17	5	PATALAN/CAYANGA/ANGALACAN	656	2,318	39,445	I, CAR	L
	18	11	IMUS	112	2,377	56,440	IV-A	L
	19	32	TUGANAY	747	2,563	140,585	XI	M
	20	13	UPSTREAM of PAMPANGA(include RIO CHICO)	8,122	21,856	81,946	III	L
	21	23	SINOCALAN/MAROSOY(DAGUPAN)	1,023	3,890	156,325	I, CAR	L
	22	72	TAGO	1,370	2,169	177,095	XIII	M
	23	26	ABULUG	2,766	2,989	174,926	CAR, II	L
	24	39	ABRA	4,951	2,984	211,794	I, CAR	L
	25	104	SIBUGUEY	994	2,493	214,287	IX	M
	26	40	ANGAT	917	9,014	223,301	III	L
Locally Funded Project	1	6	YAWA/BASUD/QUIRANGAY(LEGAZPI CITY)	126	475	475	V	L
	2	25	KINANLIMAN(REAL-1)	10	32	2,340	IV-A	L
	3	9	MANDALAGAN(BACOLOD CITY)	187	214	1,168	VI	V
	4	44	TAGOLOAN	1,762	980	5,796	X	M
	5	45	AGUS/BUAYAN	1,898	681	8,008	ARMM, X	M
	6	33	AGOS	483	680	4,024	IV-A	L
	7	8	SANTA RITA/KALAKLAN(OLONGAPO CITY)	102	479	954	III	L
	8	15	AKLAN	1,010	366	2,706	VI	V
	9	74	BUAYAN-MALUNGUN	1,400	527	10,939	XI, XII	M
	10	12	TUMAGA	255	483	1,651	IX	M
	11	20	MALUPA-DIAN(AGUANG)	666	540	2,308	III	L
	12	28	DONSOL/MANLATO	413	82	3,344	V	L
	13	22	GUINABASAN	131	433	4,457	VII	V
	14	16	DINANGGASAN(CATARMAN-1S)	29	117	1,768	X	M
	15	18	IPONAN	412	357	3,064	X	M
	16	36	AMBURAYAN	1,307	676	6,472	I, CAR	L
	17	37	BALETE	132	259	6,731	IV-B	L
	18	35	BAGO	868	595	7,327	VI	V
	19	19	LIPADAS	163	198	3,262	XI	M
	20	31	TALOMO	279	359	4,816	XI	M
	21	41	ARINGAY	421	822	9,236	I, CAR	L
	22	43	BAUANG	510	358	9,594	CAR, I	L
	23	47	DUNGCAAN(PAGBANGANAN)	176	89	9,683	VIII	V
	24	46	SILWAY-POPONG-SINAUAL(POLOMOLOK)	577	406	8,414	XII	M
	25	68	CAGAYAN DE ORO	1,365	728	10,411	X	M
	26	50	CAGURAY	361	794	11,732	IV-B	L
	27	61	PAMPLONA	698	280	12,013	II, CAR	L
	28	67	DAGUITAN-MARABONG	292	308	12,321	VIII	V
	29	75	LAKE_MAINIT-TUBAY	473	214	12,535	XIII	M
	30	108	MATALING	420	109	12,645	ARMM	M

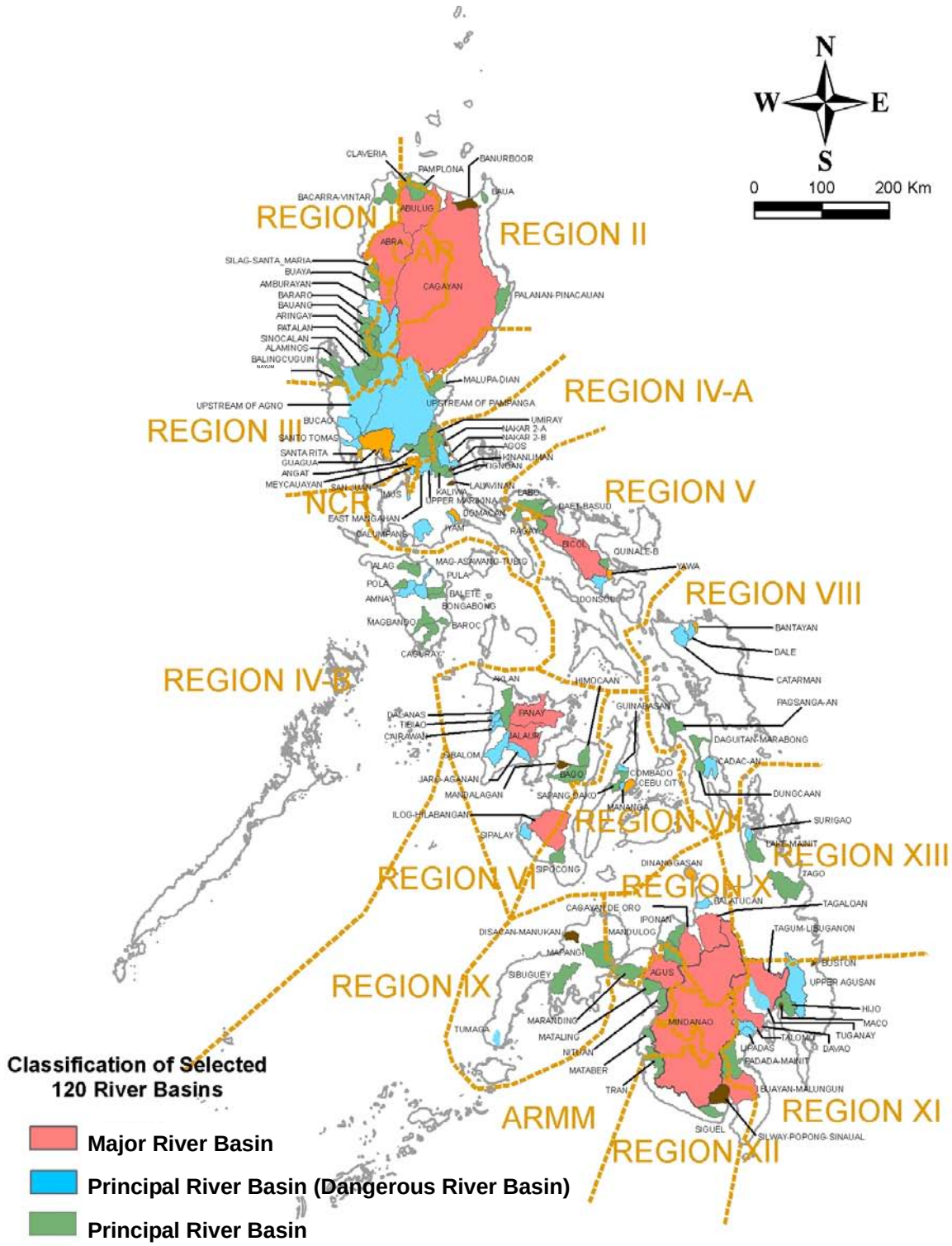
Note: Shaded row shows river basins in the list of request for foreign assisted project in DPWH Medium-Term Public Investment Program

Tab.4-1 Selection of Model River Basins

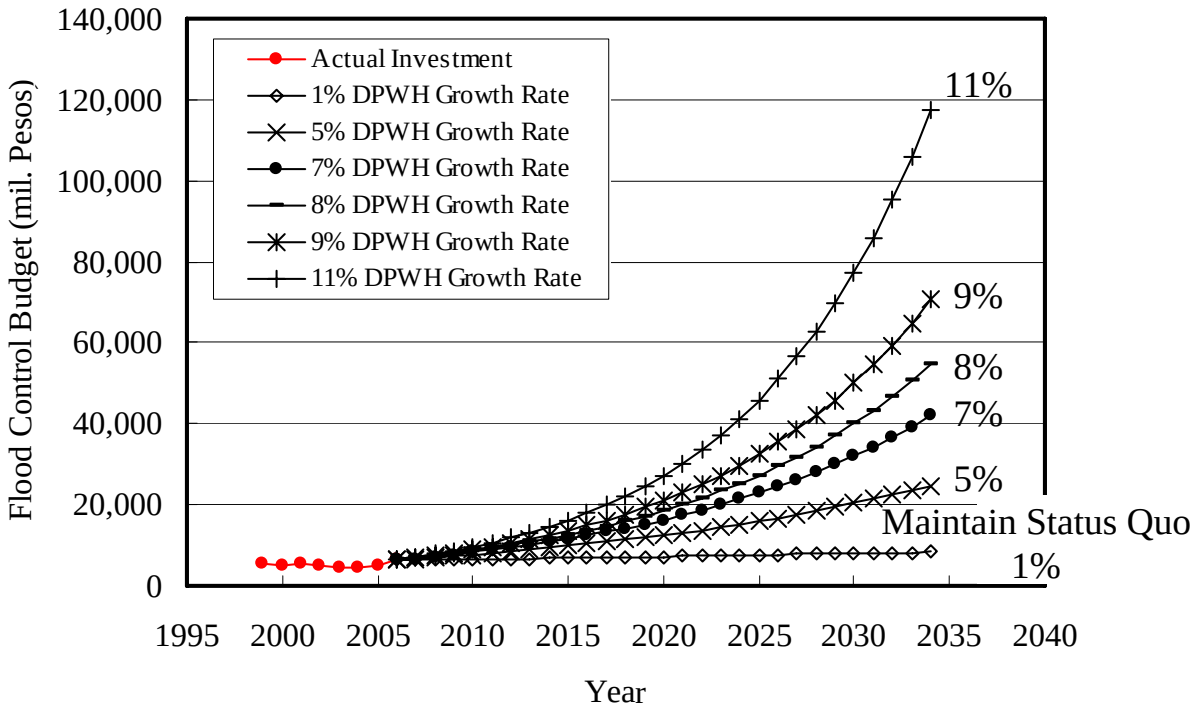
Group No.	Grouping	Luzon			Visayas			Mindanao			Total Number
		Rank	Region	River name	Rank	Region	River name	Rank	Region	River name	
1	F+O+B/F+B	5	I,CAR	PATALAN/CAYANGA/ANGALACAN	15	VI	AKLAN	12	IX	TUMAGA	17
		13	III	UPSTREAM of PAMPANGA(include RIO CHICO)	29	VI	PANAY/MAMBUSAO(Major River Basin)	19	XI	LIPADAS	
		14	II,CAR	CAGAYAN(Major River Basin)	30	VI,VII	ILOG-HILABANGAN(Major River Basin)	27	XI	UPPER AGUSAN	
		21	I	UPSTREAM of AGNO(include AMBAYAWAN,BANILA)				31	XI	TALOMO	
		23	I,CAR	SINOCALAN/MAROSOY(DAGUPAN)				68	X	CAGAYAN DE ORO(Major River Basin)	
		24	V	BICOL(Major River Basin)				72	XIII	TAGO	
		28	V	DONSOL/MANLATO							
		61	II,CAR	PAMPLONA							
2	O+B	36	I,CAR	AMBURAYAN	47	VIII	DUNGCAAN(PAGBANGANAN)	18	X	IPONAN	6
		39	I,CAR	ABRA(Major River Basin)				44	X	TAGOLOAN(Major River Basin)	
								108	ARMM	MATALING	
3	F+O/O/F	1	NCR,IV-A	UPPER MARIKINA	9	VI	MANDALAGAN(BACOLOD CITY)	17	XI	DAVAO(Major River Basin)	15
		3	NCR	SAN JUAN	22	VII	GUINABASAN	45	ARMM,X	AGUS/BUAYAN(Major River Basin)	
		7	III,NCR	MEYCAUAYAN	42	VI	JALAUR(Major River Basin)	46	XII	SILWAY-POPONG-SINAUAL(POLOMOLOK)	
		11	IV-A	IMUS	67	VIII	DAGUITAN-MARABONG	74	XI,XII	BUAYAN-MALUNGUN(Major River Basin)	
		37	IV-B	BALETE				75	XIII	LAKE_MAINIT-TUBAY	
		50	IV-B	CAGURAY							
4	F+O+B+I	20	III	MALUPA-DIAN(DAGUPAN)				10	XII,ARMM	MINDANAO(Major River Basin)	6
		25	IV-A	KINANLIMAN(REAL-1)							
		26	CAR,II	ABULUG(Major River Basin)							
		41	I,CAR	ARINGAY							
		43	CAR,I	BAUANG							
5	F+O+I/F+B+I/F+I/O+I	2	IV-A,NCR	EAST MANGAHAN	4	VII	CEBU/MANDAWE	32	XI	TUGANAY	6
		40	III	ANGAT				38	XI	TAGUM-LIBUGANON(Major River Basin)	
								104	IX	SIBUGUEY	
6	F+O+B+I+L/F+O+B+L/ F+O+L/O+B+L	6	V	YAWA/BASUD/QUIRANGAY(LEGAZPI CITY)	35	VI	BAGO	16	X	DINANGGASAN(CATARMAN-1S)	6
		8	III	SANTA RITA/KALAKLAN(OLONGAPO CITY)							
		33	IV-A	AGOS							
		34	III	GUAGUA							
Total Number		27			10			19			56

Note: Shaded row shows the selected model river basins

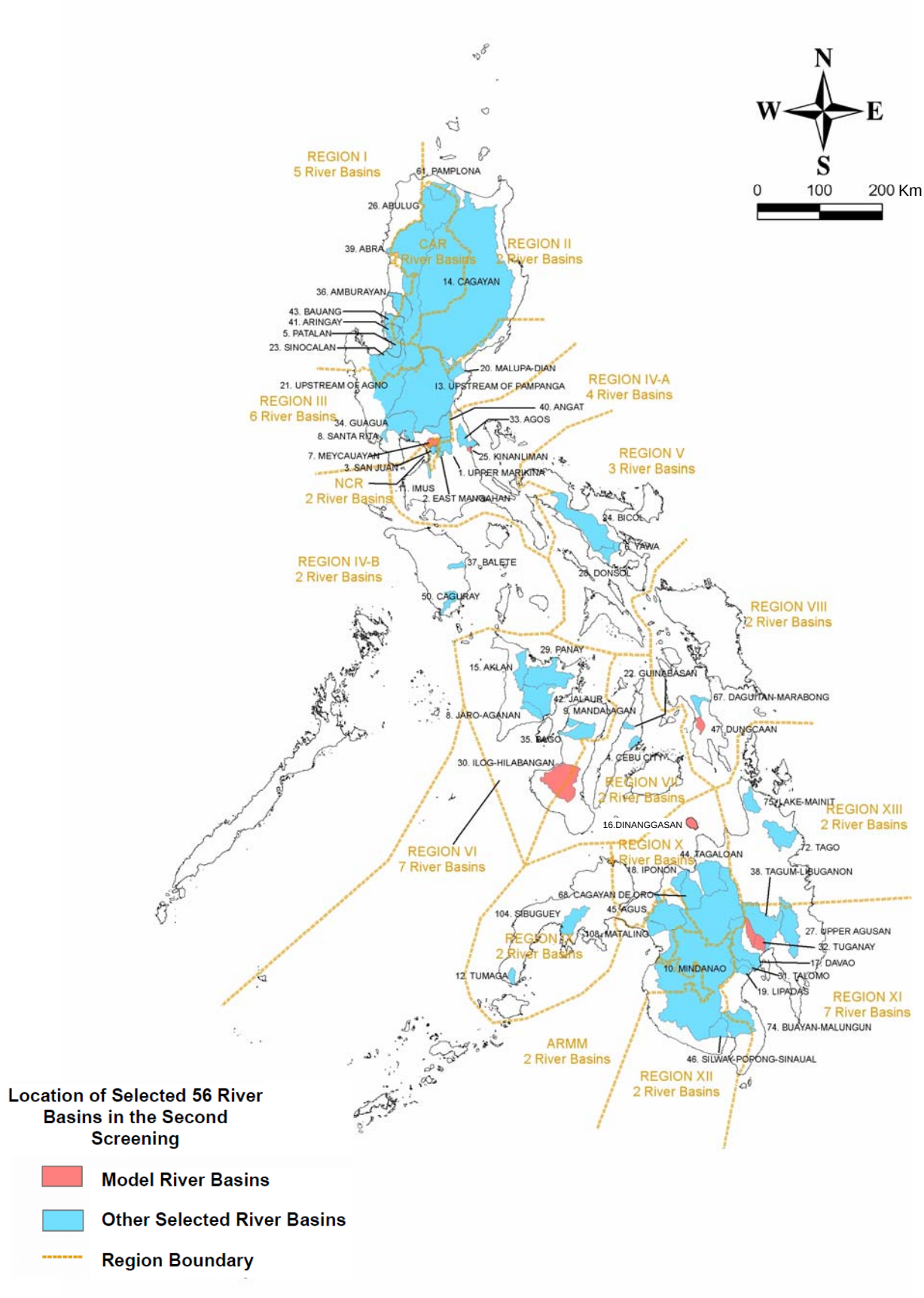
FIGURES



THE STUDY ON THE NATIONWIDE FLOOD RISK ASSESSMENT AND THE FLOOD MITIGATION PLAN FOR THE SELECTED AREAS IN THE REPUBLIC OF THE PHILIPPINES	**Fig. 2-1**
JAPAN INTERNATIONAL COOPERATION AGENCY	**Location of Selected 120 River Basins in the First Screening**



THE STUDY ON THE NATIONWIDE FLOOD RISK ASSESSMENT AND THE FLOOD MITIGATION PLAN FOR THE SELECTED AREAS IN THE REPUBLIC OF THE PHILIPPINES	**Fig. 3-1**
JAPAN INTERNATIONAL COOPERATION AGENCY	**Expected Investment Amount**



THE STUDY ON THE NATIONWIDE FLOOD RISK ASSESSMENT AND THE FLOOD MITIGATION PLAN FOR THE SELECTED AREAS IN THE REPUBLIC OF THE PHILIPPINES	**Fig. 3-2** **Location of Selected 56 River Basins in the Second Screening**
JAPAN INTERNATIONAL COOPERATION AGENCY	

Fund	Prioritization	River name	Region	Basin Area (km^2)	Project Cost (mil. Pesos)	Project Term (year, phase)	Luzon Visayas Mindanao	Classification	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Foreign	1	EAST MANGAHAN	IV-A, NCR	84	3,161	5yrs	L	P(D)	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst																				
	2	MEYCAUAYAN	III, NCR	201	7,180	5yrs x 2phs	L	O(D)	F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst														
	3	PANAY/MAMBUSAO	VI	2,311	6,068	5yrs x 2phs	V	M		D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst													
	4	MINDANAO	XII, ARMM	20,673	15,870	5yrs x 4phs	M	M			F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst
	5	NANGALISAN/BAGGAO-PARED(CAGAYAN)	II, CAR	27,743	52,826	5yrs x 4phs	L	M				D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	
	6	UPSTREAM of AGNO(include AMBAYAWAN, BANILA)	I	5,722	11,850	5yrs x 3phs	L	P(D)					F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst				
	7	ILOG-HILABANGAN	VI, VII	2,162	1,638	5yrs	V	M						F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst														
	8	DAVAO	XI	1,992	1,369	5yrs	M	M							F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst												
	9	KABILUGAN/VELASCO/BATO LAKE(BICOL)	V	2,999	12,095	5yrs x 4phs	L	M					D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst
	10	GUAGUA	III	1,605	31,715	5yrs x 4phs	L	O(D)				F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst
	11	CEBU/MANDAWE	VII	241	2,368	5yrs	V	O(D)								F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst												
	12	UPPER AGUSAN	XI	1,745	2,013	5yrs	M	P(D)									F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst												
	13	UPPER MARIKINA	NCR, IV-A	515	13,469	5yrs x 4phs	L	P(D)					D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst
	14	SAN JUAN	NCR	90	2,260	5yrs	L	P(D)											D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst									
	15	JALAUR	VI	1,534	3,249	5yrs	V	M												F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst								
	16	TAGUM-LIBUGANON	XI	2,434	3,517	5yrs	M	M													F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst						
	17	PATALAN/CAYANGA/ANGALACAN	I, CAR	656	2,318	5yrs	L	P														F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst						
	18	IMUS	IV-A	112	2,377	5yrs	L	P(D)															F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst					
	19	TUGANAY	XI	747	2,563	5yrs	M	P(D)																F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst					
	20	UPSTREAM of PAMPANGA(include RIO CHOCO)	III	8,122	21,856	5yrs x 4phs	L	P(D)				F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst
	21	SINOCALAN/MAROSOY(DAGUPAN)	I, CAR	1,023	3,890	5yrs	L	P																		F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst			
	22	TAGO	XIII	1,370	2,169	5yrs	M	P																			F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst		
	23	ABULUG	CAR, II	2,766	2,989	5yrs	L	M																				F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst
	24	ABRA	I, CAR	4,951	2,984	5yrs	L	M																					F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst
	25	SIBUGUEY	IX	994	2,493	5yrs	M	P																					F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst
	26	ANGAT	III	917	9,014	5yrs x 3phs	L	P											F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst
Local	1	YAWA/BASUD/QUIRANGAY(LEGAZPI CITY)	V	126	475	5yrs	L	O(D)	F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst																				
	2	KINANLIMAN(REAL-1)	IV-A	10	32	5yrs	L	O		F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst																		
	3	MANDALAGAN(BACOLOD CITY)	VI	187	214	5yrs	V	O			F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst																	
	4	TAGOLOAN	X	1,762	980	5yrs	M	M			F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst																	
	5	AGUS/BUAYAN	ARMM, X	1,898	681	5yrs	M	M				F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst																
	6	AGOS	IV-A	483	680	5yrs	L	P(D)				D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst																
	7	SANTA RITA/KALAKLAN(OLONGAPO CITY)	III	102	479	5yrs	L	O(D)					F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst															
	8	AKLAN	VI	1,010	366	5yrs	V	P						F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst														
	9	BUAYAN-MALUNGUN	XI, XII	1,400	527	5yrs	M	M						F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst														
	10	TUMAGA	IX	255	483	5yrs	M	P(D)							F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst													
	11	MALUPA-DIAN(AGUANG)	III	666	540	5yrs	L	P							F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst													
	12	DONSOL/MANLATO	V	413	82	5yrs	L	P(D)								F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst												
	13	GUINABASAN	VII	131	433	5yrs	V	P(D)									F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst											
	14	DINAGGASAN(CATARMAN-1S)	X	29	117	5yrs	M	O(D)									F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst											
	15	IPONAN	X	412	357	5yrs	M	P										F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst									
	16	AMBURAYAN	I, CAR	1,307	676	5yrs	L	P(D)										F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst									
	17	BALETE	IV-B	132	259	5yrs	L	P											F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst									
	18	BAGO	VI	868	595	5yrs	V	P												F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst								
	19	LIPADAS	XI	163	198	5yrs	M	P(D)												F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst								
	20	TALOMO	XI	279	359	5yrs	M	P(D)													F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst							
	21	ARINGAY	I, CAR	421	822	5yrs	L	P													F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst							
	22	BAUANG	CAR, I	510	358	5yrs	L	P														F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst						
	23	DUNGCAAN(PAGBANGANAN)	VIII	176	89	5yrs	V	P															F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst					
	24	SILWAY-POPONG-SINAUAL(POLOMOLOK)	XII	577	406	5yrs	M	O															F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst					
	25	CAGAYAN DE ORO	X	1,365	728	5yrs	M	M																	F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst				
	26	CAGURAY	IV-B	361	794	5yrs	L	P																	F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst				
	27	PAMPLONA	II, CAR	698	280	5yrs	L	P																		F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst			
	28	DAGUITAN-MARABONG	VIII	292	308	5yrs	V	P																			F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst		
	29	LAKE_MAINIT-TUBAY	XIII	473	214	5yrs	M	P																			F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst		
	30	MATALING	ARMM	420	109	5yrs	M	P																				F/S	D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst	Cnst
Exceptional Rivers																																			
		Iloilo (Phase II)									Cnst	Cnst	Cnst	Cnst	Cnst																				
		Dinalupihan-Hermosa-Lubao							F/S		D/D	D/D	Cnst	Cnst	Cnst	Cnst	Cnst																		
Total Project Cost (Foreign: 223,301, Local: 12,645)					235,946																													
Total Investment Amount					239,548				1,438	2,969	4,595	6,321	8,153	8,413	8,683	8,960	9,248	9,545	9,851	10,168	10,492	10,830	11,178	11,537	11,910	12,292	12,686	13,093	13,511	13,946	11,517	8,914	6,133	3,165

Locally-Funded Project: (Project Cost) < 1 bil Pesos
Foreign Assisted Project: (Project Cost) > 1 bil Pesos

: F/S
: D/D
: Construction

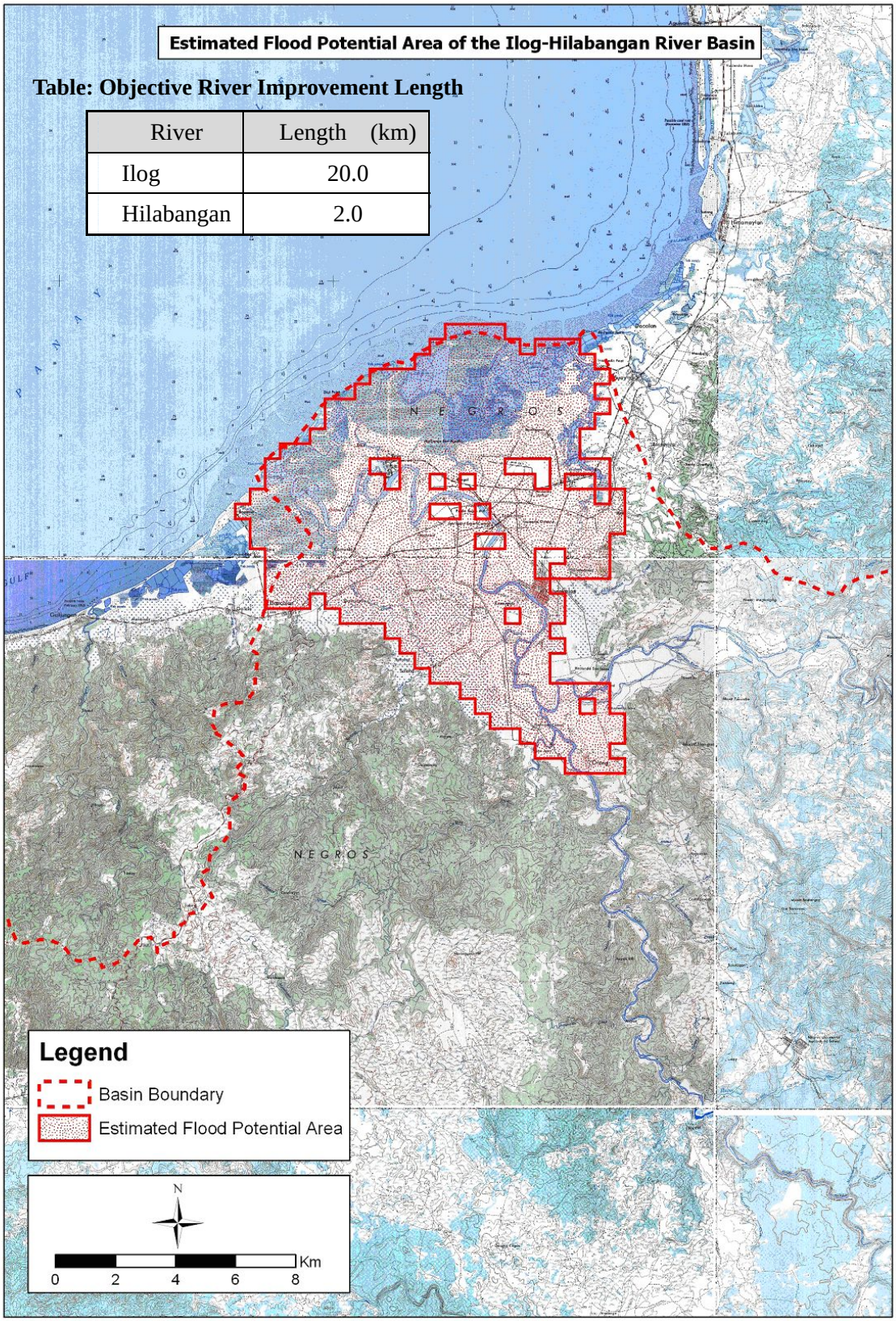
M: Major River Basin
P: Principal River Basin
P(D): Principal River Basin (Dangerous River Basin)
O: Other River Basin
O(D): Other River Basin (Dangerous River Basin)

THE STUDY ON THE NATIONWIDE FLOOD RISK ASSESSMENT AND THE FLOOD MITIGATION PLAN FOR THE SELECTED AREAS IN THE REPUBLIC OF THE PHILIPPINES

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3-3

Implementation Schedule

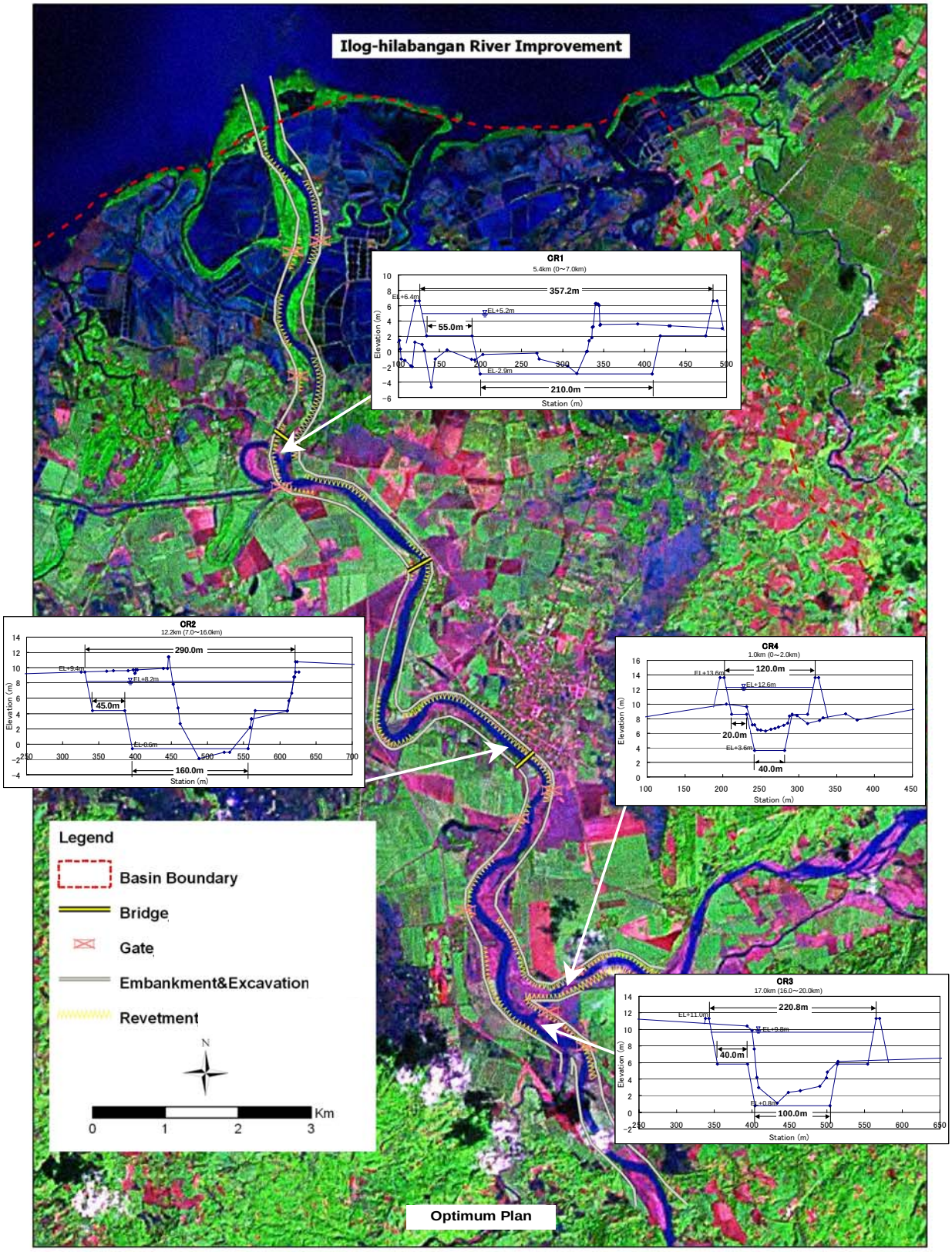


THE STUDY ON THE NATIONWIDE FLOOD RISK ASSESSMENT AND THE FLOOD MITIGATION PLAN FOR THE SELECTED AREAS IN THE REPUBLIC OF THE PHILIPPINES

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5-1

Features of River Basin (Ilog-Hilabangan)



THE STUDY ON THE NATIONWIDE FLOOD RISK ASSESSMENT AND THE FLOOD MITIGATION PLAN FOR THE SELECTED AREAS IN THE REPUBLIC OF THE PHILIPPINES	**Fig. 5-2** **Optimum Plan (Ilog-Hilabangan)**
JAPAN INTERNATIONAL COOPERATION AGENCY	

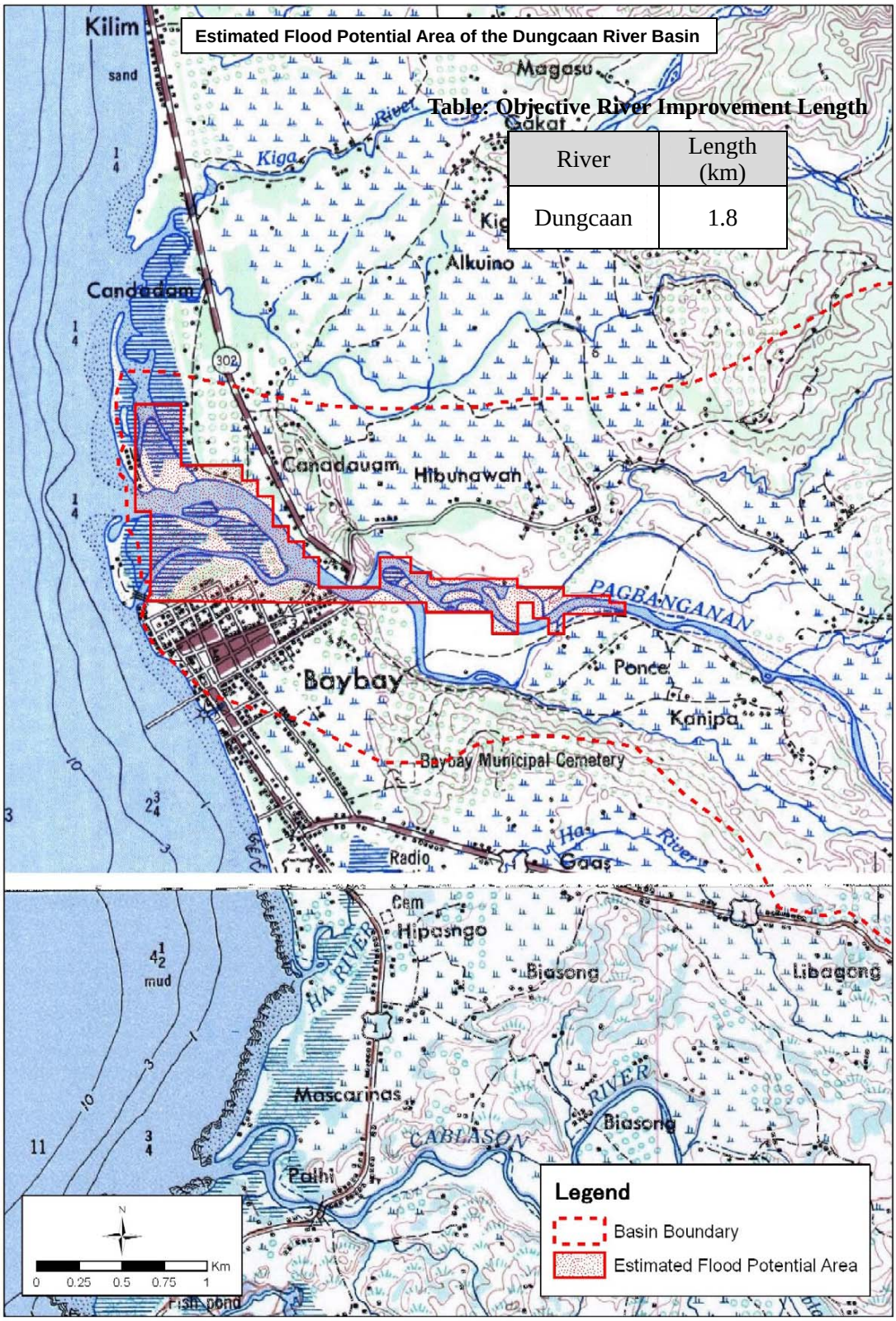


Table: Objective River Improvement Length

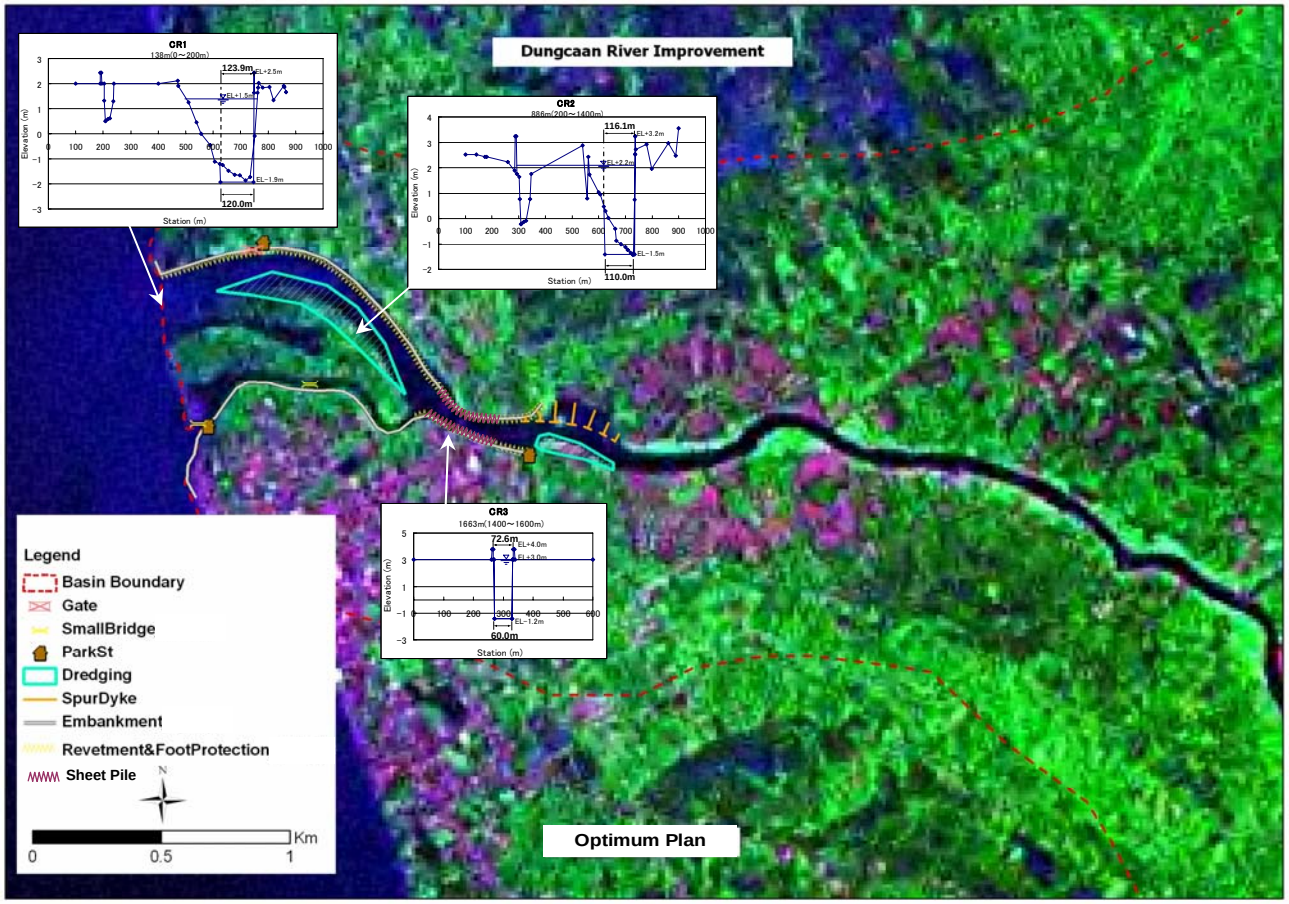
River	Length (km)
Dungcaan	1.8

THE STUDY ON THE NATIONWIDE FLOOD RISK ASSESSMENT AND THE FLOOD MITIGATION PLAN FOR THE SELECTED AREAS IN THE REPUBLIC OF THE PHILIPPINES

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5-3

Features of River Basin (Dungcaan)



THE STUDY ON THE NATIONWIDE FLOOD RISK ASSESSMENT AND THE FLOOD MITIGATION PLAN FOR THE SELECTED AREAS IN THE REPUBLIC OF THE PHILIPPINES	**Fig. 5-4** **Optimum Plan (Dungcaan)**
JAPAN INTERNATIONAL COOPERATION AGENCY	