DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
THE REPUBLIC OF THE PHILIPPINES

JAPAN INTERNATIONAL COOPERATION AGENCY

THE PREPARATORY STUDY
FOR
PASIG-MARIKINA RIVER CHANNEL IMPROVEMENT PROJECT (PHASE III)
IN
THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

Volume 1 Main Report
(Executive Summary)

October 2011

CTI ENGINEERING INTERNATIONAL CO., LTD

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VOLUME I: EXECUTIVE SUMMARY

OCTOBER 2011

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COMPOSITION OF FINAL REPORT

VOLUME I	**:**	**EXECUTIVE SUMMARY**
VOLUME II	**:**	**MAIN REPORT**
VOLUME III	**:**	**SUPPLEMENTAL DOCUMENTS**

EXCHANGE RATES USED IN THE REPORT:
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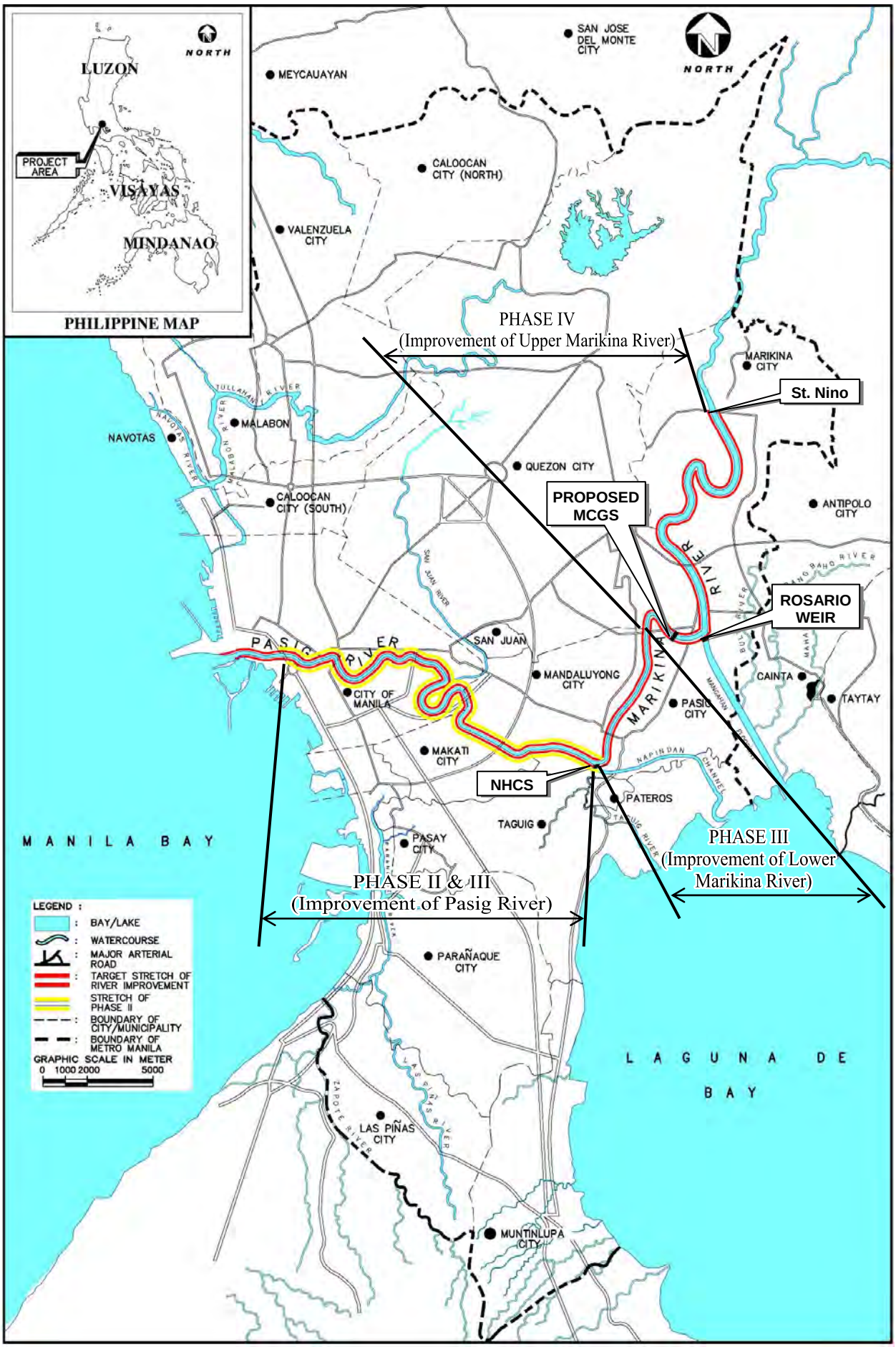

Project Location Map

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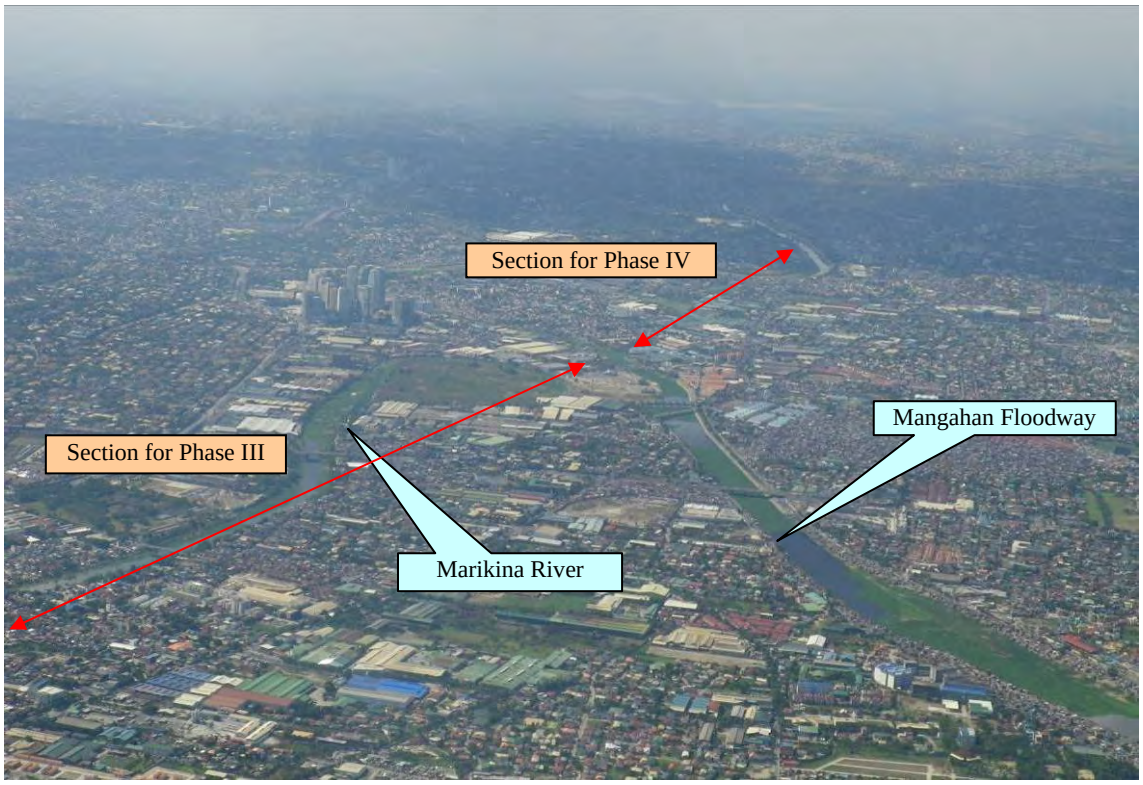

Phase III & IV Area of the Project in 2009

Pasig-Marikina River and Mangahan Floodway (1/3)

Mangahan Floodway and the Congested Residential Area (2009)

2009

1988

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SUMMARY

1. BACKGROUND AND OBJECTIVES OF THE STUDY

1.1 Background of the Study

The Pasig-Marikina River, with a total catchment area of 635 km^2, runs through the center of Metro Manila and flows out to Manila Bay. A flood control plan for the Pasig-Marikina River including the Metro Manila area was prepared in 1952. In line with the flood control plan, improvement works of the Pasig River, consisting mainly of river walls and dredging of channel, were carried out in the 1970's. Then, the Mangahan Floodway was completed in 1988 to provide protection to the center of Metro Manila against a 100-year return period flood of the Pasig-Marikina River.

After that, through "The Study on Flood Control and Drainage Project in Metro Manila (JICA; 1987-1990)", which includes a feasibility study (F/S) for the Pasig-Marikina River Channel Improvement, was identified that this safety level can be achieved with flood control works, such as the construction of a dam at the upper stream of Marikina River to store the flood discharge, river channel improvement in the downstream, and construction of the Marikina Control Gate Structure (MCGS) by which excess discharge will flow down to Laguna Lake through the Mangahan Floodway.

On the other hand, it appears that currently the Pasig-Marikina River has the capacity of only less than a 5-year return period flood as evidenced by the fact that flood damage is frequently experienced: in 1986, 1988, 1995, 1998, 1999, 2000, 2002, 2004 and 2009 (Typhoon Ondoy). Thus, Metro Manila is still facing the menace of disastrous floods.

To cope with the flooding problems, the Department of Public Works and Highways (DPWH) had decided to implement the Pasig-Marikina River Channel Improvement Project (Phase III) following the completion of the Phase I (Detailed Design) and the Phase II (channel improvement of Pasig River), also with financial assistance from Japan's ODA. Therefore, this study called "The Preparatory Study for Pasig-Marikina River Channel Improvement Project (Phase III), which is hereinafter called "the Study", was carried out from September 2010 to September 2011, to confirm the necessity of the Project, including flood damage conditions and so on.

1.2 Objectives of the Study

The objectives of the Study are as recapitulated below:

(1) To review the existing Pasig-Marikina River Channel Improvement Plan, which will focus on the river improvement stretch covered by Phase III throughout the study for the whole river improvement stretch (from river mouth to Marikina Bridge) in the Pasig-Marikina River Basin, including the present river conditions reflecting recent river basin developments, recent flood damage conditions, and impacts to flood damage by future climate change.

(2) To provide support for the formulation of a Yen-Loan Project as the "Phase-III" project, consisting of river channel improvement works and monitoring, educational campaign and publicity aimed towards the local inhabitants and so on.

1.3 Study Area

The Study Area covers the entire Pasig-Marikina River Basin, focusing on the river channel improvement of the Phase III Project, which includes the Phase III stretch in Lower Marikina River and the priority areas selected from the potential areas in the Phase II stretch (Pasig River).

2. PROJECT FORMULATION

2.1 Objectives of the Overall Project

The objectives of the overall project called "The Pasig-Marikina River Channel Improvement Project" (PMRCIP) are to mitigate the flood damage caused by channel overflow of the Pasig-Marikina River, to facilitate urban development and at the same time enhance the favorable environment along the river, as follows:

(1) To mitigate the frequent inundation or massive flooding caused by the overflow of Pasig-Marikina River resulting in severe damage to human life, livestock, property and infrastructure aiming to alleviating issues on living and sanitary conditions in Metro Manila, including parts of Rizal Province;

(2) To create a more dynamic economy by providing a flood-free urban center as an important strategy for furthering national development; and

(3) To rehabilitate and enhance the favorable environment and aesthetic view along the riverside areas by providing more ecologically stable conditions which will arrest the progressive deterioration of environmental conditions, health and sanitation in Metro Manila.

2.2 Objective of the Phase III Project

In the context of the objectives of the overall project, the objective of the Phase III Project is to implement river channel improvement project for the lower stretch of Marikina River and the priority areas selected from the potentials areas in the Phase II stretch in Pasig River which could not be undertaken in the ongoing construction for the Phase II Project due to financial constraints.

2.3 Design Discharge Distribution

The Phase III Project targets the Lower Marikina River and the priority areas selected from the potential areas in the Pasig River Phase II stretch, as stated above. To formulate the Phase III Project, the contents of the Detailed Design completed in 2002 and its Review conducted in 2008 were reexamined in the Study, considering the present site conditions.

For the urgent flood control of the Pasig-Marikina River, it is proposed that the river channel is to be improved, aiming to increase the flow capacity in order to cope with design discharges on the scale of a 30-year return period flood, which are 550 m^3/s for Lower Marikina River, 600 m^3/s for Upper Pasig River and 1,200 m^3/s for Lower Pasig River, as shown in Figure 2.1. The construction of MCGS is not included in this Phase III Project, but proposed to be constructed in the future under Phase IV.

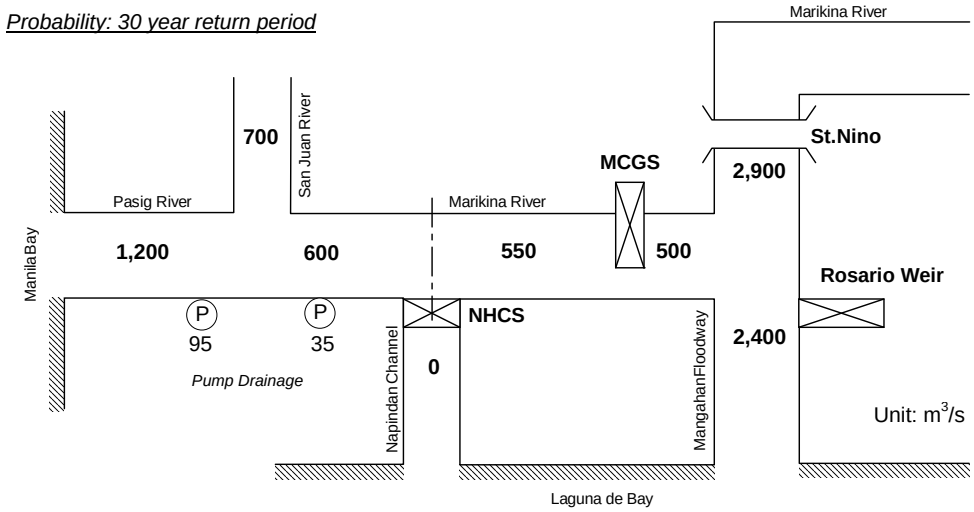

Figure 2.1 Design Discharge Distribution (30-Year Return Period)

2.4 Review of River Structures in the Detailed Design

2.4.1 Preliminary Design of River Structures Proposed for Priority Areas of Phase II

(1) Stretch for Phase II

The Phase II Project targets for channel improvement only 13.2 km long of the total length of 28.9 km on both banks proposed in the Detailed Design in Phase I due to the shortage of project funds brought about by the substantial price increase of construction materials, particularly, steel, major material of the Project. Since about 5.8 km of revetment works at some bank sections of the Pasig River were constructed under the projects of DPWH-PRRP, PRRC and participating LGUs before the start of construction for the Phase II Project, the potential areas are only about 9.9 km in total at 42 sections on both banks (refer to Figure 2.1.1 in the main part of this report). From these potential areas, Priority Groups 1 and 2 of priority areas are selected for channel improvement works and proposed for inclusion in the Phase III Project.

The above improvement lengths on both banks are as summarized in the following table.

Table 2.1 River Channel Improvement Stretch for Phase II

D/D Improvement Stretch	Other Projects (DPWH-PRRP, PRRC, LGUs)	Phase II Construction Stretch	Priority Areas for Phase III	Remaining Areas to be Improved by Others	Stretch for Pasig River Channel Improvement
28.9 km	5.8 km (on both banks	13.2 km (on both banks)	8.1 km (on both banks)	1.8 km (on both banks)	16.4 km (32.8 km on both banks)

(2) Preliminary Design of River Structures

The results of the Detailed Design completed in 2002 were reviewed in 2008 at the start of the Phase II Project and construction is being carried out based on the results of the review. Since the improvement works on the Pasig River is presently ongoing as the Phase II Project, the preliminary design of revetment to be installed at the priority areas selected from the potential areas that has been carried out in the Study follows the design adopted by Phase II from the viewpoint of consistency.

2.4.2 Preliminary Design of River Structures Proposed for Lower Marikina River Channel Improvement

(1) Stretch for Phase III

Based on the Detailed Design, the construction of MCGS is to be included in the Phase III Project. However, in this Study, the deferment of construction of MCGS is proposed. Therefore, the channel improvement works for the Lower Marikina River in the Phase III Project targets only the 5.4 km stretch from the junction with the Pasig River to the upstream, i.e., except the construction area for the proposed MCGS.

(2) Preliminary Design of River Structures

The following are the flood control structures proposed in Phase III for the Lower Marikina River:

- Dredging/Excavation of Riverbed
- Earth Dike
- Concrete River Wall
- Boundary Bank
- Bridge Pier Protection Works

2.5 Nonstructural Measures

The Pasig-Marikina River Channel Improvement Project (Phase III) is to be implemented to improve the channel flow capacity to the scale of a 30-year return period flood. However, the occurrence of larger floods of more than a 30-year return period is anticipated even after the improvement and completion of structural measures for the whole stretch of Pasig-Marikina River. Under such circumstances, the introduction of nonstructural measures would be effective and also faster to implement at a lower-cost to reduce socio-economic and human losses in comparison with the structural measures which would take a long time to complete.

The nonstructural measures for Phase III are to be selected, aiming at the possibility of utilizing the outputs of such measures in the future and in consideration of the points and criteria shown in the following table to avoid the duplication of measures in projects conducted by other donors.

Table 2.2 Selection of Nonstructural Measures

Criteria	Nonstructural Measures
(1) To facilitate the construction of Phase III and to enable deepening of understanding of necessity and effectiveness of flood mitigation measures	• Implementation of Educational Campaign and Publicity (around construction site) • Overseas Training
(2) Fast-acting measures for flood risk reduction	• Establishment of Website to disseminate information on the activities of FMC and water level of Pasig-Marikina River
(3) Expansive measures for other cities and region	• Preparation of hazard maps with information on evacuation center, evacuation route, means of evacuation and so on (Pasig City)

3. STRATEGY FOR PROJECT IMPLEMENTATION, OPERATION/ MAINTENANCE AND PROJECT FUNDS

The stretches of the Pasig and Lower Marikina river channels to be improved are located within the administrative jurisdiction of Metropolitan Manila Development Authority (MMDA). The implementation of construction for the Phase III Project is to be undertaken by the DPWH and the completed flood control facilities are to be transferred by DPWH to MMDA for operation and maintenance after the completion of Phase III construction works.

The Phase III Project is eligible for the preferential terms of Japanese ODA Loans called "STEP" (Special Terms for Economic Partnership). The STEP Loan is expected to raise the visibility of Japanese ODA among citizens of both recipient countries and Japan through the best use of advance technologies and know-how of Japanese firms and institutions.

4. PROJECT EVALUATION

4.1 Economic Evaluation

The economic internal rate of return (EIRR) of the Project is as shown in the table below. All phases are judged to be feasible and economically viable.

Table 4.1 Economic Evaluation

Project	EIRR	NPV(15%)	B/C
Phase II	23%	1,478	1.7
Phase III	38%	3,844	3.7
Phase IV	35%	2,167	3.4
Entire Project	28%	7,489	2.7

4.2 Effects of the Project

One of the major objectives of the entire Project is to promote the river channel improvement of the Pasig-Marikina River to the safety level of a 100-year return period flood in accordance with the Master Plan formulated in 1990. However, the river channel improvement is to be implemented only for the Phase III stretch including the priority areas in the Phase II stretch, adopting the Phase II Project safety level of 30-year return period in a manner of urgent project.

As the result of implementation of construction of the Project, the current flow capacity of 200 m^3/s in the Pasig River will increase to 1,200 m^3/s at maximum, as shown in the table below.

Table 4.2 Flow Capacity of Pasig-Marikina River after Completion of Phase III

River Name	Stretch (km)	Flow Capacity (m^3/s)			
		Present River Channel			After Project
		Average	Minimum	Maximum	Minimum
(1)Pasig River	0.0 - 1.0	1,200	900	1,500	1,200
	1.0 - 4.0	600	200	1,200	1,200
	4.0 - 7.0	1,000	600	1,500	1,200
	7.0 - 17.1	500	200	1,000	600
(2)Lower Marikina	0.0 - 6.5	400	200	1,000	550

However, the safety level for the 30-year return period cannot be attained under the "without MCGS" situation, because the safety level will remain at about 20-year return period in the lower Pasig River downstream from the confluence of the San Juan River, about 10-year return period in the upper Pasig River upstream from the confluence of the San Juan River, and 2-year return period in the Lower Marikina River.

5. IMPLEMENTATION SCHEDULE

The Implementation Schedule of Phase III is shown in Figure 5.1. The construction period will terminate in April 2017 and completion of the Project will coincide with the termination of consulting services, i.e., June 2017.

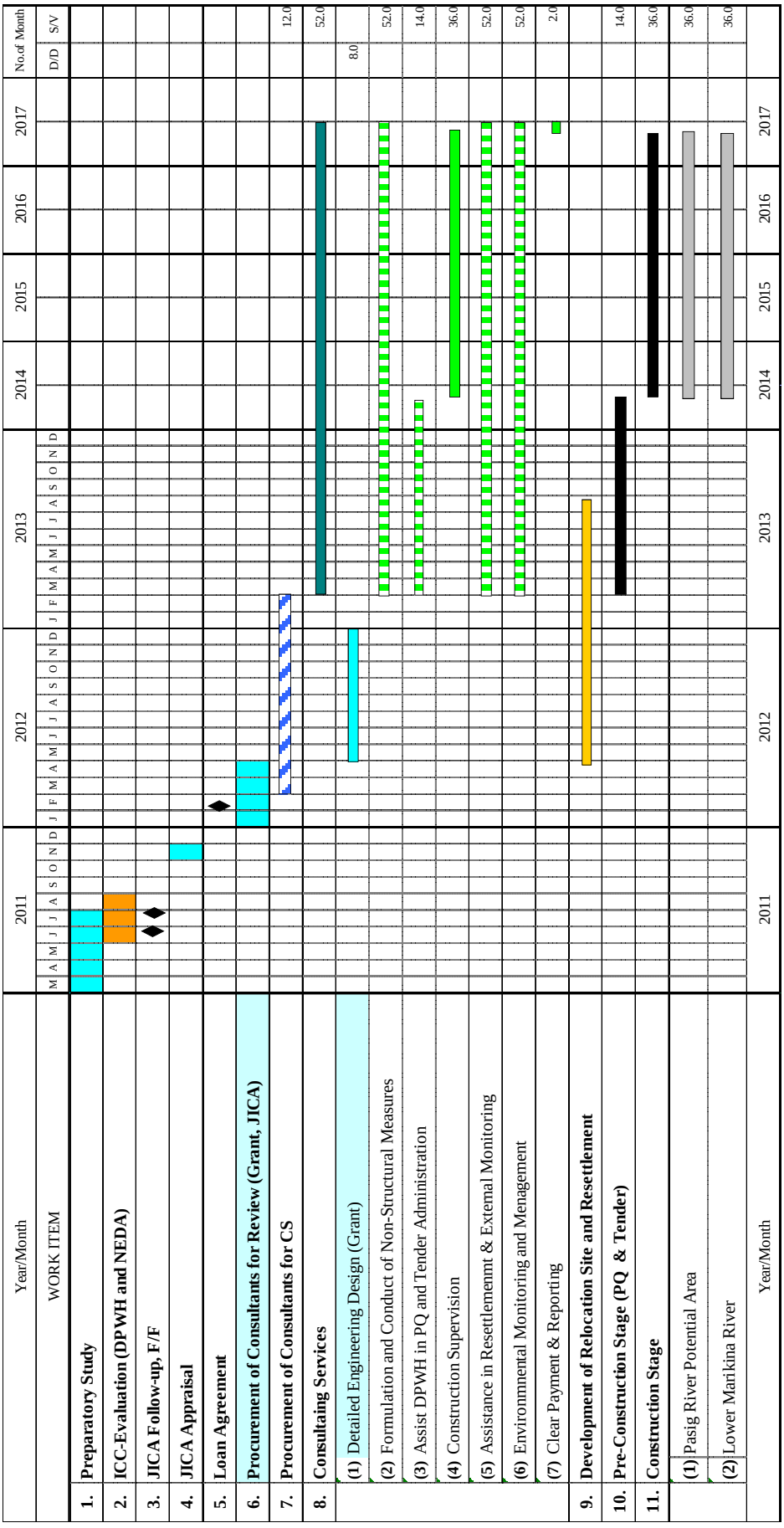

Figure 5.1 Implementation Schedule of Phase III

6. CONCLUSION AND RECOMMENDATION

6.1 Conclusion

In the Study, the currently existing Pasig-Marikina River Channel Improvement Plan were reviewed, focusing on the river improvement stretch covered by Phase III, to support the formulation of a Yen-Loan Project to be called as "Phase III", which will consist of river channel improvement works and monitoring, including educational or information campaign and publicity aimed towards the local residents and so on. As a result, the Study concludes that the Phase III Project is economically viable, technically feasible, and social and natural environmentally acceptable.

6.2 Recommendation

As evidenced by the recurrent and serious floods brought about by strong typhoons, especially, Typhoon Ondoy in 2009 which brought about the devastating flood in the region, Metro Manila is very fragile to floods, which is attributed mainly to the poor flood discharge capacity of the Pasig-Marikina River Channel. To mitigate flood damage in the region and its surrounding areas, the Pasig-Marikina River Channel Improvement Project has been initiated with the implementation of construction works for the Pasig River in the Phase II Project. In order to attain the ultimate goal of flood mitigation by the Project, it is strongly recommended that prompt actions toward the implementation of the Phase III Project should be taken without any lapse of time in accordance with the Implementation Schedule proposed by the Study, including the preparation of Implementation Program (I/P), obtaining the Resolution from Regional Development Committee (RDC) and the approval of the Investment Coordination Committee (ICC).

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ABBREVIATIONS AND ACRONYMS

Government Institutions and Other Organizations

CDCC	:	City Disaster Coordinating Council
NEDA	:	National Economic and Development Authority
DENR	:	Department of Environment and Natural Resources
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
FCSEC	:	Flood Control and Sabo Engineering Center (DPWH)
HLURB	:	Housing and Land Use Regulation Board
MWSS	:	Metropolitan Manila Waterworks and Sewerage System
MMDA	:	Metro Manila Development Authority
PAGASA	:	Philippine Atmospheric, geophysical and Astronomical Services Administration
PMO-MFCP	:	Project Management Office for Major Flood Control Projects, DPWH
PRRC	:	Pasig River Rehabilitation Commission
OCD	:	Office of Civil Defense
RDC	:	Regional Development Committee

Others

ADB	:	Asian Development Bank
AO	:	Administrative Order
AusAID	:	Australian Agency for International Development
B/C	:	Benefit/Cost Ratio
BDC	:	Barangay Development Council
BDRRMC	:	Barangay Disaster Risk Reduction and Management Council
CDCC	:	City Disaster Coordinating Council
CDRRMC	:	City Disaster Risk Reduction and Management Council
CSCAND	:	Collective Strengthening of Community Awareness for Natural Disasters
DO	:	Department Order
D/D	:	Detailed Design
DF/R	:	Draft Final Report
DRRM	:	Disaster Risk Reduction Management
DRM	:	Disaster Risk Management
EFCOS	:	Effective Flood Forecasting and Warning System including Telemetering and Flood Warning System in the Pasig-Marikina-Laguna Lake Complex
ECC	:	Environmental Compliance Certificate
EIA	:	Environmental Impact Assessment
EIRR	:	Economic Internal Rate of Return
EIS	:	Environmental Impact Statement
EMP	:	Environmental Monitoring Plan
FMC	:	Flood Mitigation Committee
F/S	:	Feasibility Study
GMMA	:	Greater Metro Manila Area
GCM	:	Global Circulation Model
GDP	:	Gross Domestic Product
GIS	:	Geographic Information Systems
GNP	:	Gross National Product
IC/R	:	Inception Report

IEE	:	Initial Environmental Examination
IEC	:	Information Education Campaign
ICP	:	Information Campaign and Publicity
I/P	:	Implementing Program
IT/R	:	Interim Report
IPCC	:	Intergovernmental Panel on Climate Change
JBIC	:	Japan Bank for International Cooperation
JICA	:	Japan International Cooperation Agency
L/A	:	Loan Agreement
LDRRMC	:	Local Disaster Risk Reduction and Management Council
LIAC	:	Local Inter-Agency Committee
LGU	:	Local Government Unit
MCGS	:	Marikina Control Gate Structure
MDCC	:	Municipal Disaster Coordinating Council
MDRRMC	:	Municipality Disaster Risk Reduction and Management Council
MHW	:	Mean Monthly Highest Water Level
MM, m/m	:	Man-Month(s)
MOA	:	Memorandum of Agreement
MP	:	Master Plan
MTPDP	:	Medium Term Philippine Development Plan
MTPIP	:	Medium Term Public Investment Program, DPWH
NCR	:	National Capital Region
NDRRMC	:	National Disaster Risk Reduction and Management Council
NFMFP	:	National Flood Mitigation Framework Plan
NGO	:	Non Government Organization
NPV	:	Net Present Value
O&M	:	Operation and Management
ODA	:	Official Development Assistance
PAF	:	Project Affected Family
PAP	:	Project Affected People
PEISS	:	Philippine Environment Impact Statement System
PD	:	Presidential Decree
PDRRMC	:	Provincial Disaster Risk Reduction and Management Council
PMRCIP	:	Pasig-Marikina River Channel Improvement Plan
PRS	:	Philippine Reference System
PTM	:	Philippine Transverse Mercator
PO	:	People’s Organization
RA	:	Republic Act
RAP	:	Relocation Action Plan
ROW	:	Right-of-Way
SAPROF	:	Special Assistance for Project Formation
SC	:	Steering Committee
STEP	:	Special Terms for Economic Partnership
STM	:	Stakeholder’s Meeting
STW	:	Stakeholder’s Workshop
TOR	:	Terms of Reference
TWG	:	Technical Working Group
UDHA	:	Urban Development and Housing Act

MEASUREMENT UNITS

(Length)		
mm	:	millimeter(s)
cm	:	centimeter(s)
m	:	meter(s)
km	:	kilometer(s)
(Area)		
mm^2	:	square millimeter(s)
cm^2	:	square centimeter(s)
m^2	:	square meter(s)
km^2	:	square kilometer(s)
ha	:	hectare(s)
(Weight)		
g, gr	:	gram(s)
kg	:	kilogram(s)
ton	:	ton(s)

(Time)		
s, sec	:	second(s)
min	:	minute(s)
h, hr	:	hour(s)
d, dy	:	day(s)
y, yr	:	year(s)
(Volume)		
cm^3	:	cubic centimeter(s)
m^3	:	cubic meter(s)
l, ltr	:	liter(s)
mcm	:	million cubic meter(s)
(Speed/Velocity)		
cm/s	:	centimeter per second
m/s	:	meter per second
km/h	:	kilometer per hour

CHAPTER 1 OUTLINE OF THE STUDY

1.1 Objectives of the Study

The objectives of the Study are as recapitulated below:

(1) To review the existing Pasig-Marikina River Channel Improvement Plan (PMRCIP), focusing on the river improvement stretch covered by Phase III in the course of the study for the whole river improvement stretch (from river mouth to Marikina Bridge) in the Pasig-Marikina River Basin and including the following items: present river conditions reflecting recent river basin development, recent flood damage conditions, and impacts to flood damage by future climate change.

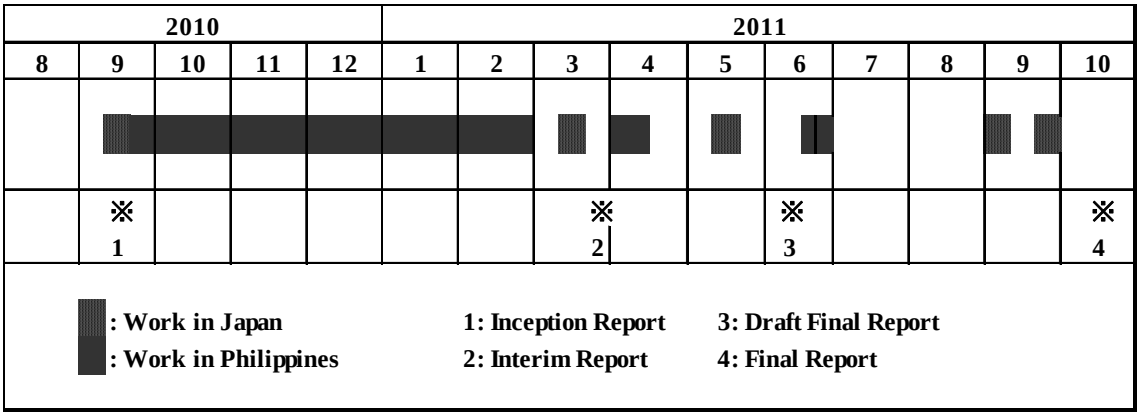
(2) To provide support for the formulation of a Yen-Loan Project as the "Phase III" project, consisting of the river channel improvement works and monitoring, information campaign and publicity towards the local inhabitants and so on.

1.2 Study Area

The Study Area covers the Pasig-Marikina River Basin, focusing on the river channel improvement stretches for Phase III.

1.3 Study Schedule

The Overall Study Schedule is shown in Figure 1.3.1. The total duration of the Study is 14 months, and reports are to be submitted, as shown in the same figure.



Note: The timing of submission of reports shown in the figure is for submission to JICA.

Figure 1.3.1 Study Schedule

CHAPTER 2 STUDY ON PLANNING CONDITIONS

2.1 Target Stretch for River Channel Improvement

The target river channel for overall Pasig-Marikina river channel improvement is 29.7 km long, as follows:

(1) Pasig River (16.4 km long from Del Pan Bridge to the junction of Napindan River and Lower Marikina River)

(2) Lower Marikina River (7.2 km long from the junction of Pasig River and Napindan River to the proposed MCGS)

(3) Upper Marikina River (6.1 km from the proposed MCGS to Marikina Bridge)

Originally, out of the three stretches, the Phase II Project targets the Pasig River and the Phase III Project targets the Lower Marikina River.

2.1.1 Stretch for Phase II

Before the Phase II Project was started, about 5.8 km of revetment construction works at some sections of the banks of Pasig River were completed under the projects of DPWH-PRRP, PRRC and participating LGUs.

The Phase II Project targets for improvement only 13.2 km of the 28.9 km on both banks proposed in the Detailed Design, because of shortage of project funds attributed to the substantial price increase of construction materials, particularly, steel, the major material for the Project.

The remaining sections, excluding the above 5.8 km already completed and the 13.2 km targeted in Phase II, are called potential areas with the total length of about 9.9 km at 42 sections on both banks, as shown in Table 2.1.1, and out of these potential areas, priority areas consisting of Priority Groups 1 and 2 were selected for implementation in Phase III.

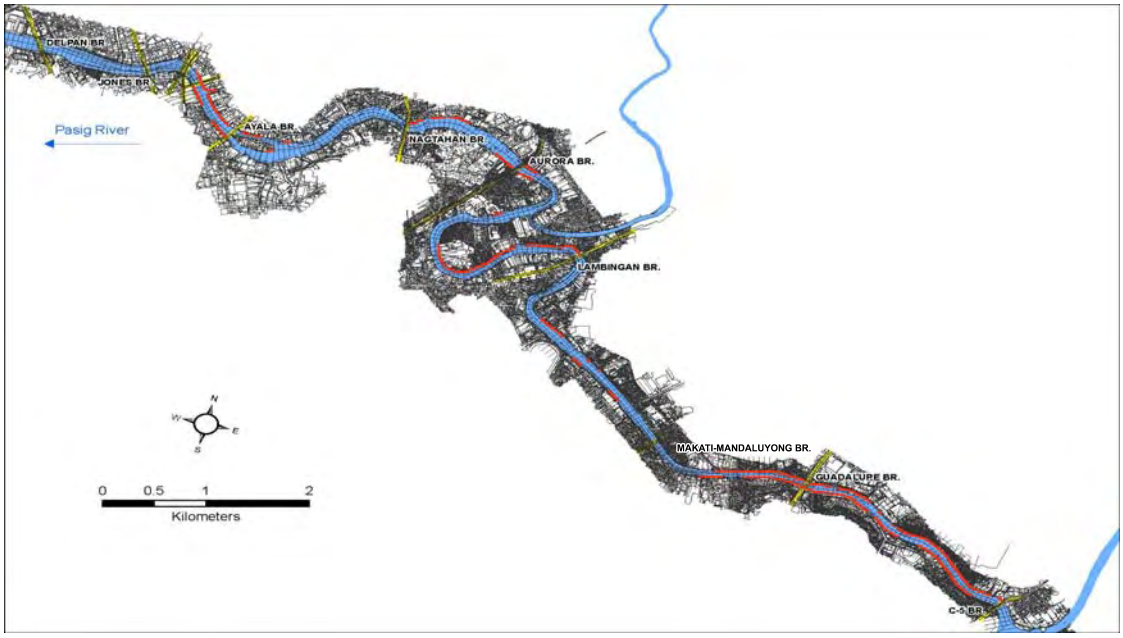


Figure 2.1.1 Potential Areas along the Pasig River

The above improvement lengths on both banks are as summarized below.

Table 2.1.1 River Channel Improvement Stretch for Phase III Priority Areas

D/D Improvement Stretch	Other Projects (DPWH-PRRP, PRRC, LGUs)	Phase II Construction Stretch	**Priority Areas for Phase III**	Remaining Areas to be Improved by Others	Stretch for Pasig River Channel Improvement
28.9 km	5.8 km (on both banks	13.2 km (on both banks)	**8.1 km (on both banks)**	1.8 km (on both banks)	16.4 km (32.8 km on both banks)

2.1.2 Stretch for Phase III

Based on the Detailed Design, the construction of MCGS is included in the Phase III Project. However, in this Preparatory Study, the deferment of construction of MCGS is proposed as discussed in Subsection 2.1.3 below. Therefore, the Lower Marikina River Channel Improvement under the Phase III Project targets the 5.4 km stretch from the junction with Pasig River to the upstream, except the construction area for the proposed MCGS.

2.1.3 Construction of MCGS

(1) Confirmation of the Necessity of MCGS

Under the existing condition of "without MCGS and with the Rosario Weir fully opened" the diversion of the design flood discharge of 2,900 m^3/s (30-year return period) of the Upper Marikina River to the Mangahan Floodway and Lower Marikina River was estimated based on the Hydraulic Model Test conducted in 1983, as shown in the following table:

Table 2.1.2 Design Discharge Distribution

River	Upper Marikina River	Mangahan Floodway	Lower Marikina River
Without MCGS	2,900 m^3/s	1,800 m^3/s	1,100 m^3/s
With MCGS	2,900 m^3/s	2,400 m^3/s	500 m^3/s

As shown in the table above, without the MCGS, the design flow capacity of the floodway cannot be fully utilized. In addition, the discharge diverted to the Lower Marikina and Pasig rivers will increase. Therefore, it is necessary to limit the diverted discharges from the Pasig and Lower Marikina rivers by controlling the discharge from the Upper Marikina River through the MCGS.

(2) Proposed Deferment of Construction of MCGS

From the hydraulics aspect, the construction of MCGS is necessary to ensure the safety of Metro Manila from flood damage due to the overflow of Pasig and Lower Marikina rivers.

On the other hand, due to the present existence of a number of informal settlers inside of the Mangahan Floodway, the design flow capacity of 2,400 m^3/s have been lowering to only about 2,000 m^3/s or even less. Also, there are three open portions at the left side bank of Mangahan Floodway to receive the flow from the Cainta, Buli, and Maho rivers, and some amount of floodway flood discharge may spill through the openings towards the inland areas along these rivers, resulting in the increase in flood inundation damage. Therefore, to assure the safety of diversion of the design discharge of 2,400 m^3/s to the Mangahan Floodway, the issues concerning the open portions and the informal settlers should be resolved before the construction of the MCGS.

In addition, the residents along the Upper Marikina River may not accept the construction of MCGS without improving the dike and expanding the width of channel in the Phase IV section of Upper Marikina River and thus, it is necessary to obtain their understanding and agreement on the construction of MCGS.

Taking the necessary arrangements to be made into consideration, which may require a long time to accomplish, the MCGS is proposed to be deferred to the Phase IV Project.

2.2 Consideration of Flood Control Measures

2.2.1 Structural Measures

(1) Pasig River Channel Improvement

For the channel improvement of priority areas selected from the potential areas in the Phase II stretch, structural measures such as revetment consisting of steel sheet pile foundation and reinforced concrete river wall is proposed for Phase III considering consistency with the ongoing Phase II Project.

(2) Lower Marikina River Channel Improvement

The improvement plan of Lower Marikina River was also prepared during the Detailed Design Stage (Phase I). Since there are no remarkable changes in the present site conditions after the detailed design, the said improvement plan is adopted for the Phase III Project, as follows:

- Dredging/excavation with 40 m riverbed width to increase the flow capacity and lower the design flood level.
- Construction of dikes and river walls to protect the existing public facilities such as promenades, school, etc.

In addition to the dredging/excavation works, dikes will protect from floods the existing promenades, school, etc. Since private structures are increasingly being constructed within the river area year by year, works such as boundary bank are proposed to distinguish the private lots from the river area and prevent illegal encroachment. Dredged materials sacked in geo-textile bags will be utilized for bank embankment because of the soft foundation. Selected soils are added to the sacked materials.

2.2.2 Nonstructural Measures

As mentioned above, the Pasig-Marikina River Channel Improvement Project (Phase III) is to be implemented to improve the channel flow capacity to the scale of a 30-year return period flood. However, the occurrence of larger floods of more than a 30-year return period is anticipated even after the improvement and completion of structural measures for the whole stretch of Pasig-Marikina River. Under such circumstances, the introduction of nonstructural measures would be effective and also faster to implement at a lower-cost to reduce socio-economic and human losses in comparison with the structural measures which would take a long time to complete.

(1) Nonstructural Measures during the Construction Stage of Phase III

The nonstructural measures to be implemented in the construction period of Phase III are to be selected in consideration of the following criteria: (a) Measures to facilitate the construction of Phase III and to deepen the understanding on the necessity and effectiveness of flood mitigation measures; (b) Fast-acting measures for flood risk reduction; and (c) Expansive measures for other cities and regions. In addition, the duplication of measures

applied to projects conducted by other donors is to be avoided, and measures in which the results could be utilized in future projects are to be selected.

Table 2.2.1 Selection of Nonstructural Measures

Criteria	Nonstructural Measures
(1) To facilitate the construction of Phase III and to enable deepening of understanding of necessity and effectiveness of flood mitigation measures	• Implementation of Information Campaign and Publication (around construction site) • Overseas Training
(2) Fast-acting measure for flood risk reduction	• Establishment of Website to disseminate information regarding activities of FMC and water level of Pasig-Marikina River
(3) Expansive measures for other cities and region	• Preparation of hazard maps with information of evacuation centers, evacuation route, means for evacuation and so on (Pasig City)

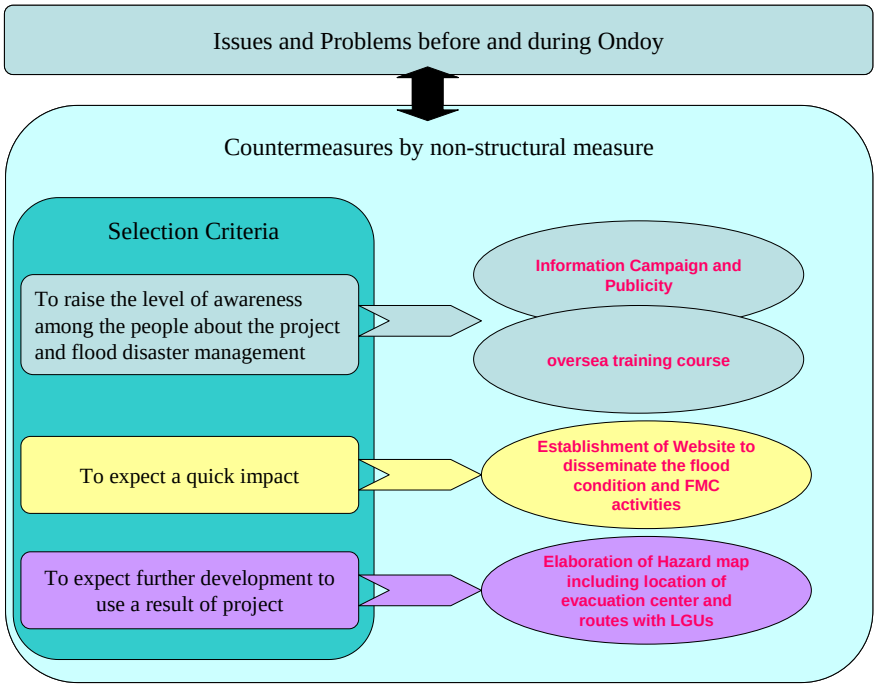


Figure 2.2.1 Selection of Nonstructural Measures

(2) Adaptation Measures against Climate Change Impact

(a) Variation of Flood Condition by Climate Change

Rainfall probabilities were calculated based on the AGCM simulation results and the observed rainfall data. As a result of comparison of those probabilities, it was estimated that the amount of rainfall of a 100-year return period would increase by 10 % in 2025. In addition, the future tide level also would increase by 12 cm on average in 2025, based on the 4th Assessment Report issued by IPCC. The figure and table below show the flood inundation area, amount of flood damage and inundation depth of a 100-year return period flood in cases of “with” and ”without” climate change, which were estimated by using the flood simulation model established in the Study on the condition after the completion of construction of Phase II and Phase III.

Table 2.2.2 Climate Change Impact on Flood Condition

Item	Hydrological Condition		Flood Damage (peso)	Flood Area (km)	Inundation Depth (m)
	2-day Rainfall (mm)	Tidal Level Rising (cm)			
Present Condition (2011)	586.6	-	147 bil.	2,774 km	-
Consideration of Climate Change Impact (2025)	645.3	+12 cm	204 bil.	4,203 km	10～70 cm
Increment Ratio	10%	-	39%	52%	-

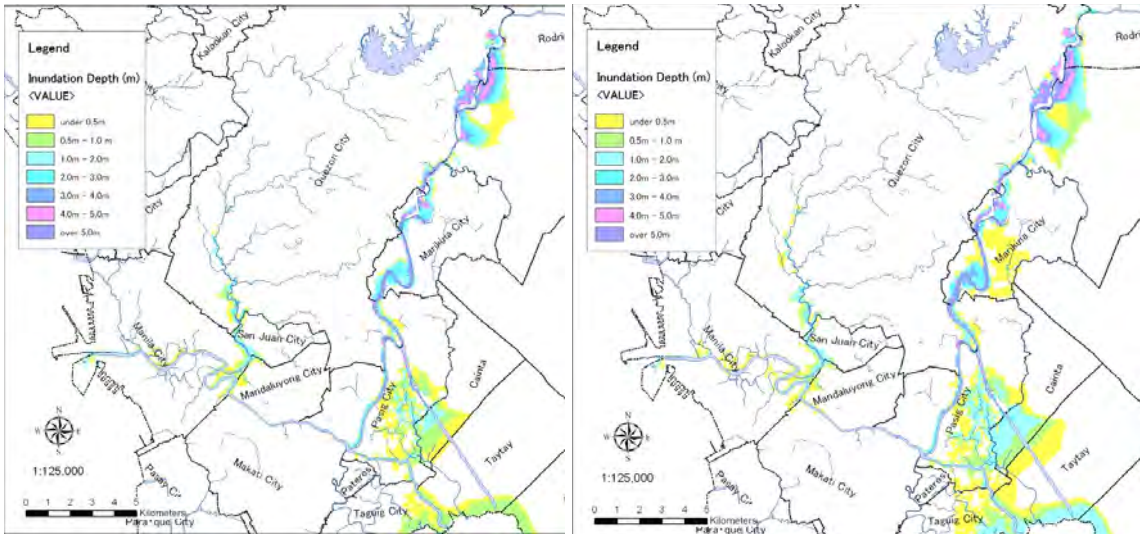


Figure 2.2.2 Inundation Map "Without" and "With" Climate Change by 100-year Return Period Flood (Left: Without Climate Change; Right: With Climate Change)

(b) Characteristics of Flood Hazard

In consideration of well-practiced activities as to flood damage mitigation by LGUs, the variation of flood depth and inundation area at upper, middle and lower stretch of Pasig-Marikina River are as summarized by city in the next table to grasp the impact on flood condition in more detail.

Table 2.2.3 Climate Change Impact on Flood Condition

No.	City	Inundation Area (ha)				Average Water Depth (m)			Salient Characteristics		Stretch
		(1) w/ CC	(2) w/o CC	Increment	Rate of Increment (%)	(1) w/ CC	(2) w/o CC	Rate of Increment (%)	Increment of Flood Area	Increment of Water Depth	
1	Makati	7	4	3	**175**	0.23	0.15	0.08	-	-	Lower
2	Mandaluyong	73	54	19	**135**	0.52	0.52	0.00	-	-	
3	Manila	655	416	**239**	**157**	0.50	0.50	0.00	O	-	
4	San Juan	94	92	2	102	1.34	1.28	0.06	-	-	
5	Angono	162	134	28	121	1.46	1.07	**0.39**	O	O	Middle
6	Cainta	972	438	**534**	**222**	0.92	0.92	0.00	O	O	
7	Pasig	1499	1100	**399**	**136**	0.88	0.88	0.00	O	O	
8	Taguig	474	427	47	111	1.09	0.62	**0.47**	O	O	
9	Taytay	1221	764	**457**	**160**	0.81	0.57	**0.24**	O	O	
10	Rodriguez	141	118	23	119	2.88	2.72	**0.16**	-	O	Upper
11	San Mateo	742	659	83	113	2.15	1.89	**0.26**	O	O	
12	Marikina	925	758	**167**	122	1.93	1.92	0.01	-	O	
13	Quezon	614	539	75	114	2.93	2.79	**0.14**	-	O	

(c) Selection of Adaptation Measures

There can be seen the variations of flood condition before and after the impact, which are (i) Increment of flood water depth; (ii) Increment of flood area; and (iii) Increment of both (i) and (iii). The adaptation measures should be proposed in consideration of such regional variations of flood condition or damage, and the proposed measures must be flexible to expansion and upgrade in step with the climate change impact. In this connection, the nonstructural measures are as classified in next table by function to be adapted to the flood characteristics such as increment of flood water depth and flood inundation area.

Table 2.2.4 Nonstructural Measures Corresponding to Flood Characteristics

Adaptation Measures			Component A (adaptation to increment of depth)	Component B (adaptation to increment of flood area)
Flood Evacuation and Warning System	Preparedness	Revision of flood hazard map and Expansion of information dissemination range	✓	✓
		Installment of additional evacuation center and rearrangement of evacuation route	✓	✓
		Examination of quality and quantity of critical materials	✓	✓
		Setting up of standard/timing of flood warning	-	-
	Communication /information dissemination	Strengthening and promoting of communication system		✓
		Installment of flood information board		✓
	Monitoring and Warning	Installment of additional warning post		✓
		Strengthening of CCTV network		✓
		Installment of simple water gauge	-	-
Land Use Regulation		Land use regulation considering hazard maps by LGUs	✓	✓
		Heightening of road and residents area	✓	✓
		Improvement of legal system regarding preservation of retention function of basins. (for example, flood water detention pond).	✓	✓

(d) Adaptation Measure for Cities

Activities in the local area for prevention of flood damage are managed and operated by LGUs, especially, cities. Thus, the applicable component type constructed in the previous item (c) is selected and summarized in the next table in consideration of the characteristics of flood condition of those cities.

Table 2.2.5 Component of Adaptation Measures

No.	City	Variation of Flood Condition			Component of Adaptation Measures
		Increment of Flood Area	Increment of Inundation Depth	Both	
1	Makati	✓			C
2	Mandaluyong	✓			C
3	Manila	✓			B
4	San Juan				C
5	Angono		✓		B
6	Cainta	✓			B
7	Pasig	✓			B
8	Taguig		✓		B
9	Taytay	✓	✓	✓	A,B
10	Rodriguez		✓		A
11	San Mateo		✓		B
12	Marikina	✓			A
13	Quezon		✓		A

A: Adaptation of Component A; B: Adaptation of Component B; C: No measure is necessary, since impact by climate change is very small

2.3 Review of Existing EIA (EIS) Report

2.3.1 Environmental Compliance Certificate (ECC) issued for the Project

The validity of the Environmental Compliance Certificate (ECC) was confirmed as follows:

The ECC remains valid if the ECC was issued to a certain project at once and the contents of the project with the ECC and the EIS were not changed. However, the ECC automatically expires if the project has not been implemented within five (5) years from the ECC issuance, or if the ECC was not requested for extension within three (3) months from the expiration of its validity in which case, it is necessary to obtain a new ECC.

The Environmental Compliance Certificate, No. ECC-98-NCR-301-9807-128-120, which was granted on the basis of EIS (1998), is valid for the entire project period. Also, the validation was reconfirmed before the implementation of the Phase II Project. A letter from the DENR-EMB, which granted the validation of the existing ECC, was received on March 7, 2008.

2.3.2 Comparison of the EIS and the JICA Guidelines for Environmental and Social Considerations (April 2010)

The EIS of 1998 was reviewed as follows based on the JICA Guidelines for Environmental and Social Considerations of April 2010 (hereafter "The JICA Guidelines") and World Bank Operation Policy (OP) 4.01, Annex B. Based on the review, it was found that, in the EIS of 1998,certain items are missing, or not complete based on the JICA Guidelines, such as (1) Legal framework of environmental and social considerations; (2) Information/data for understanding the environmental and social conditions; (3) Concrete quantitative data; and (4) In the scoping stage, involuntary resettlement issues were not fully discussed.

Based on the issues mentioned above, the lacking information have been collected, and then an environmental and social impact evaluation was performed as described in the Section 5.1. On the other hand, the resettlement issues, which may or may not occur in small-scale, are as described in the following Section 2.4.

2.4 Resettlement Plan

2.4.1 Scope of Resettlement Impact

(1) Population Census

In total, there are 58 households and population of 204 of Informal Settler Families (ISFs) are expected to be affected by the implementation of the project and required to be resettled.[1]

Besides those residents, there are 16 Absentee House Owners (AHO). Detailed information of said AHO will be gathered during the community participation process which will be conducted prior to the commencement of resettlement activities.

The Cut-Off date of the RAP for this Project is November 2010. However, in case there is no resettlement activities conducted after two years from the said cut-off date, the census data shall be updated which is in November 2012 in accordance with the World Bank Operational Policy (OP) 4.12.

[1] It is recognized that Pasig City has an on-going relocation program for the informal settlers living on the danger areas based on RA 7279, and this program covers the informal settlers living on the easement area along the Lower Marikina River. Such informal settlers are not covered by this RAP as they will not be affected by the construction works of the Project.

The project scopes and its impacts will be reviewed during the Detailed Construction Design which is scheduled in 2012, thus, validation of census/tagging survey will be conducted.

Table 2.4.1 Number of PAFs and PAPs for Resettlement in the Project

Type of loss	Number of Affected Households			Number of Affected Population		
	Legal	Illegal	Total	Legal	Illegal	Total
Required for displacement	-	**58**	**58**	-	**204**	**204**
1. Structure owner on public land	-	49	49	-	163	163
2. Structure owner on private land	-	-	-	-	-	-
3. Renters	-	7	7	-	29	29
4. Rent-free Occupants (Sharers)	-	2	2	-	12	12
5. Commercial and business enterprises owners on public land	-	-	-	-	-	-
6. Commercial and business enterprises owners on private land	-	-	-	-	-	-
7. Community owned structures including physical cultural resources	-		-	-	-	-
Not required for displacement	**2**	**90**	**92**	**-**	**-**	**-**
8. Land owners (temporary use of lands)	2	-	2	-	-	-
9. Structure owners not residing in the project affected area (To be validated)	-	16	16	-	-	-
10. Owners of improvements, crops and trees that will be affected	-	74	74	-	-	-
11. Wage earners	-	-	-	-	-	-
Grand Total (1 – 11)	**2**	**148**	**150**	**-**	**204**	**204**

(2) Land and Asset Survey

There is no permanent acquisition of private lands necessary for the implementation of the Project.

Only temporary use of two (2) private lands for temporary storage of material, etc. will be needed during construction of the project.

All affected structures, improvements, crops and trees are required to be removed.

Table 2.4.2 Number of Structures to be Affected 100 %

LGU	Barangay	Salvaged	Light	Mixed	Strong	Total
Manila	Barangay 900	0	2	12	12	26
	Barangay 896	0	0	13	5	18
	Barangay 897	1	1	6	1	9
	Barangay 894	0	0	2	0	2
Makati	West Rembo	0	1	2	2	5
	Total	1	4	35	20	60

Table 2.4.3 Number of Improvements to be Affected 100 %

LGU	Barangay	Fence	Pig Pen	Dog House	Pigeon House	Chicken Pen	Deep well	Kitchen	Shelter
Manila	Barangay 900	0	2	6	0	0	0	0	0
	Barangay 896	0	1	8	0	0	0	0	0
	Barangay 897	0	0	5	0	0	0	0	0
	Barangay 894	0	0	0	0	0	0	0	0
Makati	West Rembo	0	0	1	0	0	0	0	0
Pasig	Bagong Ilog	1	0	8	0	0	0	0	0
	Ugong	0	0	5	0	5	3	0	3
	Caniogan	0	0	2	0	0	0	0	0
	Maybunga / Rosario (Under confirmation)	1	0	20	1	27	1	5	12
Total		2	3	46	1	32	4	5	15
Grand Total		108							

Animals are not covered for compensation, because PAFs can bring them to relocation site if the PAFs wish.

Table 2.4.4 Number of Gardens and Trees to be Affected

LGU	Barangay	Garden / Field	Trees (Fruit, timber)
Manila	Barangay 900	0	0
	Barangay 896	8	0
	Barangay 897	0	0
	Barangay 894	0	0
Makati	West Rembo	1	0
Pasig	Bagong Ilog	2	20
	Ugong	19	284
	Caniogan	0	0
	Maybunga / Rosario (Under confirmation)	29	580
Total		59	884

2.4.2 Legal Framework

(1) DPWH Policy and Guidelines on Resettlement

The policy and guidelines of DPWH on resettlement are expressed in the Infrastructure Right-of-Way Procedural Manual (April, 2003) and the Land Acquisition, Resettlement, Rehabilitation and Indigenous Policy (LARRIPP), 3rd edition (April, 2007).

(2) JICA's Policy on Involuntary Resettlement

The key principle of JICA's policy on involuntary resettlement is as summarized below.

- Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.
- When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.
- People who must be resettled involuntarily and people whose means of livelihood will be hindered or lost must be sufficiently compensated and supported, so that they can improve or at least restore their standard of living, income opportunities and production levels to pre-project levels.
- Compensation must be based on the full replacement cost as much as possible.
- Compensation and other kinds of assistance must be provided prior to displacement.
- For projects that entail large-scale involuntary resettlement, resettlement action plans must be prepared and made available to the public. It is desirable that the resettlement action plan include elements laid out in the World Bank Safeguard Policy, OP 4.12, Annex A.
- In preparing a resettlement action plan, consultations must be held with the affected people and their communities based on sufficient information made available to them in advance. When consultations are held, explanations must be given in a form, manner, and language that are understandable to the affected people.
- Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.
- Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

(3) Gaps Between Philippine Legal Framework and JICA Guidelines

The existing LARRIPP (2007) of DPWH was prepared based on the World Bank Resettlement Policy.

Therefore, it is found that there is no significant difference between the DPWH and JICA's Legal and Program Frameworks.

However, there are several gaps in the qualification of eligibility of persons, as well as composition of losses covered by compensation.

Hence, appropriate approaches were designed/formulated to complement the gaps between the Philippine legal framework resettlement and JICA's Policy on Involuntary Resettlement that conforms to the Government and JICA policies and/or practices, to come up with a Project Policy for this RAP.

Table 2.4.5 Entitlement Matrix

Type of Loss	Application	Entitled Person	Compensation / Entitlements	Organization Responsible
STRUCTURES (Classified as Residential/ Commercial/ Industrial)	More than 20% of the total structure loss or where less than 20% loss but the remaining structures no longer function as intended or no longer viable for continued use.	Owners of structures, including shanty dwellers, who have no land title, but are able to present voter's ID or certificate from Barangay. **44 structures owned by resident households (44 owner households, 5 co-owner households)**	• Cash compensation for entire structure at full replacement cost, and • Transportation assistance	DPWH
		Absentee House Owners **16 structures owned by absent owners**	• Cash compensation for entire structure at full replacement cost	DPWH
		Renter and Rent-free Occupants (sharer) of the structure **9 households (7 renter, 2 rent-free occupants)**	• Transportation assistance , and • (For renters) Rental subsidy equivalent for 3-month, maximum P 15,000, if relocating in Metro Manila.	DPWH
	Less than 20% of the total structure loss or where more than 20% loss but the remaining structures still function as intended or viable for continued use.	Owners of Structures, including shanty dwellers, who have no land title, but are able to present voter's ID or certificate from Barangay. Absentee House Owners	• Cash compensation for the affected portion of the structure as replacement cost.	DPWH
IMPROVEMENTS Pig pens, dog houses, pigeon houses, fences.	Severely or marginally affected	PAF with or without tax declaration, etc. Owner of the improvement **108 Improvements**	• Cash compensation for the affected improvements at full replacement cost	DPWH
CROPS, TREES, PERENNIALS		Socially recognized owner **59 Gardens** **884 Trees**	• Cash compensation for crops (which are not yet suitable for harvesting), trees, and perennials at current market value as prescribed by the concerned LGUs and DENR, confirmed by DPWH as the same level with market value.	DPWH
POOR AND VULNERABLE HOUSEHOLDS	Landless, informal occupants of public land, except Professional Squatters and Squatting Syndicates as defined in RA 7279.	58 households **(structure owner (to be resettled) : 49** **renter : 7** **rent-free occupants (sharer) : 2)**	• Inconvenience allowance P 10,000. • For transportation assistance, microbuses will be used for free transportation of families that include children, women and senior people, instead of trucks. • For the families with persons who need special physical or medical care, DPWH will request respective LGUs to provide nurses or social workers to help them before and during the resettlement activities.	DPWH LGU
LIVELIHOOD REHABILITATION ASSISTANCE / TRAINING	PAF to be resettled.	**58 households** **(structure owner (to be resettled) : 49** **renter : 7** **rent-free occupants (sharer) : 2)**	• DPWH will monitor the change of living standard of the PAF before and after the resettlement. • When the PAF are found that their living standard worsen, or whose present means of livelihood became not-viable, DPWH, in coordination with other appropriate institutions, will provide assistances, such as skills and livelihood trainings.	DPWH
TEMPORAL LOSS OF CONTROL OF LAND USE	Owners of unused land parcels located along the bank of Pasig River and Lower Marikina River.	Locations and necessary size of land parcels will be validated before the commencement of construction works in 2013.	• Land owners will be paid for the rent / lease of the land parcels based on the market value, for the length of the DPWH occupation.	DPWH

Type of Loss	Application	Entitled Person	Compensation / Entitlements	Organization Responsible
	(Required land : two (2) parcels, about 15,000 m2 in total)		• DPWH will return the land parcels to the owner at the end of the rent / lease contract. DPWH is responsible to recover the condition of the parcel the same as 'before-project' condition.	
OTHER LOSS OR IMPACT NOT PREDICTED WHEN THE RAP IS PREPARED	Those who are severely or marginally affected.	Households or persons affected by any unforeseen impact identified during implementation of the Resettlement Plan	DPWH, in coordination with other appropriate institutions, will be responsible to recognize the impact, to assess the severity, and to negotiate with the PAF/PAP so that the loss or impact are adequately compensated and the PAF/PAP is adequately assisted.	DPWH

Note : Professional Squatters and Squatting Syndicates, who have previously been awarded home lots or housing units by the government but who sold, leased or transferred to settle illegally in the same place or in another urban area, and non bona fide occupants and intruders of lands reserved for socialized housing, will not be eligible for compensation and assistance.
Table format source: Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy, 3rd edition (2007), DPWH, p. 14-16, and JICA

2.5 Mechanism of Land Development

Along the Pasig-Marikina River, land development projects by both private and public sectors, some of which may cause unfavorable impacts in terms of flooding condition, have been rapidly promoted.

2.5.1 Typical Examples of Unfavorable Land Development

In principle, the typical cases of land development detected in the Pasig-Marikina River Basin are as follows:

- Case 1: Encroachment to river channel
- Case 2: Land development in flood prone area without any protection works against flood damage
- Case 3: Land development in the upper river basin, which causes increase of flood discharge as well as sedimentation

Among these cases, Case 1 and Case 2 are urgent and significant issues to be dealt with, while Case 3 may not be remarkable or serious issues at present, but expected to be significant in the near future.

2.5.2 Consideration on Improvement of Current Mechanism

(1) Issues on Current Mechanism

The following points are the issues concerning the current mechanism:

- In principle, the mechanism for the control of illegal land development has been set up in each LGU and no serious defect can be identified in such mechanism itself.
- Also, the law to control illegal land development activities has been enforced.
- As one of the essential issues, the shortage of human and financial resources to control illegal land development activities is pointed out.
- On the other hand, there is no specific law designating the river area and with the agency responsible for managing and controlling illegal activities in the river area.

(2) Short Term Improvement

To exchange information among LGUs as well as the agencies concerned, a coordinating committee has to be considered, such as the Flood Mitigation Committee (FMC), or the strengthening of capacity of existing organizations to perform such coordinating function in the Pasig-Marikina River Basin.

Besides, education campaign, which is proposed by the Study to be applied as one of nonstructural measures, will also contribute to the monitoring and control of illegal activities in the river channel.

Through the FMC or the strengthening of capacity of existing organizations mentioned above, the following improvements are expected and, as a result, the target of strict control of encroachment and disorderly land development can be achieved:

- Enough exchange of information on causes and influences of land development to flood damage among LGUs and agencies concerned.
- Enough recognition among LGUs and agencies concerned on the necessity to control disorderly land development.
- Assurance of human and financial resources sharing the necessary human resources and expenses among LGUs and other agencies concerned.

The basic scenario mentioned above is as illustrated in the following figure.

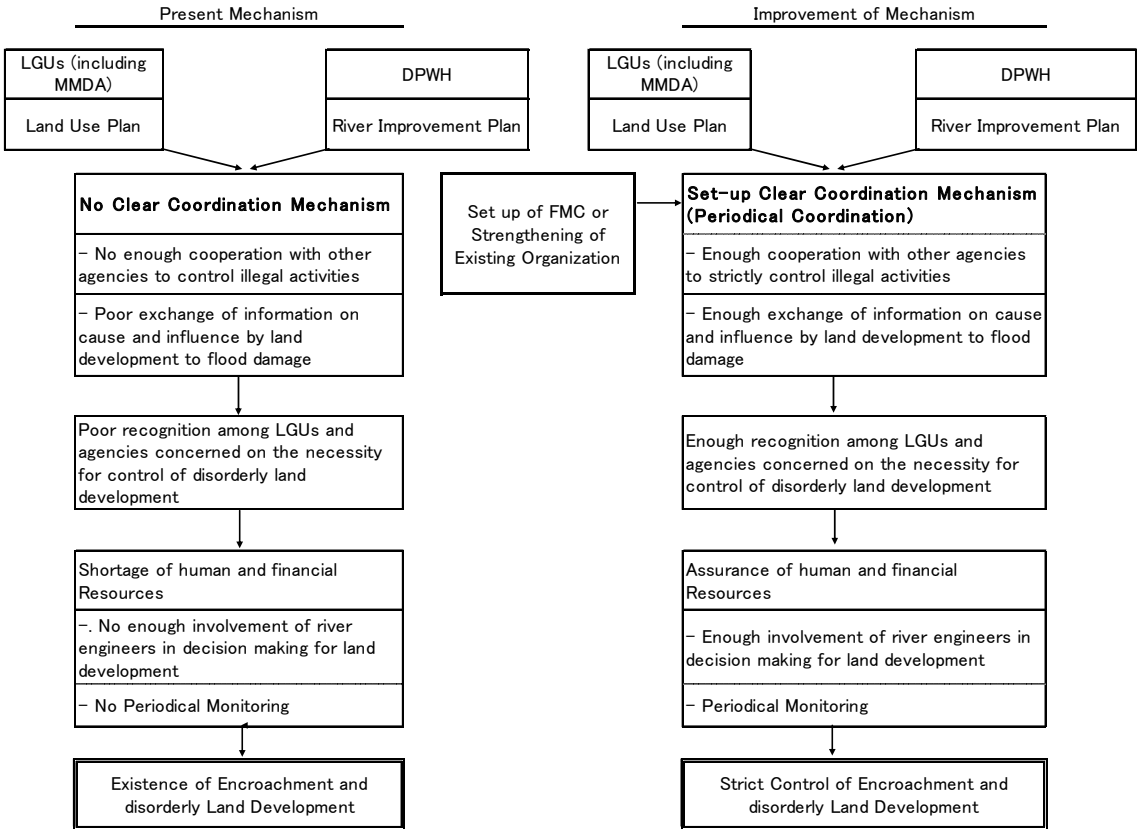


Figure 2.5.1 Basic Scenario for Improvement of Current Mechanism

(3) Middle-Long Term Improvement

In this Study, it is proposed that the FMC should be set up to cope with the issues on land development that could cause adverse influence to the flooding condition, since these issues need to be urgently settled down in parallel with the promotion of the Plan (PMRCIP). On the other hand, for measures to thoroughly solve these issues, it is necessary to promulgate a law like "the Japanese River Law", which will designate the range of river area, together with the responsible agency from the middle and long-term views, because only the Water Code is currently available in the Philippines and the designation of river area in the Water Code as well as the responsible agency to manage the river channel is not clearly stipulated. Under such law, strict management of river channel can be achieved.

2.6 Establishment of Flood Mitigation Committee (FMC)

By comparing the merits between the case of strengthening of existing coordination organization and the case of establishment of FMC, it has been concluded that establishment of the FMC is preferable to cope with the issues on the current mechanism of land development. The establishment of the FMC is as outlined below.

(1) Strategy

In principle, the FMC to be established shall make every effort to promptly implement an appropriate O&M of a flood control project which shall consist of structural and nonstructural measures, as well as minimize unfavorable activities which could bring about adverse influence to the control of flood discharge and/or hamper the smooth flow in the river channel.

(2) Basic Functions of FMC

The FMC shall, in principle, have the following two functions:

- To coordination agencies concerned on issues related to flood control.
- To provide instructions to the responsible agency/agencies on the necessary actions to cope with the above issues.

(3) Role and Responsibilities of FMC

The role and responsibilities of the FMC shall be as follows:

- To enhance/strengthen the publicity and awareness on the Project;
- To coordinate among LGUs to facilitate the activities on resettlement and acquisition of the ROW;
- To facilitate and assist in the introduction and operation of nonstructural measures by MMDA and LGUs;
- To facilitate and assist in the monitoring of O&M activities and all illegal activities in the Phase III stretch and the potential areas in Phase II;
- To set up a "query window" for the Project;
- To control illegal land use and disorderly land development in the whole Pasig-Marikina River Basin; and
- Others

(4) Members of the FMC

The list of standing and observer members of the FMC is given in the following table.

Table 2.6.1 Members of FMC

Stage	Assignment	Name of Office
Planning, D/D, Implementation Stage	Chairperson	Dept of Public Works and Highways (DPWH)
	Co-Chairperson	Metro Manila Development Authority (MMDA)
	Standing Member	PRRC and LGUs (Manila, Makati, Mandaluyong, Pasig and Quezon Cities)
	Observer Member	DNER, LLDA, OCD, NEDA, HUDCC, PAGASA, and LGUs (Antipolo, Cainta, San Juan, Marikina, Rodriguez, Pateros, San Mateo, Taguig, Tanay and Tyatay Cities)
Operation and Maintenance (O & M) Stage	Chairperson	Metro Manila Development Authority (MMDA)
	Co-Chairperson	Dept of Public Works and Highways (DPWH)
	Standing Member	PRRC and LGUs (Manila, Makati, Mandaluyong, Pasig and Quezon Cities)

Stage	Assignment	Name of Office
	Observer Member	DNER, LLDA, OCD, NEDA, HUDCC, PAGASA, and LGUs (Antipolo, Cainta, San Juan, Marikina, Rodriguez, Pateros, San Mateo, Taguig, Tanay and Tyatay Cities)

2.6.2 Timing of Set-up of FMC

The establishment of FMC seems to be necessary before the financial arrangement for Phase III Project is finished to ensure that a responsible agency will attend to the issues relating to land development as well as implementation of the project and O&M. In this connection, it is recommended that the FMC establishment is finished by the time the loan is released and made available for disbursement on the Project (by February 2012, according to the currently expected schedule; refer to Figure 5.4.1).

2.7 Arrangement of Memorandum of Agreement (MOA)

2.7.1 General Background of Necessity of MOA

It is generally understood that one of the significant issues on flood control projects is the insufficient operation and maintenance (O&M) activities for measures provided, especially flood control structures. To improve the situation, a Memorandum of Agreement (MOA) for project implementation between the Central Government (DPWH) and LGUs was initiated after enforcement of the Local Government Code of 1991, since the responsibility for O&M of flood control structures is to be turned over to the LGUs after completion of project implementation by DPWH.

2.7.2 Items included in MOA for Phase III Project

(1) Points for consideration

To identify the necessary items to be involved in Phase III Project, the following points are conceived with regards to reference materials:

- In principle, a MOA is prepared for the project to be implemented. In this connection, the MOA should at least cover items related to the project area of Phase III and the potential areas in the Phase II stretch. However, it is essential to consider basin-wide land development activities as well as other development activities, which would affect the flood condition in Pasig-Marikina River Basin and hence some items related to the basin-wide area should be involved.
- According to the MOA prepared for Phase II Project, the role of LGUs represented by MMDA is limited to O&M works and the establishment of a joint working group with DPWH, compared to the MOA for the Tagoloan project which stipulates the role of LGUs in more detail.
- It seems to be also necessary to clarify the role of LGUs in detail and, therefore, it is preferable that the MOA for LGUs is referred to that of Tagoloan.
- Furthermore, it is also necessary to clarify the role of LGUs and MMDA.
- As for the role of DPWH, the contents are referred to both MOAs.
- Since it is essential to establish a flood mitigation committee (FMC) as discussed earlier, the role and responsibility of FMC should be clarified or specified in the MOA.
- In the case of Pasig-Marikina River Basin, permission and/or approval for project implementation such as improvement of navigation facilities as well as coordination on resettlement of informal setters will be required from PRRC,

so that the roles and responsibilities of PRRC should be also specified in the MOA.

- In principle, it is preferable to prepare one MOA covering all necessary items related to all agencies concerned and to receive approval or agreement. However, it may take a long time to receive agreement on only one MOA from all agencies concerned, especially the LGUs which may have different conditions involved in the Project. In this connection, it is proposed to arrange one MOA only for DPWH, MMDA and PRRC, while the approval and agreement between DPWH and the LGUs are obtained in a manner of "Individual Certificate of Support between DPWH and each LGU."

(2) Items to be Included in the MOA and the Certificate of Support and Agreement

Considering the points mentioned above, the items to be included in the MOA and the Certificate of Support should in principle cover the items shown in the following tables.

Table 2.7.1 Items to be included in the MOA

Agencies	Items to be involved	
DPWH	1	Take all the necessary measures to ensure proper and efficient implementation of the Project including provision of funds and preparation of RAP.
	2	Overall management and coordination of the Project during its implementation, especially close coordination with MMDA, PRRC, LLDA and LGUs concerned.
	3	Secure the budget for the Project.
	4	Comply with all the conditions stipulated in the ECC.
	5	Conduct information dissemination.
	6	Provide quarterly updates on the status of the Project.
	7	Conduct trainings of O&M for MMDA, if necessary.
	8	Turn over to MMDA the completed project for the O&M.
	9	Provide technical assistance to MMDA in the rehabilitation, if necessary.
	10	Create FMC in cooperation with MMDA and LGUs concerned with the following responsibilities.
	(a)	Enhance / strengthen the publicity and awareness of the Project.
	(b)	Coordinate, facilitate and assist the activities on the resettlement and acquisition of the ROW.
	(c)	Execute and sustain non-structural measures.
	(d)	Monitor the O&M activities and any illegal activities.
	(e)	Set-up a "query window" for the Project.
	(f)	Act as grievance and redress committee for ROW acquisition and other matters.
	(g)	Control of illegal land use and disorderly land development
MMDA	1	Undertake the Operation and Maintenance (O&M) of the Project in coordination with LGUs.
	2	Issue Certificate of Availability of Fund for Items 1.
	3	Provide the local technical and administrative personnel.
	4	Introduce and operate non-structural measures covered by MMDA.
	5	Create a Flood Mitigation Committee (FMC) in cooperation with DPWH and LGUs concerned.
PRRC	1	Procure and develop the resettlement area (s) as well as provide livelihood assistance for the informal settlers.
	2	Give the approval and/or permission necessary for the Project implementation such as design related to navigation facilities and environmental facilities.
	3	Cooperate with DPWH, the city governments and the other agencies concerned in the creation of the Flood Mitigation Committee (FMC), and act as Standing Member of FMC.

Table 2.7.2 Items to be included in the Certificate of Support

Items to be involved		LGUs				
		Manila	Makati	Mandal-uyong	Pasig	Quezon
1	Arrange and develop the resettlement area	○	○			
2	Construct secondary drainage system	○	○	○	○	○
3	Implement the Resettlement Action Plan (RAP)	○	○		*	
4	Issue Certificate of Availability of Fund among necessary items 1-3	○	○	○	○	○
5	Maintain / preserve the current situation of the ROW and other areas.	○	○	○	○	○
6	Introduce and operate non-structural measures in their own territory.	○	○	○	○	○
7	Monitor and control of illegal land use and disorderly land development.	○	○	○	○	○
8	Create a Flood Mitigation Committee (FMC) in cooperation with DPWH, MMDA, PRRC and LLDA	○	○	○	○	○

○: Items involved each LGU
*: Resettlement of currently existing I/Ss in Pasig City will be undertaken by the other resettlement program provided by Pasig City

2.7.3 Timing of Execution of MOA

The execution of the MOA and the Certificate of Support should be completed before the financial arrangements for Phase III Project is finished to assure the roles and responsibilities of all agencies concerned in coping with the issues related to land development as well as implementation of the project and O&M before the start of construction works for Phase III. In this connection, the signing of MOA should have been finished at the time of appraisal of the project (by November 2011, refer to Figure 5.4.1).

CHAPTER 3 PROJECT FORMULATION

3.1 Objectives of the Project

3.1.1 Objectives of the Overall Project

The objectives of the overall Project are to mitigate flood damage caused by channel overflow of the Pasig-Marikina River, to facilitate the urban development of Metro Manila and to enhance the favorable environment along the river.

(1) To mitigate the frequent inundation or massive flooding caused by the overflow of Pasig-Marikina River resulting in severe damages to human life, livestock, property and infrastructure with the aim of alleviating the living and sanitary conditions in Metro Manila including parts of Rizal Province.

(2) To create a more dynamic economy by providing a flood-free urban center as an important strategy for furthering national development.

(3) To rehabilitate and enhance the favorable environment and aesthetic view along the riverside areas by providing more ecologically stable conditions which will arrest the progressive deterioration of environmental conditions, health and sanitation in Metro Manila.

3.1.2 Objective of the Phase III Project

In the context of the objectives of the overall project, the objective of the Phase III Project is to implement the river channel improvement for the stretch of Lower Marikina River and the remaining portions of Pasig River, which are not covered by the ongoing Phase II Project.

3.2 Planning Conditions

The Phase III Project targets the Lower Marikina River and the priority areas selected from the potential areas in the Phase II stretch in Pasig River. To formulate the Phase III Project, the Detailed Design completed in 2002 and the Review conducted in 2008 shall be reexamined in this Study, considering the present site conditions.

For the urgent flood control of the Pasig-Marikina River, it is proposed that the river channel is to be improved aiming at increase in flow capacity for design discharges with the scale of a 30-year return period as shown below.

Under the condition that the construction of MCGS is not included in this Phase III Project but constructed in the future, the design discharges are 550 m^3/s for Lower Marikina River, 600 m^3/s for Upper Pasig River and 1,200 m^3/s for Lower Pasig River.

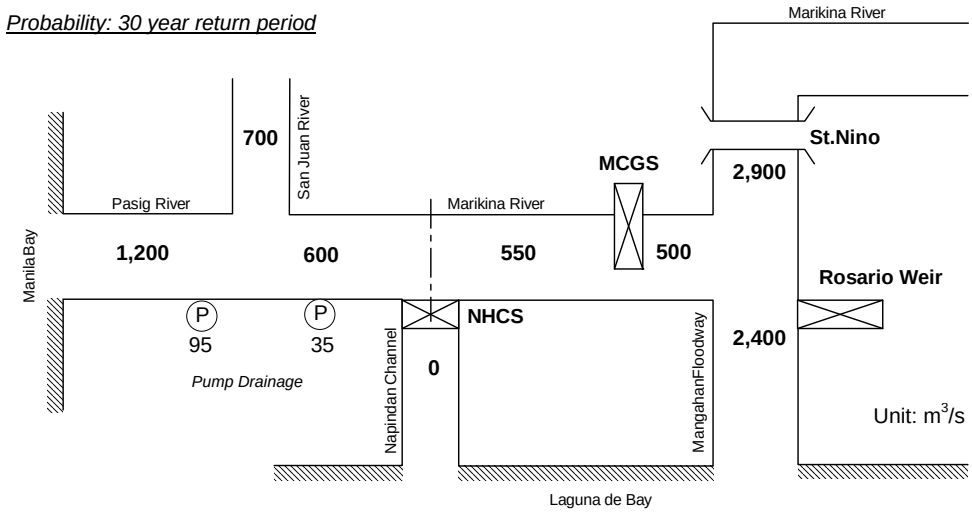


Figure 3.2.1 Design Discharge Distribution (30-Year Return Period)

3.3 River Improvement Plan of Pasig River and Lower Marikina River

The river improvement plan prepared in the Detailed Design Phase (Phase I) was based on the Design Guidelines, Criteria and Standards for Public Works and Highways (DPWH, Philippines) and the Technical Standard for Rivers and Sabo Facilities (Ministry of Land, Infrastructure, Transport and Tourism, Japan). As a result of the review in this Study, the said plan is applied for the Phase III Project without any change. The basic plan of the Pasig-Lower Marikina River Channel Improvement is as summarized below.

(1) Design High Water Level (DHWL)

In the detailed design stage, the Design High Water Level has been set up mainly considering the following points:

- To minimize the influence to existing river related structures (bridges, drainage facilities, port facilities and navigation facilities).
- To minimize damage in case collapse of dike minimizing the difference between the ground height and design high water level.
- To keep the design high water level within recorded maximum flood water level.
- To apply the average high spring tide at the design water level of river mouth, which is also the design height of port and coastal facilities.

(2) Design Channel Alignment

Metro Manila where the area is fully utilized with houses, factories, commercial building and many infrastructures has been developed along the Pasig-Marikina river course from ancient time, so that the widening of river channel is almost impossible without drastic set-back of existing buildings or facilities. . In this connection, the channel alignment follows the existing awkward river alignment, though it is desirable to modify the design alignment to smooth it from the flooding point of view.

(3) Design Longitudinal Profiles of Riverbed and DHWL

Pasig River, which flows out into Manila Bay, remarkably receives tidal influence so that the flow capacity is not expected to increase so much by dredging. Besides, maintenance of the dredged riverbed requires maintenance dredging from time to time. From this

consideration, the design longitudinal profile of riverbed for the Pasig River is based on the existing riverbed.

On the other hand, dredging of the riverbed to about 2 m in Marikina River is required for the purpose of navigation. Considering this requirement and also the difficulty of heightening the design high water level, dredging is applied to increase the flow capacity of Marikina River for the purpose of flood control.

(4) Design Cross-section

As mentioned above, the design alignment of the Pasig-Marikina River is based on the existing one to minimize land acquisition and house evacuation. Under this condition, in order to maximize the flow capacity, a rectangle cross section is applied to the Pasig River, while the existing cross section is applied to Lower Marikina River. Except the sharp curve portion at the area of Sta. Ana, the lower channel of Pasig River downstream from the junction with San Juan River is generally designed with the minimum width of 100 m, while the upstream of the junction with San Juan River is designed with the minimum width of 60 m. The design minimum width of Lower Marikina River is 90 m.

(5) Design Freeboard

The design freeboard adopts the design for flood control structures corresponding to the design discharge shown below in accordance with the "Design Guidelines, Criteria and Standard for DPWH."

Table 3.3.1 Design Freeboard

Design Discharge (m^3/s)	Design Freeboard (m)
Less than 200	0.6
200 – Less than 500	0.8
500 – Less than 2,000	1.0

Freeboard of 1.0 m is employed for Pasig River where the design discharge is between 1,200 m^3/s and 600 m^3/s, and the freeboard of 1.0 m is applied for Lower Marikina River where the design discharge is 550 m^3/s.

(6) Confirmation of Flow Capacity for Improved River Channel and Limit of River Channel Improvement

As mentioned in the above procedure, the flow capacity for the improved river channel was examined by non-uniform calculation and it was confirmed that the flow capacity corresponds to the design discharge distribution with MCGS under a 30-year return period flood.

The design feature for the river channel improvement is almost the limit for the Pasig-Marikina River considering the current land use conditions, so that further improvement in a manner of river channel improvement to increase flow capacity is difficult. In this connection, it is necessary to provide storage facilities in the upper river basin such as dam and retarding basin to store the excess discharge for further enhancement of safety level, including the provision of nonstructural measures in the entire Pasig-Marikina River Basin.

3.4 Review of River Structures in Detailed Design

(1) Preliminary Design of River Structures Proposed at Priority Areas of Phase II

Since improvement works of the Pasig River is presently ongoing as the Phase II Project, the preliminary design for revetment at priority areas selected from the potential areas in this Study follows the design of Phase II from the viewpoint of consistency. The results of the Detailed Design completed in 2002 were reviewed in 2008 at the start time of Phase II Project and the construction has been carried out based on the said review.

(a) Revetment and River Wall

In the contract for the Phase II Project, the contractor/s carried out subsoil explorations in addition to the detailed design. Taking the additional soil data into consideration, the preliminary design for new revetments/river walls at the priority areas has been conducted.

New revetments are composed of combined structures such as steel sheet pile foundation and inclined/vertical reinforced concrete wall on top (refer to Figure 3.4.1).

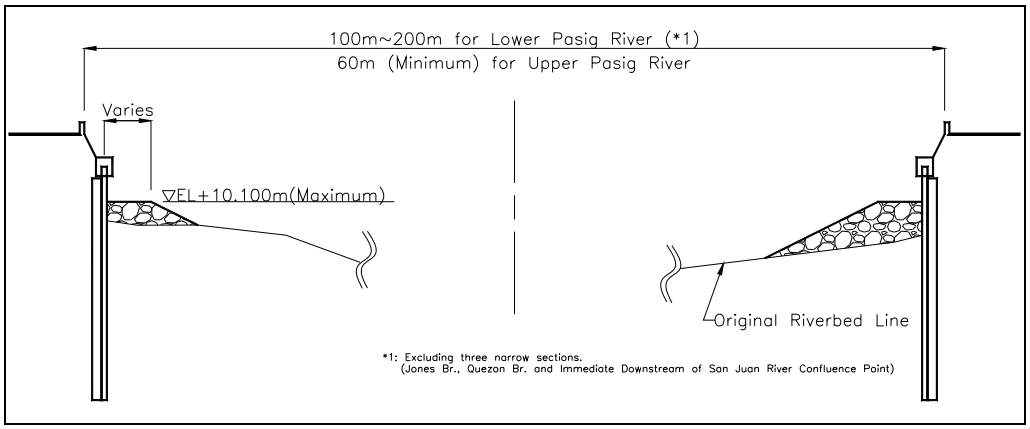


Figure 3.4.1 Typical Section of proposed Revetment

Steel Sheet Pile foundation has two types: (i) Steel Sheet Pile only (SP Type); and (ii) more strong Steel Sheet Pile combined with H-steel Beam (SP with H-Beam Type) as shown in Figure 3.4.2. Each type of pile is applied based on the subsoil condition.

(i) Steel Sheet Pile: SP Type (ii) SP with H-Beam Type

Figure 3.4.2 Cross-Section of Steel Sheet Pile Foundation

The following Figure 3.4.3 shows the location of priority areas (Priority Group No. 1 and No. 2) selected from the potential areas.

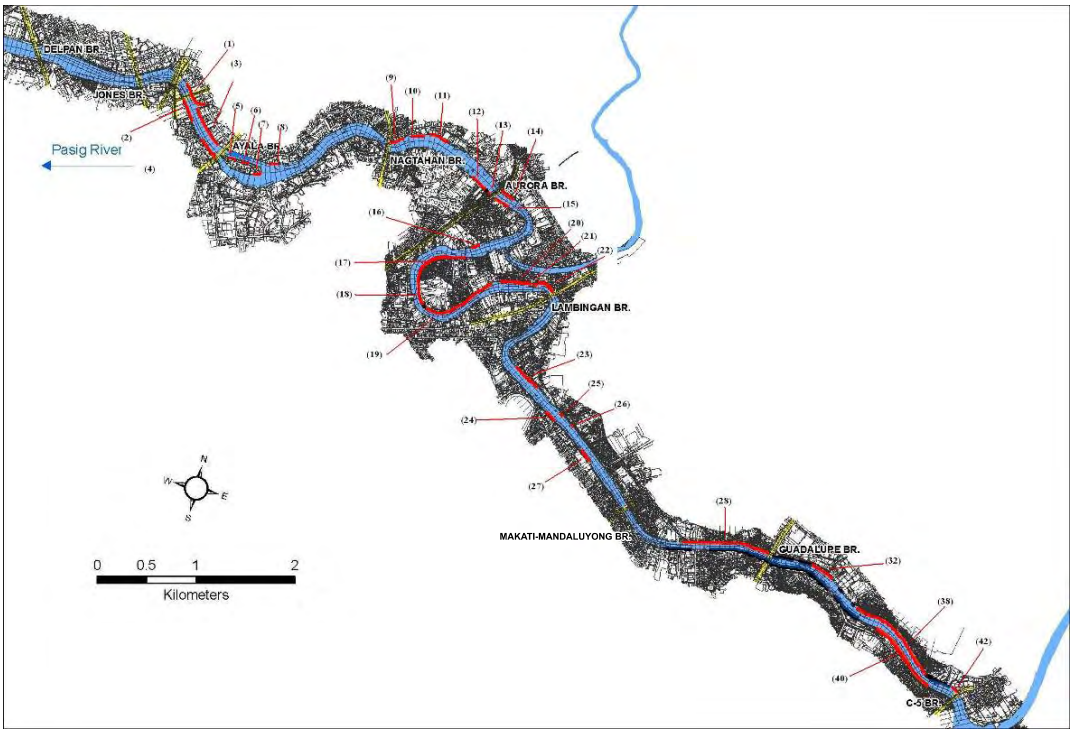


Figure 3.4.3 Locations of Prioritized Potential Areas for Implementation in Phase III Project

(b) Improvement of Existing Drainage Outlets

Corresponding to the construction of new revetments, existing drainage outlets are also to be improved. Size of drainage outlets ranges mainly from 0.3 m to 1.52 m of reinforced concrete pipes. Flap gates attached to the outlets are proposed at the low-bank area between Del Pan Bridge and Guadalupe Bridge to protect reverse flow from Pasig River.

(2) Preliminary Design of River Structures Proposed for Lower Marikina River Channel Improvement

The following are the proposed flood control structures for Lower Marikina River:

- Dredging/Excavation of Riverbed
- Earth Dike
- Concrete River Wall
- Boundary Bank
- Bridge Pier Protection

The major structures are described below and the layout plan of the proposed channel improvement is shown in Figure 3.4.5.

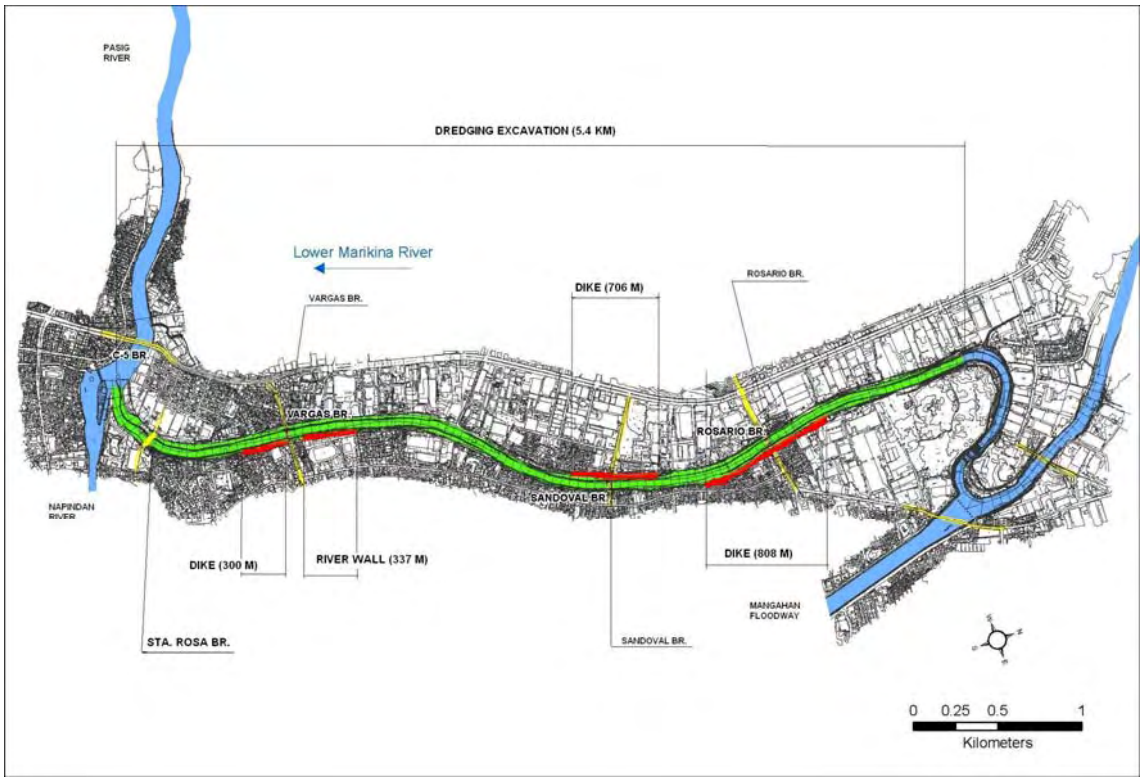


Figure 3.4.4 Layout Plan of Lower Marikina River Channel Improvement

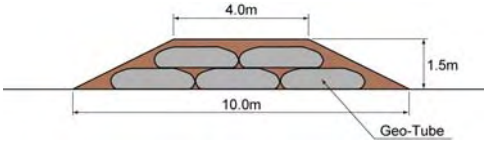
(a) Dredging/Excavation of Riverbed

Sampling of riverbed materials of Lower Marikina River conducted in the Detailed Design shows that riverbed is composed of sandy and silty clay. Typical cross-section of dredging is designed to have 40 m wide bottom and stable slope with 1 (vertical) to 3 (horizontal). Design dredged riverbed elevation is EL+6.500 m (DHWL: EL +14.036 m) and design longitudinal riverbed elevation slope is 1/4,300 (design longitudinal high water level slope: 1/9,000). Based on the results of river channel cross-section survey conducted in this Study, necessary dredging/excavation volume of Lower Marikina River is estimated at approximately 612,000 m^3.

(b) Earth Dike and Concrete River Wall

Dikes and river walls are proposed for protection of four public areas. Dikes with 3 m wide concrete paved top and revetment covering riverside slope from erosion are constructed at the existing promenades (3 locations; 1,814 m long in total consisting of 300 m, 706 m and 808 m). Proposed 337 m long concrete river wall to raise the height of the existing wall protects the area of school.

(c) Boundary Bank

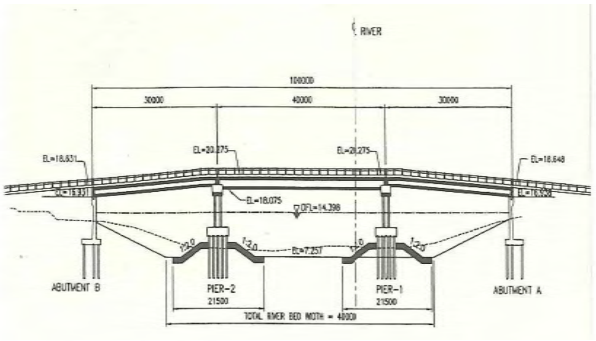


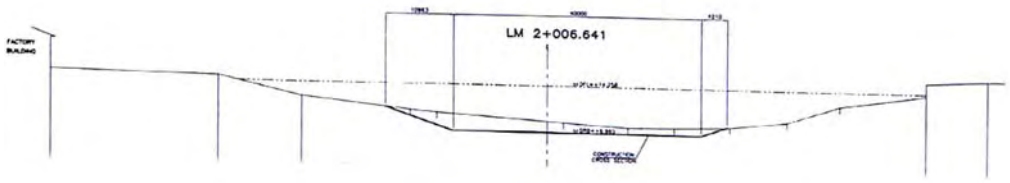
Along the Lower Marikina River flowing in the urban area, there are almost no roads. To assure boundary between river area and private property and also provide maintenance roads along the river channel as much as possible, it is proposed to provide the Boundary Bank as shown in the figure. Boundary Bank is a low embankment to reuse the dredged materials, filling materials in geo-textile tubes with filtration effect. Geo-tube

should be covered with soil because geo-tube is not strong against sunshine. Detailed structure is to be designed in the next stage, Detailed Design.

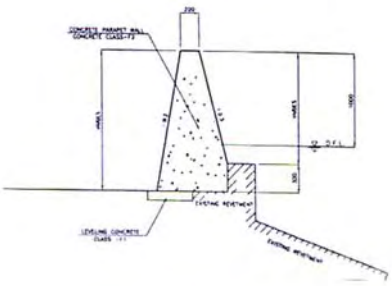
(d) Bridge Pier Protection

There are four existing bridges within the proposed dredging section. To ensure the stability of existing bridge piers from dredging (excavation of riverbed), it is proposed to provide reinforcement works with stone riprap around the piers.

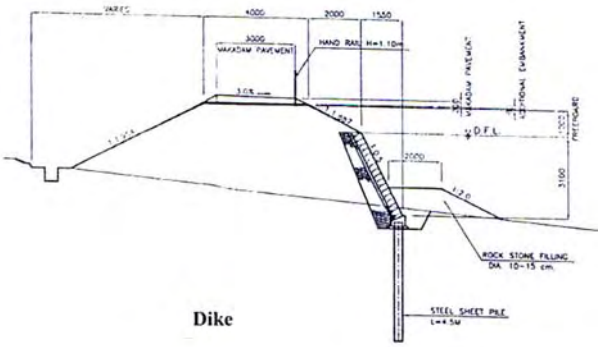




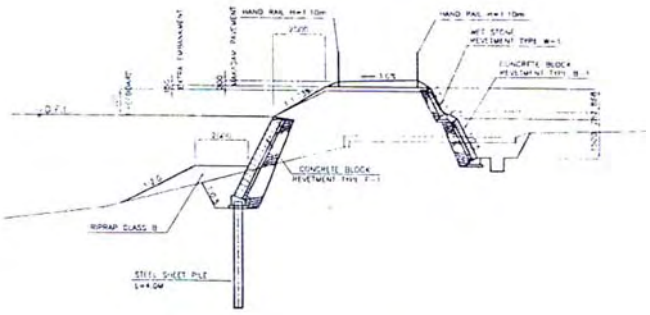
Dredging Works



River Wall



Dike



Dike

Figure 3.4.5 Typical Sections of Proposed Structures

3.5 Strategy for Project Implementation and Operation/Maintenance

The area of the Pasig-Lower Marikina River Channel to be improved is located within the jurisdiction of Metropolitan Manila Development Authority (MMDA). Implementation of the project is undertaken by the DPWH and the completed flood control facilities of the Project are transferred to the MMDA from DPWH for operation and maintenance.

(1) DPWH for Project Implementation

It is proposed that the same Project Management Office for Major Flood Control and Drainage Projects Cluster I (PMO-MFCP I) which is managing the ongoing Phase II Project will manage the Phase III Project, since the ongoing Phase II will be completed in 2012 and construction of Phase III will start in 2013. The PMO-MFCP I is generally responsible for the implementation of flood control projects in Metro Manila which are financed by foreign financing institutions.

(2) Project Funds

The Phase III Project is eligible for the preferential terms of Japanese ODA Loans called "STEP" (Special Terms for Economic Partnership)". The STEP Loan is expected to raise the visibility of Japanese ODA among citizens in both recipient countries and Japan through the best use of advanced technologies and know-how of Japanese firms.

The STEP Loan has conditions on utilizing Japanese advanced technology and knowhow of Japanese firms. Civil works of Phase III Project have two (2) critical technical/environmental problems: (a) the adopted steel sheet pile foundation for construction of revetments cannot be driven into the existing hard subsoil (about 65% sections) by the commonly used Vibro-Hammer driving method; and (b) the 612,000 cum dredged materials containing high water content are not allowed environmentally to pass the narrow streets in the urban house-congested area for disposal. To solve these technical/environmental problems, it is proposed to use Japanese advanced technology such as Vibro-Hammer with Water-jet for driving method and Eco-Tube Method for Re-use and Pre-Mix Method for Solidification for the treatment of dredged materials.

(3) MMDA for Operation and Maintenance

There is the Memorandum of Agreement (MOA) executed on July 9, 2002 and the Guidelines on the Transfer of Flood Control Responsibilities in Metro Manila from DPWH to MMDA dated August 2002 between DPWH and MMDA. In addition, the Minutes of Discussion on the implementation of Phase II Project among the DPWH, MMDA and JICA includes the commitment dated February 2003 indicating the MMDA's responsibility for the operation and maintenance of the completed project.

The MMDA was established in 1994 and its responsibility for flood control is specified as flood control and sewerage management which includes the formulation and implementation of policies, standards, programs and projects for an integrated flood control, drainage and sewerage system. Number of MMDA personnel are 7,140 in total. Regarding flood control, the Flood Control and Sewerage Management Office has the responsibility.

After the completion of the Phase II and/or the Phase III project, the O&M of the completed facilities are transferred to the MMDA. Such facilities along the Pasig River are steel revetments, reinforced concrete river walls and concrete drainage outlets. Although materials used for these structures may not need frequent maintenance, monthly site inspections should be conducted. However, drainage outlets will need frequent maintenance activities, particularly, during/after floods.

On the other hand, since the major completed facilities of Lower Marikina River are dredged/excavated channel, dikes and river wall, frequent maintenance works will not also be necessary. However, periodical inspection and inspection during/after floods should be conducted. For maintenance of the dredged channel, cross-section/longitudinal survey of riverbed is necessary once a year. Depending on the status of riverbed obtained from the results of surveys, maintenance dredging work may be necessary once in several years. Navigation also requires the maintenance of sufficient channel depth.

It is deemed that the MMDA has presently necessary equipment such as backhoes, dump trucks, tug boats, dredgers, etc., and staff for such required inspection and maintenance works.

CHAPTER 4 CONSTRUCTION PLAN AND COST ESTIMATE

4.1 General

4.1.1 Contract Packages of Phase III

The construction area for Phase III covers Pasig River Priority Areas and the Lower Marikina River Area.

Table 4.1.1 Phase III Construction Area

Name of Package	From	To	Length (km)
Pasig River - Priority	Del Pan Bridge	Immediate Vicinity of NHCS	16.4*
Lower Marikina River	Immediate Vicinity of NHCS	Downstream of Rosario Weir	5.4

* Construction section is part of Pasig River

4.1.2 Scope of Work

(1) Main Structures to be Constructed

The works are aimed to mitigate flood damage caused by channel overflow. Main civil works are the construction of new revetments and river walls, improvement and heightening of existing revetments, and improvement of drainage works along the Pasig River. Besides the above works, dredging works for the channel in Lower Marikina River and embankment works consisting of dredged materials sacked in geo-tubes will be carried out.

(2) Construction Stretch of Major Works

The construction stretch for Phase III is divided into those of Pasig River and Lower Marikina River. The length in each river is as tabulated below.

Table 4.1.2 Main Civil Works of Phase III Project

River	Main Civil Works	Length (m)
Pasig	Revetment works with Steel Sheet Pile	5,720
	River Wall (including repair works)	8,125
Lower Marikina	Dredging of Riverbed	5,400
	Dike with Revetment (Steel Sheet Pile Foundation)	1,814
	River Wall	337
	Boundary Bank	7,063
	Bridge Pier Protection	4 Bridges

The new revetment works and revetment repair works also include concrete works, reinforcing works, earthwork and other appurtenant works. In addition, drainage improvement works require concrete works with rebar, earthwork and other appurtenant works.

The volume of these main construction works for Pasig River and Lower Marikina River are as estimated below.

Table 4.1.3 Main Construction Works Volume for Phase III (excluding Steel Sheet Pile Works)

Item	Unit	Pasig River	Lower Marikina River
Concrete	m^3	10,300	1,970
Rebar	t	4,190	70
Excavation (incl. Riverbed Excavation)	m^3	36,920	6,050
Dredging	m^3	0	612,000
Backfill (Common/Sand)	m^3	43,000	1,300
Improvement of Dredging Soil	m^3	0	472,000
Riprap/Rockfill	m^3	51,500	6,500
Boundary Bank	m^3	0	50,100

4.2 Construction Schedule

The construction schedules for the Pasig River and Marikina River are shown in Figure 4.2.1 and Figure 4.2.2. The construction work will be completed in 3 years. Construction periods for the main activities estimated in this design review stage are as graphically shown in the figures below.

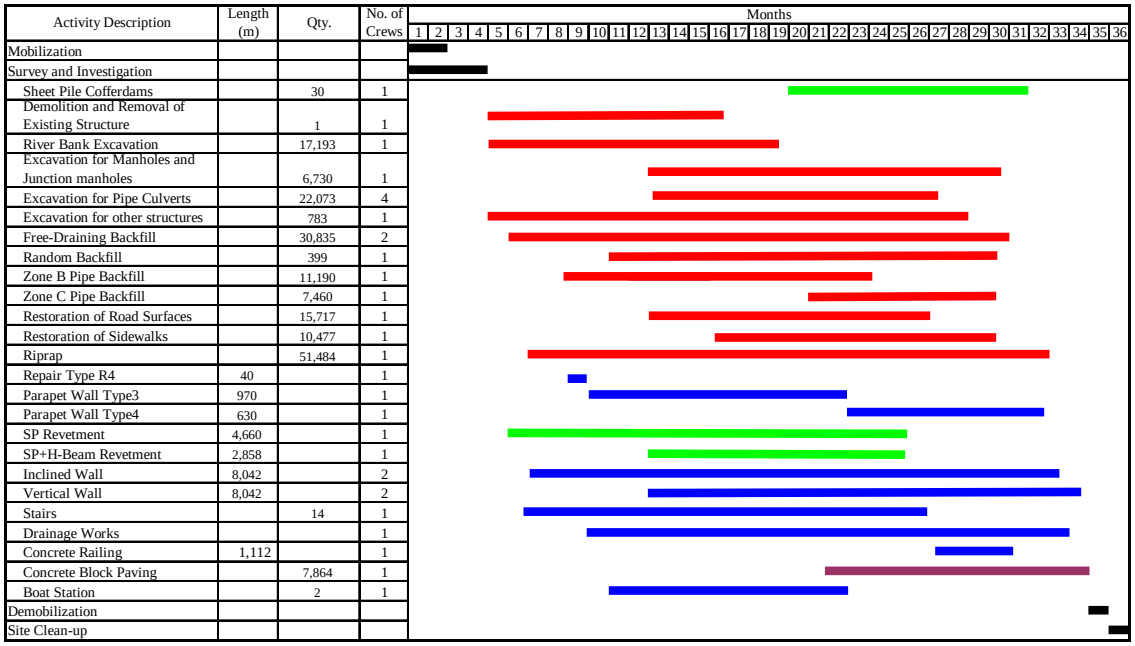


Figure 4.2.1 Construction Schedule for Pasig River

Activity Description	Length (m)	Qty.	No. of Crews
Mobilization			
Survey and Investigation			
Demolition and Removal of Existing Structure		1	1
River Bank Excavation		3,100	1
Excavation for other structures		6,050	1
Dredging		612,000	1
Geo Bag Backfill		40,471	1
Random Backfill		1,300	1
Soil Improvement		472,000	1
Riprap		2,250	1
SP Revetment	1,800		2
Stairs		18	1
Drainage Works		1 (L.S)	1
Concrete Railing	1,800		1
Concrete Block Paving		4190	1
Demobilization			
Site Clean-up			

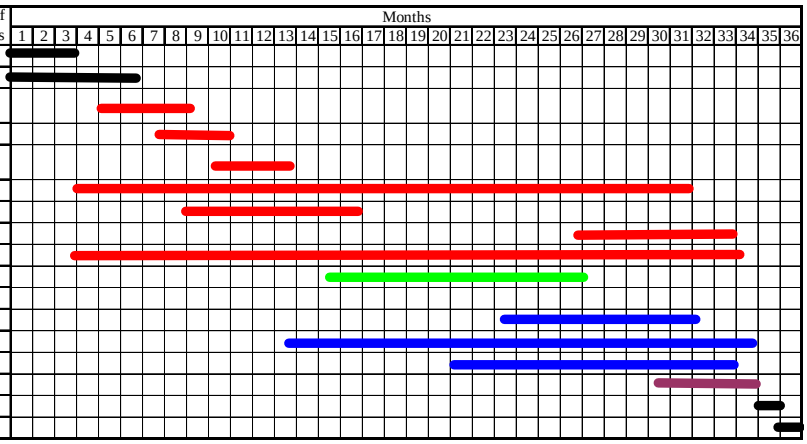


Figure 4.2.2 Construction Schedule for Lower Marikina River

CHAPTER 5 PROJECT EVALUATION AND IMPLEMENTATION

5.1 Environmental Evaluation of the Project

5.1.1 Assessment of Project Impacts

The following table shows the possible negative impacts without mitigations based on the available data/information:

Table 5.1.1 Assessment of Negative Impacts

Items			Assessment		Explanation
			EIS (1998)	This Review	
Social Environment:	1	Involuntary Resettlement	-	A	58 house holds (204 people) to be relocated due to the Project were identified.
	2	Local Economy such as Employment and Livelihood, etc	-	D	There are no negative impacts expected due to construction activities.
	3	Land Use and Utilization of Local Resources	-	D	Since project area is already urbanized, no negative impacts might be anticipated for change in land use and utilization of local resources.
	4	Social Institutions such as Social Infrastructure and Local Decision - making Institutions	-	D	Since construction activities is limited inside of existing river area in the urbanized, no negative impacts might be anticipated.
	5	Existing Social Infrastructures and Services	D	B	Construction materials are transported via barge and construction activities are conducted in river area. River navigation might be affected slightly. Use of existing river parks along the Lower Marikina River will be affected because of construction of dikes and re-construction of river parks on dikes.
	6	The Poor, Indigenous and Ethnic people	-	D	Livelihood of general low income people is not dependent on resources from the rivers, such as fish and drinking water. Also, no Indigenous and Ethnic People were identified.
	7	Misdistribution of Benefit and Damage	-	D	People in the project affected area do not think construction work is a problem for their daily life according the interview conducted.
	8	Cultural heritage	-	D	No cultural heritage sites or spiritually important places are identified in the project affected areas.
	9	Local Conflicts of Interest	-	D	No negative impact on local conflict could be predicted based on information of Phase II Project.
	10	Water Usage or Water Rights and Communal Rights	-	D	There are no people that are dependent on river water for domestic consumption, irrigation, etc.
	11	Sanitation	-	B	Inadequate sanitation during construction is a major cause of disease and dirty the area.
	12	Hazards (risk) Infectious Diseases such as HIV/AIDS	-	D	Almost no demand is anticipated for commercial sex workers who are potentially HIV positive and might spread the disease, based on the result of Phase II Project.
Natural Environment	13	Topography and Geographical Features	-	D	In the construction, dredging of river bed and filling low-lying area with dredged materials are planned. However, such works are in the limited scale.
	14	Soil Erosion	-	D	In the construction, no soil erosion which affects on wide area due to earth excavation might occur.
	15	Groundwater	-	D	No changes in volume, flow direction, lowering water level, etc., for groundwater are anticipated.

Items			Assessment		Explanation
			EIS (1998)	This Review	
	16	Hydrological Situation	-	D	Revetments are planned to be constructed along the existing river banks. Although the channel will be deepened by the dredging, there is no change in normal water level because dredged section is within tidal affected area of Manila Bay. No change in hydrological situation is anticipated by the project.
	17	Coastal zone	-	D	No damage to coastal zone is anticipated since site is far from coastal zone.
	18	Flora, Fauna and Biodiversity	-	D	Although construction works will damage some terrestrial flora, these can be naturally revived in time. No endangered or concerned species are identified in the construction affected area.
	19	Meteorology	-	D	Not affected or least likely affected by the construction work.
	20	Landscape	-	D	In the construction period, no obstruction to landscape views of river walk/parks is expected.
	21	Global Warming	-	D	Not affected or least likely affected by the construction work.
Pollution	22	Air Pollution	D	D	Exhaust and fumes from construction machinery will add pollutants to the air, but the pollution will be very light, temporary, and localized, and it will not be as significant an issue as the already heavily polluted air in Metro Manila Area. As Phase II project monitoring results show that the machineries and vehicle used for the construction works least likely aggregate already existing air pollution. Dust will be generated due to construction activities such as transportation, spreading and embankment of soils, stones, etc.
	23	Water Pollution	B	B	In the project construction period, suspension of sediments and release of sediment pollutants will occur as a result of excavation/dredging in the river.
	24	Soil Contamination	B	B	Dredged materials contain some heavy metals. However, all the values taken from sediment to be dredged are less than regulatory levels set by the Philippines. It can be said that disposal of dredged materials is less likely to cause soil contamination.
	25	Waste	B	B	In the project construction period, generation of garbage, demolished structures, dredged material (612,000 m^3), etc. are expected.
	26	Noise and Vibration	B	B	During construction period, vibration and noise caused by construction activities add pollution to surroundings, but the pollution will be very light, temporary and localized, and it will not be as significant an issue as the already existing ones in the Metro Manila area. As Phase II project monitoring results show that the machineries and vehicle used for river channel improvement work least likely aggregate already existing noise and vibration.
	27	Ground Subsidence	-	D	No ground subsidence was reported in Phase II. Also, the same result is expected for Phase III. No ground extraction is planned in the construction.
	28	Offensive Odor	C	B	In the dredging work, offensive odor is occasionally and locally anticipated.
	29	Bottom Sediment	-	D	Since the dredging works remove polluted sediments of river, no pollution of bottom sediments are predicted.
	30	Accidents	-	B	In the project construction period, construction related accidents might occur.

A: Significant Impact; B: Slight Impact; C: Uncertain Impact; D: Few Impact; - : Not Applicable
EIS (1998) did not use JICA's method to evaluate the impact using "A, B, C and D". Evaluation results of EIS(1998) were converted to JICA's method..

5.1.2 Mitigation Measures and Monitoring Points in the Phase III Construction Phase

The following table shows the suggested mitigation measures for the possible impacts:

Table 5.1.2 Mitigation Measures for Negative Impacts

Items			Evaluation Table 5.1.1	Mitigation Measures
Social Environment:	1	Involuntary Resettlement	A	Project Affected People (PAP) are relocated according to the Resettlement Action Plan which is prepared in accordance with JICA Guidelines/World Bank's related policies.
	2	Local Economy such as Employment and Livelihood, etc.	D	Hire construction workers locally and prevent influx of outsiders in coordination with construction contractor and Barangay captains.
	3	Land Use and Utilization of Local Resources	D	Not necessary
	4	Social Institutions such as Social Infrastructure and Local Decision-making Institutions	D	Not necessary
	5	Existing Social Infrastructures and Services	B	Make a good coordination with Coastal Guard, related LGUs and Barangays on operations time between the barges, ferry, and boats and construction equipment so that dredged activities and construction operation might minimize interference to commercial activities. During construction of dike and re-construction of river parks, temporary access will be provided for the residents.
	6	The Poor, Indigenous and Ethnic people	D	Not necessary
	7	Misdistribution of Benefit and Damage	D	Not necessary
	8	Cultural Heritage	D	Not necessary
	9	Local Conflicts of Interest	D	Not necessary
	10	Water Usage or Water Rights and Communal Rights	D	Not necessary
	11	Sanitation	B	Provision of facilities and system at each construction site and disposal periodically by construction contractor..
	12	Hazards/ Risk; Infectious Diseases such as HIV/AIDS(	D	Seminars to be conducted for construction workers by construction contractor.
Natural Environment	13	Topography and Geographical Features	D	Not necessary.
	14	Soil Erosion	D	For small scale of erosion, excavation works should be done in accordance with the design of civil works for stability.
	15	Groundwater	D	Not necessary
	16	Hydrological Situation	D	Not necessary
	17	Coastal zone	D	Not necessary
	18	Flora, Fauna and Biodiversity	D	Not necessary
	19	Meteorology	D	Not necessary
	20	Landscape	D	Not necessary
	21	Global Warming	D	Not necessary
Pollution	22	Air Pollution	D	Air quality is monitored as the same as Phase II, although it is considered to be "D". Fumes and exhaust from machinery and equipment used for Project can be reduced or prevented by properly installed and maintained mufflers and filters. CO_2 level is suppressed by frequent and timely changing of machine/engine oil and stopping excessive idling of engines. Hosing of ground/cover-sheets are done during earth work in order to prevent dust from dispersing into the air.

Items			Evaluation Table 5.1.1	Mitigation Measures
	23	Water Pollution	B	Use technology that prevents sediments from suspending/re-dissolving to the river, such as prevention sheet, watertight type eco-grab, etc.
	24	Soil Contamination	B	For dredged materials, cement will be added, which will contain the hazardous substances within cement-mixed soils. Leaching from dredged materials at disposal site should be monitored. As required based on monitoring, more adequate mitigation measures should be taken, such as use of sheets under disposal materials.
	25	Waste	B	Generated contaminated solid wastes/sediments are taken care of according to Republic Act 6969. Construction debris and work related garbage are transported to the construction contractor's office unit and disposed of according to regulation by a licensed entity. Eco-tube or cement-base pre-mix method for solidification can be used as mentioned above.
	26	Noise and Vibration	B	Noise and vibrations are reduced by using adequate machines and by installing mufflers/noise reduction devices. If necessary, construction work that involves generation of nuisance noise and vibration is carried out during less noticeable/affective times. As Phase II project monitoring results show that the machineries and vehicle used for river channel improvement work least likely affects to social and earth environment..
	27	Ground Subsidence	D	Not necessary
	28	Offensive Odor	B	Use technologies that prevent offensive odor from being generated during dredging work. For example, dredged materials on barge are covered with a plastic sheet, or stored in Eco-Tube or Cement-base pre-mix method to contain the fowl smell.
	29	Bottom Sediment	D	Not necessary
	30	Accidents	B	Prevent accidents that might occur around a construction site by looking for possible dangerous and hazardous conditions. Use billboards, Information, Education and Campaign (IEC) to the residents and construction workers to promote workplace safety awareness.

A: Significant Impact; B: Slight Impact; C: Uncertain Impact; D: Few Impact; - : Not Applicable
EIS (1998) did not use JICA's method to evaluate the impact using "A, B, C and D". Evaluation results of EIS(1998) were converted to JICA's method

5.2 Economic Evaluation

5.2.1 Summary of Estimated Benefit

The estimated benefit of each project component is as given in the table below.

Table 5.2.1 Benefit Estimation for Each of the Project Components in 2010

Project	Benefit (Million Pesos)
Phase II	1,265
Phase III	3,676
Phase IV	4,314
Entire Project	9,256

Unit: million pesos

5.2.2 Economic Analysis

The economic internal rate of return (EIRR) of each project component is as given below. All of the project components are judged to be economically viable.

Table 5.2.2 Economic Analysis

Project	EIRR	NPV15%	B/C
Phase II	23%	1,478	1.7
Phase III	38%	3,844	3.7
Phase IV	35%	2,167	3.4
Entire Project	28%	7,489	2.7

The analysis for the projects was conducted for the period until 2067 with an assumption of 50-years project life after the completion of the Phase III civil works in 2017.

5.3 Effects of the Project and Performance Indicators

(1) Effects of the Project

One of the major objectives of the Project is to promote the river channel improvement of the Pasig-Marikina River to the safety level of 100-year return period in accordance with the Master Plan formulated in 1990. However, the river channel improvement for the Phase III stretch including the priority areas in the Phase II stretch is to be implemented following the Phase II project with the safety level of 30-year return period in a manner of urgent project.

As the result of implementation of the Project, the current flow capacity of Pasig River will increase from 200 m^3/s to a maximum 1,200 m^3/s.

Table 5.3.1 Flow Capacity of Pasig-Marikina River

River Name	Stretch (km)	Flow Capacity (m^3/s)			
		Present River Channel			After Project
		Average	Minimum	Maximum	Minimum
(1) Pasig River	0.0 - 1.0	1,200	900	1,500	1,200
	1.0 - 4.0	600	200	1,200	1,200
	4.0 - 7.0	1,000	600	1,500	1,200
	7.0 - 17.1	500	200	1,000	600
(2) Lower Marikina	0.0 - 6.5	400	200	1,000	550

However, the safety level for the 30-year return period cannot be attained under the "without MCGS" condition. The safety level will remain at about 20-year return period in the Lower Pasig River downstream from the confluence of San Juan River while it is about 10-year return period in the Upper Pasig River upstream from the confluence of San Juan River and 2-year return period in the Lower Marikina River.

As to inundation, it will not be observed in floods of up to 30-year return period in the case of construction of MCGS, while inundation areas will still exist in the case of "without MCGS."

(2) Performance Indicators

(a) Operation Indicator

As the operation indicator, the application of annual maximum flood discharge is considered in view of the following reasons:

- The following indicators are generally applied to flood control projects: (1) Flow capacity at the reference point; (2) Annual maximum flood discharge at the reference point; and (3) Annual maximum water level at the reference point.
- Among the above indicators, "(1) Flow capacity at the reference point" seems to be the most preferable to evaluate the maintenance condition of the design flow capacity, which will be achieved through the river channel improvement project. However, to

monitor the flow capacity at the reference point, it is required to conduct river channel survey every year from the river mouth to the reference point. Thus, it may be too difficult to apply the flow capacity as the indicator.

- With regard to "(2) Annual maximum flood discharge at the reference point," it seems to be the second priority to evaluate the maintenance condition of the design flow capacity, while "(3) Annual maximum water level", which is already an obtainable indicator can only evaluate the safety water level, but not discharge. Since the river channel improvement is designed based on the discharge, the discharge is more preferable than the water level to evaluate the maintenance conditions.

Under the above considerations, the application of annual maximum flood discharge at the St.Niño water level gauging station is proposed as the operational indicator for the Pasig-Marikina River Channel Improvement Project, since it is the one being used as reference point for the Pasig-Marikina River.

(b) Effect Indicator

Effect indicators of the project are as presented below.

Table 5.3.2 Effect Indicators 1 (Flood Area, Population and Assets)

Return period	St.Nino Discharge (m^3/s)	Without the Project				Completion Phase II			
		Flood Area (km^2)	Affected Population (1000)	Asset Value (Billion Pesos)	Damages (Million Peso)	Flood Area (km^2)	Affected Population (1000)	Asset Value (Billion Pesos)	Damages (Million Peso)
		A	B	C	D	E	F	G	H
1/2	1470	1.2	55	8.2	2,526	1.0	44	6.5	2,008
1/5	2020	19.5	379	62.0	17,244	17.9	347	56.9	15,809
1/10	2350	24.0	599	88.5	31,314	19.5	487	71.9	25,437
1/20	2740	36.8	1,004	146.2	55,961	30.9	843	122.8	46,996
1/30	2900	42.0	1,221	177.6	80,573	35.4	1,029	149.7	67,893

Table 5.3.3 Effect Indicators 2 (Flood Area, Population and Assets)

Return period	St.Nino Discharge (m^3/s)	Completion Phase III				Completion Phase IV			
		Flood Area (km^2)	Affected Population (1000)	Asset Value (Billion Pesos)	Damages (Million Peso)	Flood Area (km^2)	Affected Population (1000)	Asset Value (Billion Pesos)	Damages (Million Peso)
		I	J	K	L	M	N	O	P
1/2	1470	0.5	24	4	1,116	0.0	0.0	0.0	0.0
1/5	2020	1.4	26	4	1,201	0.0	0.0	0.0	0.0
1/10	2350	16.2	404	60	21,130	0.0	0.0	0.0	0.0
1/20	2740	29.4	802	117	44,702	0.0	0.0	0.0	0.0
1/30	2900	34.6	1,004	146	66,282	0.0	0.0	0.0	1.2

Table 5.3.4 Estimation of Benefit (Benefit and Impact of Phase II)

Return Period	Impact of Phase II				Benefit Estimation Phase II			
	Flood Area (km^2)	Affected Population (1000)	Asset Value (Billion Pesos)	Damages (Million Peso)	Average Damages Avoided (Million Peso)	Average Annual Exeedance Probability	Annual Average Damages (Million Peso)	Cumulative Value (Million Peso)
	A-E	B-F	C-G	D-H				
1/2	0.25	11	1.7	518	259	*-	56	56
1/5	1.62	32	5.2	1,434	976	0.30	293	348
1/10	4.50	112	16.6	5,878	3,656	0.10	366	714
1/20	5.90	161	23.4	8,965	7,421	0.05	371	1,085
1/30	6.61	192	27.9	12,680	10,822	0.02	180	1,265

Table 5.3.5 Estimation of Benefit (Benefit and Impact of Phase III)

Return Period	Impact of Phase III				Benefit Estimation Phase III			
	Flood Area (km^2)	Affected Population (1000)	Asset Value (Billion Pesos)	Damages (Million Peso)	Average Damages Avoided (Million Peso)	Average Annual Exeedance Probability	Annual Average Damages (Million Peso)	Cumulative Value (Million Peso)
	E-I	F-J	G-K	H-L				
1/2	0.43	19	2.9	892	446	*-	208	208
1/5	16.50	321	52.5	14,608	7,750	0.30	2,325	2,533
1/10	3.30	82	12.2	4,307	9,458	0.10	946	3,479
1/20	1.51	41	6.0	2,294	3,301	0.05	165	3,644
1/30	0.84	24	3.6	1,611	1,953	0.02	33	3,676

Table 5.3.6 Estimation of Benefit (Benefit and Impact of Phase IV)

Return Period	Impact of Phase IV				Benefit Estimation Phase IV			
	Flood Area (km^2)	Affected Population (1000)	Asset Value (Billion Pesos)	Damage (Million Peso)	Average Damage Avoided (million pesos)	Average Annual Exeedance Probability	Annual Average Damage (million pesos)	Cumulative Value (million pesos)
	I-M	J-N	K-O	L-O				
1/2	1	24	4	1,116	558	*-	279	279
1/5	1	26	4	1,201	1,159	0.30	348	627
1/10	16	404	60	21,130	11,165	0.10	1,117	1,743
1/20	29	802	117	44,702	32,916	0.05	1,646	3,389
1/30	35	1,004	146	66,280	55,491	0.02	925	4,314

Table 5.3.7 Estimation of Benefit (Benefit and Impact of Entire Project)

Return Period	Impact Entire Project				Benefit Estimation Entire Project			
	Flood Area (km^2)	Affected Population (1000)	Asset Value (Billion Pesos)	Damage (Million Peso)	Average Damage Avoided (million pesos)	Average Annual Exeedance Probability	Annual Average Damage (million pesos)	Cumulative Value (million pesos)
	A-M	B-N	C-O	D-P				
1/2	1.2	55	8	2,526	1,263	*-	543	543
1/5	19.5	379	62	17,244	9,885	0.30	2,965	3,508
1/10	24.0	599	88	31,314	24,279	0.10	2,428	5,936
1/20	36.8	1,004	146	55,961	43,638	0.05	2,182	8,118
1/30	42.0	1,221	178	80,572	68,266	0.02	1,138	9,256

As identified from these tables, the Project will bring a huge effect on the mitigation of current flood damages.

5.4 Project Implementation

5.4.1 Project Implementation Agency

The implementation of construction work in the ongoing Phase II Project is being managed by the DPWH-PMO-MFCP-I. After completion of the project, operation and maintenance for flood control facilities will be turned over to MMDA based on the MOA between DPWH and MMDA. Awareness activities on Flood Risk Management together with concerned LGU's and residents are also carried out in the Phase II Project.

For the Phase III Project, implementation agencies vary in each stage, as shown below.

Table 5.4.1 Project Implementation Agency

Stage	Activities	Implementation Agency	Main Office	Other Related Offices
Pre-Construction	Detailed Design, Tendering	DPWH	PMO	PS, BOD,BOC
	Nonstructural Measures	DPWH, MMDA, LGU		FCSEC, FMC, LDRRMC
Construction	Construction Supervision	DPWH	PMO	FMC
Post-Construction	Operation and Maintenance	MMDA		DPWH-NCR
	Nonstructural Measures	MMDA, LGU		FMC, DPWH FCSEC

A Memorandum of Agreement (MOA) among DPWH, MMDA and PRRC, and a Certificate of Support between DPWH and LGUs concerned shall have to be executed and approved by the time the STEP Loan application is approved and funds are released, preferably, before the start of construction work for Phase III. Each agency shall carry out its roles and responsibilities as stipulated in the MOA or the Certificate of Support from LGUs.

5.4.2 Implementation Schedule

The Implementation Schedule for the Phase III Project is shown in Figure 5.4.1. As shown in the figure, the construction work will be completed in April 2017 and project completion date will coincide with the completion of consulting services in June 2017.

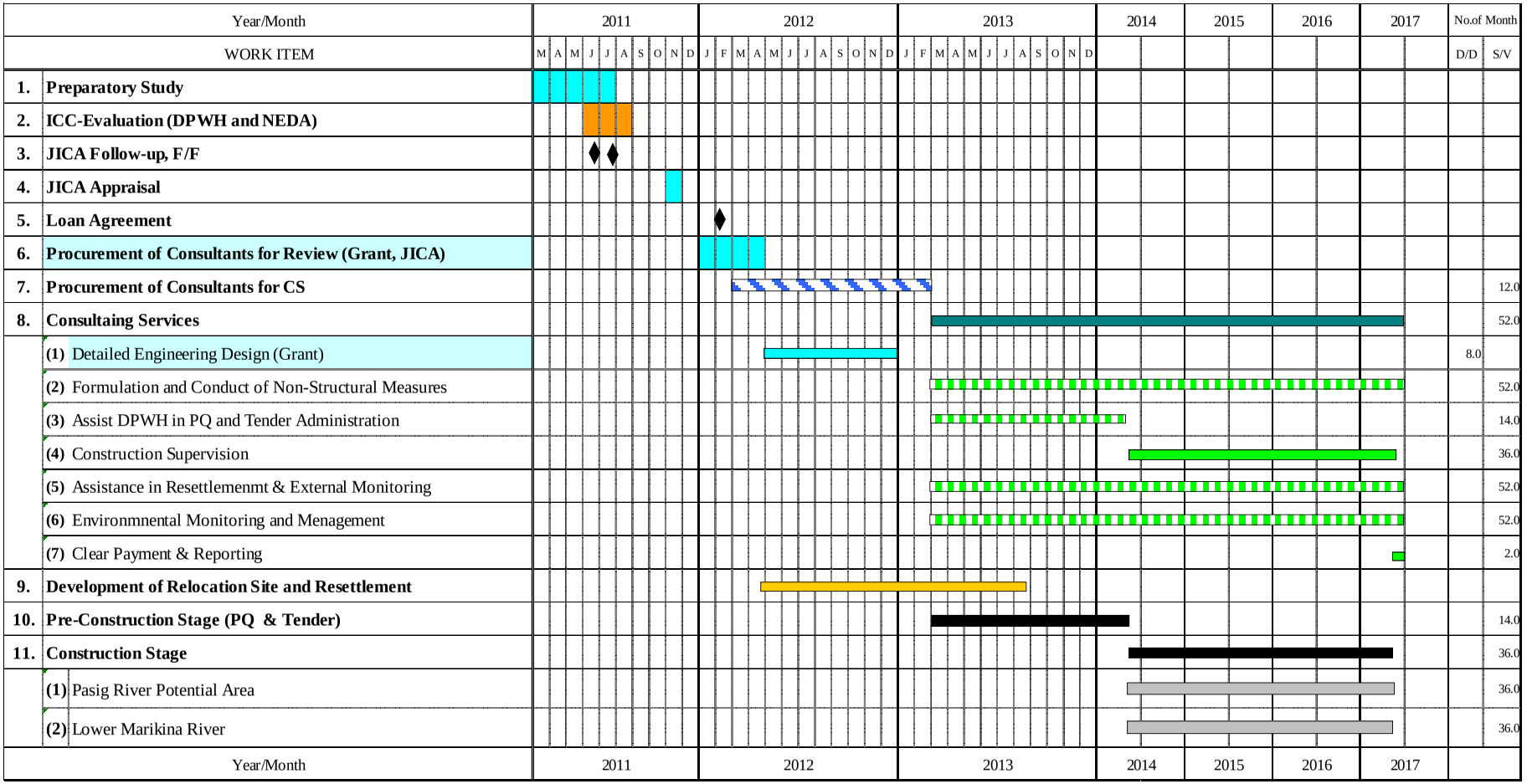


Figure 5.4.1 Implementation Schedule for Phase III

5.5 Overall Project Schedule

(1) Original Phasing

The Overall Project Schedule together with the original phasing of the works was arranged in the Detailed Design Stage, as shown below.

Table 5.5.1 Phasing Prepared in the Detailed Design Stage

Phases	Stretches	River Improvement Works				Drainage Works		Bridge Works	
		Dredging/ Excavation (m^3)	Embankment (m^3)	Parapet (km)	Revetment (km)	Single Barrel Culvert	Double Barrel Culvert	Foundation ProtectionWorks	Span Expansion Works
Phase II	Lower Pasig River : 9.20 km (Del Pan Bridge to Lambingan Bridge)	7 x 103	0	14.5	9.13	28	-	-	-
	Upper Pasig River : 7.20 km (Lambingan Bridge to Napindan Channel)	8 x 103	0	13.7	8.44	56	2	-	-
Phase III	Lower Marikina River: 6.00 km (Napindan Channel to MCGS)	500 x 103	200 x 103	0.34	1.13	11	1	Vargas Br.; Sandoval Br.; Rosario Br.	-
	MCGS and Its Vicinity: 1.20 km (MCGS to Mangahan FW)	250 x 103	70 x 103	0	1.08	-	-	-	-
Phase IV	Upper Marikina River: 6.10 km (Mangahan FW to Sto. Niño)	1,360 x 103	740 x 103	2.1	9.00	18	7	Marcos Br.; Manalo Br.	Manalo Br. (One Span)

Note: Phase I is the Detailed Design Stage
Single Barrel Pipe Culvert : min. size 610 mm; max. size 1,520 mm
Double Barrel Pipe Culvert : 1,370 mm
Box Culvert : min. size 1.0 m x 1.0 m; max. size 2.1 m x 2.4 m

(2) Phasing Modified by the JICA Preparatory Study

In connection with the original phasing of the works described above, this JICA Preparatory Study points out the following issues:

- Necessity of river channel improvement for potential areas in the Phase II stretch.
- Necessity of deferment of construction of MCGS.

(a) Necessity of River Channel Improvement for Phase II Potential Areas

In the original phasing, the Pasig River Channel improvement works would be completed for the whole stretch of 16.4 km consisting of the Lower Pasig and Upper Pasig rivers. However, due to cost constraint caused by drastic price escalation from 2005-2007, the river improvement stretch was narrowed down to selected priority areas, and some portions remained without river channel improvement works. Then, due to Typhoon Ondoy, several remaining portions of the channel suffered from severe damage and required urgent restoration works.

In this JICA Preparatory Study for Phase III, the river channel stretches to be covered by the Phase III Project were identified and improvement works for the potential areas in the Phase II stretch are also proposed.

(b) Necessity of Deferment of Construction of MCGS

As mentioned in Subsection 2.1.3, the construction of MCGS should be deferred to the last phase of the overall Project, or the Phase IV Project.

Under the above conditions, a modified phasing was proposed, as shown in the following table.

Table 5.5.2 Modified Phasing of Channel Improvements Works for Phase III Project

Phases	Stretches	River Improvement Works				Drainage Works		Bridge Works	
		Dredging/ Excavation (m^3)	Embankment (m^3)	Parapet (km)	Revetment (km)	Single Barrel Culvert	Double Barrel Culvert	Foundation Protection Works	Span Expansion Works
Phase II	Lower Pasig River: 9.20 km (Del Pan Bridge to Lambingan Bridge)	7 x 103	0	14.5	9.13	28	-	-	-
	Upper Pasig River: 7.20 km (Lambingan Bridge to Napindan Channel)	8 x 103	0	13.7	8.44	56	2	-	-
Phase III	Lower Marikina River: 5.4 km (Napindan Channel to MCGS)	618 x 103	51 x 103	0.34	1.81	11	1	Vargas Br.; Sandoval Br.; Rosario Br. Sta. Rosa Br.	-
	Phase II Potential Areas	37 x 103	50 x 103	9.92	7.52	49	-		
Implementation of East Mangahan Project									
Phase IV	Upper Marikina River: 6.10 km (Mangahan FW to Sto. Niño)	1,360 x 103	740 x 103	2.1	9.00	18	7	Marcos Br.; Manalo Br.	Manalo Br.(One Span)
	MCGS and Its Vicinity: 1.20 km (MCGS to Mangahan FW)	250 x 103	70 x 103	0	1.08	-	-	-	-

CHAPTER 6 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

In the Preparatory Study, the currently existing Pasig-Marikina River Channel Improvement Plan was reviewed, focusing on the river improvement stretch covered by Phase III to support the formulation of a Yen Loan Project to be called as "Phase III", which shall consist of river channel improvement works and monitoring, including educational/information campaign and publicity aimed towards the local inhabitants and so on. The Study concludes that the Phase III Project is economically viable, technically feasible, and social and natural environmentally acceptable.

6.2 Recommendation

(1) As evidenced by the perennial flood damage caused by typhoons, especially, the recent Typhoon Ondoy which brought about the devastating flood damage in 2009, Metro Manila is very vulnerable to flood, which is attributed mainly to the poor flood discharge capacity of the Pasig-Marikina river channel. To alleviate the impacts of perennial flood damage, the Pasig-Marikina River Channel Improvement Project (PMRCIP) was initiated with the implementation of channel improvement works for the Pasig River in the Phase II Project. In this connection, it is strongly recommended that necessary actions to initiate the Phase III Project, including preparation of the Implementation Program (I/P), obtaining the Resolution of RDC, and application/approval of ICC, should be taken without lapse of time in accordance with the implementation schedule proposed in the Study.

(2) For implementation of the Phase III Project, it is expected that the informal settlers along the river course will be resettled. In this Study, materials for the Resettlement Action Plan (RAP) were arranged, and DPWH had already formulated the RAP. It is recommended that the necessary actions to promote the RAP should be initiated soonest.

(3) To implement the project smoothly and also, to control illegal and/or disorderly land development which may lead to unfavorable impacts to the flooding condition in the Pasig-Marikina River Basin, this Study proposes the establishment of a Flood Mitigation Committee (FMC) and to have the Memorandum of Agreement (MOA) and Certificate of Support of LGUs executed to assure the roles and responsibilities of all agencies concerned. In this connection, it is recommended that actions leading to the setup of FMC including execution of the MOA and the Certificate of Support of LGUs should be taken immediately.

(4) This Study proposes the implementation of river channel improvement works targeting the Phase III stretch and the priority areas in the Phase II stretch. However, certain areas excluded from the priority areas in this project remain without provision of improvement works. For the remaining potential areas where river channel improvement works seem to be necessary from the environmental point of view, this Study recommends that river channel works in the frame of a PRRC project shall be implemented as early as possible.

(5) The introduction of nonstructural measures in parallel with the preparation for river channel improvement works in the Phase III stretch and the priority areas in the Phase II stretch is proposed. In this connection, it is recommend that necessary arrangements should be taken to introduce the proposed nonstructural measures, especially the educational/information campaign and publicity, which are essential to facilitate project implementation by deepening the understanding of stakeholders particularly the local people on the significance of the project.

(6) In principle, the implementation of the Pasig-Marikina River Channel Improvement Project, Phase III, is expected to receive funding assistance through the Special Terms for Economic Partnership (STEP) Yen Loan. In this connection, it is proposed that the necessary application and arrangements are made to avail of the STEP Loan through the confirmation and justification of necessity by DPWH and all the other agencies concerned.

(7) The objective river of the Phase III project is the Lower Marikina River, and it is expected that the river channel improvement works will be continued up to the Upper Marikina River as the Phase IV project, which shall include the construction of the Marikina Control Gate Structure (MCGS) as the whole project. However, for the implementation of the Phase IV, it is necessary to settle down several issues on such as adjustment with the development along the upper-Marikina River Channel, existence of informal settlers in the Mangahan Floodway, drainage system of the east bank of the Mangahan Floodway and agreement among stakeholders for construction of MCGS. In this connection, it is recommended that discussions among stakeholders to settle down these issues should be initiated as early as possible, so that implementation of the Phase IV project can be started immediately after completion of Phase III project.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