3.5 Resettlement Plan

3.5.1 Project Description

Major works of the Phase III Project are summarized as follow:

1) Construction of Revetments supported by Steel Sheet Piles and Reinforced Concrete River Wall along the Pasig River (about 9.9 km long in total on both banks)

2) Dredging of Lower Marikina River Channel (about 5.4 km long)

3) Dike and River Wall (about 2.1 km long in total) and Boundary Bank (about 7.0 km long) construction along the Lower Marikina River

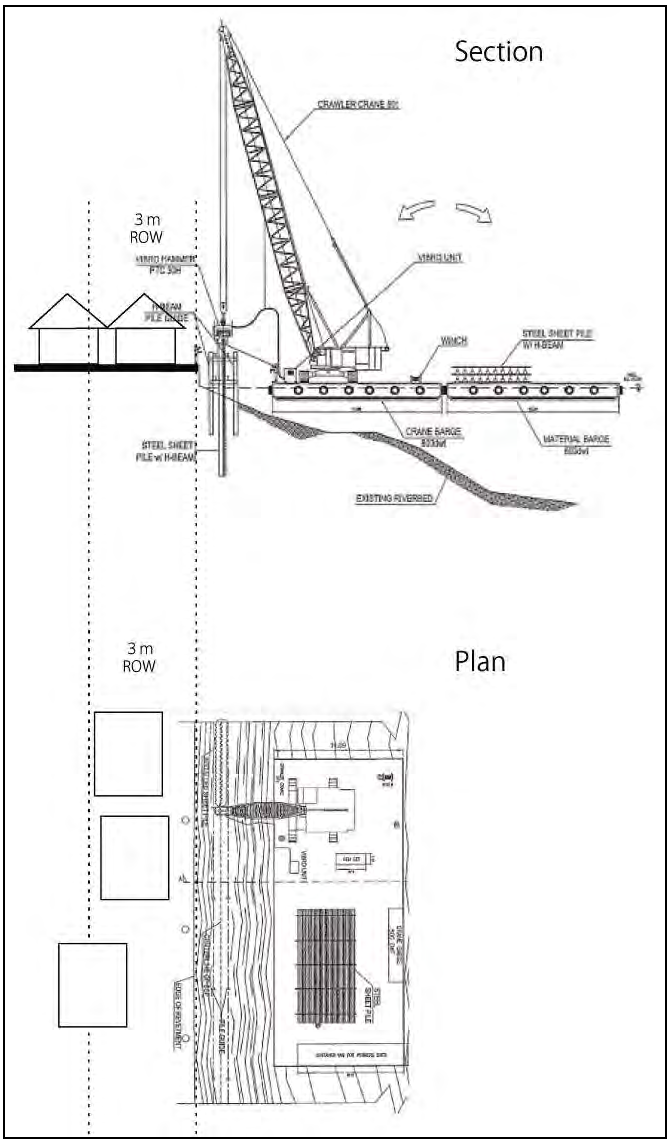
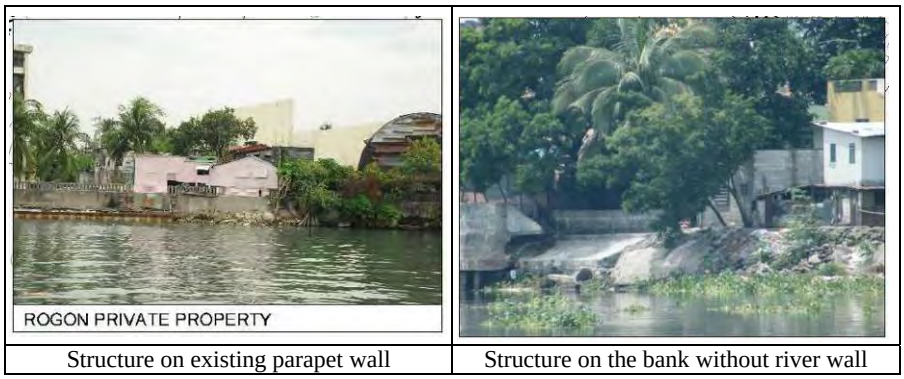


Figure 3.5.1 Typical Image of River Works on Pasig River



Structure on existing parapet wall	Structure on the bank without river wall

Figure 3.5.2 Existing Condition on Pasig River

Figure 3.5.3 Images of Similar Construction Work on Pasig River

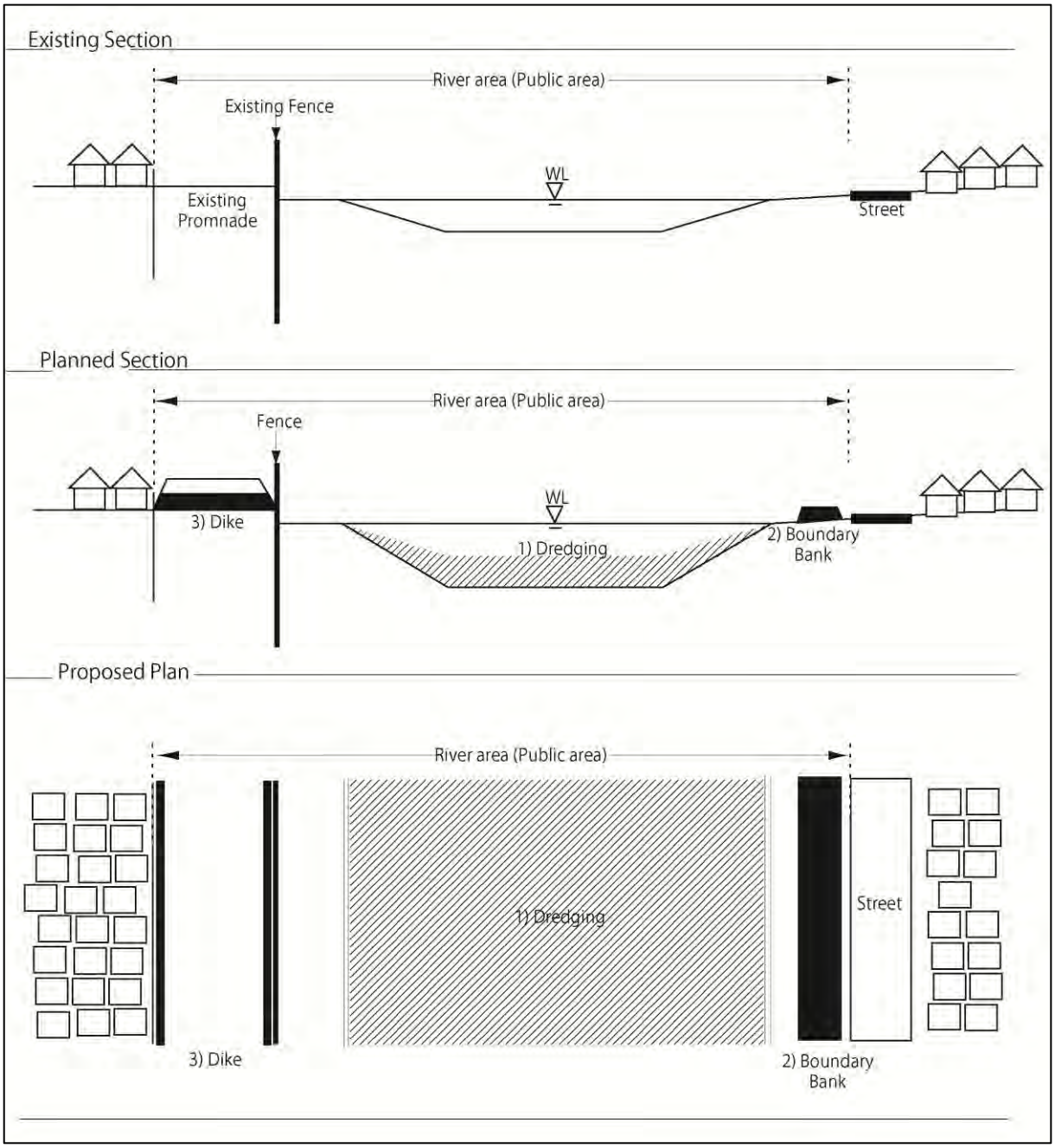


Figure 3.5.4 Schematic Image of River Works on Lower Marikina River

At the foot of Rosario Bridge	Existing outer wall of High School	Existing promenade

Figure 3.5.5 Existing Condition on Lower Marikina River

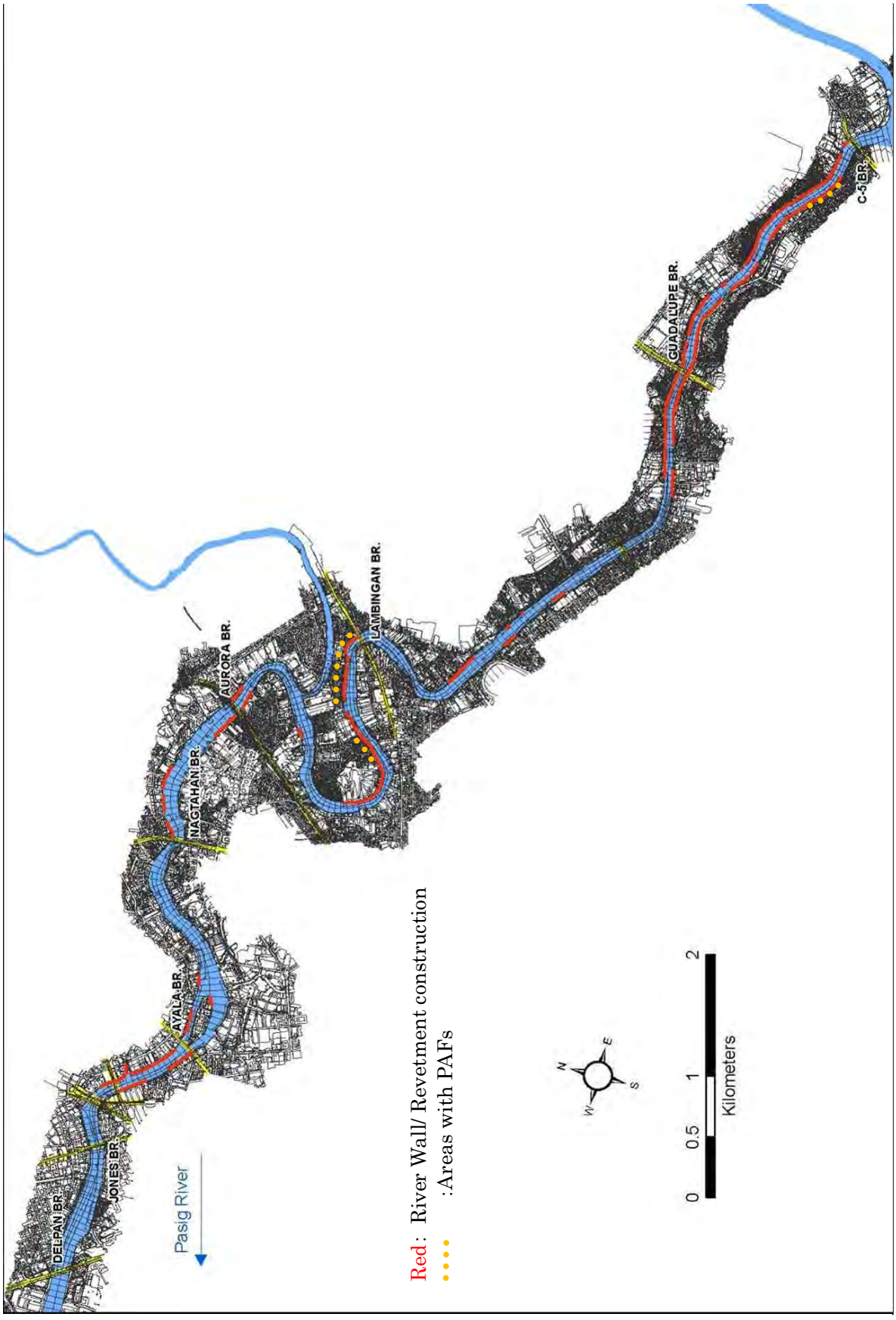


Figure 3.5.6 Proposed River Works on Pasig River (Draft, as of Feb. 18, 2011)

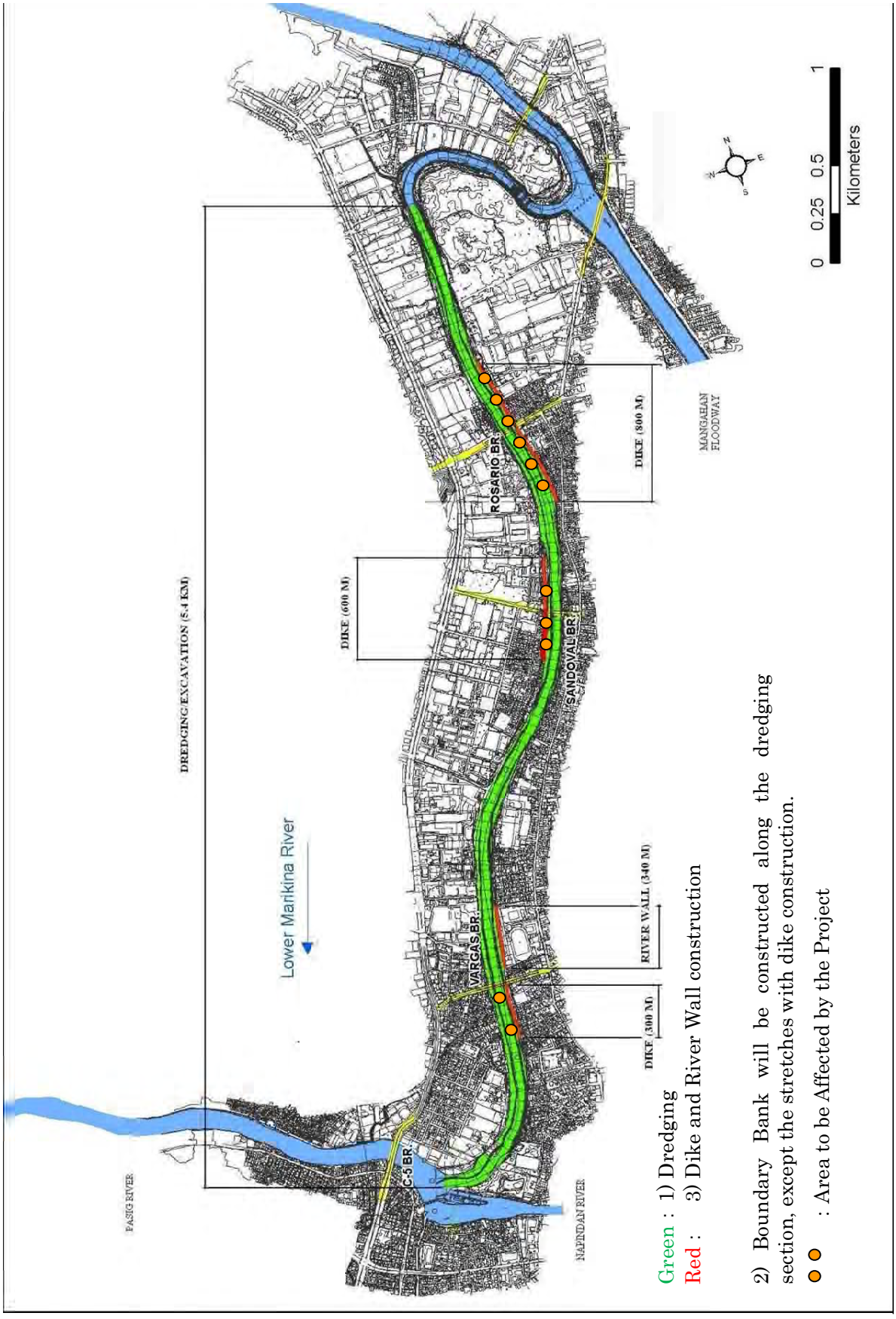


Figure 3.5.7 Proposed River Works on Lower Marikina River (Draft, as of Feb. 18, 2011)

3.5.2 Potential Impacts

(1) Identification of the Project Components that Give Rise to Resettlement and their Zone of Impact

The resettlements of the Project Affected Families (PAFs) and compensation for improvements are mainly caused by the implementation of the project.

The proposed structures will be constructed within the existing river channel area. There are existing structures/improvements, cultivated lands within the river channel will be affected by the construction activities. Moreover, at the some sections, construction activities for the construction of revetment with steel sheet pile foundation will affect on the existing houses on the easement of river banks.

Dike will be constructed at the existing promenades (river parks). However, promenades will be reconstructed on the dike, with slopes, stairs, pavements and street lights. During construction, temporary access roads from promenade side to the existing houses will be provided, in addition to the access at the city-side of the houses, so no loss of access to residence are expected.

Besides the promenade, there is are no public infrastructures and social service facilities to be affected by the Phase III Project.

The river channel area belongs to the government. There is no permanent acquisition of private land. Only temporary acquisition of lands will be needed for the contractors' yards.

(2) Identification of the Alternatives Considered to Avoid or Minimize Resettlement

The Pasig-Marikina River flows in the center of Metro Manila which is a capital of the Republic of the Philippines. Both banks of the river are currently the urban area and occupied with residential houses, factories, offices, roads, etc.

To increase the flow capacity of river channel for flood control, measures of widening, deepening, heightening of river wall, short-cut of channel were alternatively studied.

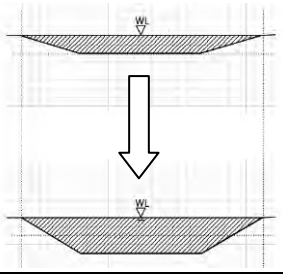
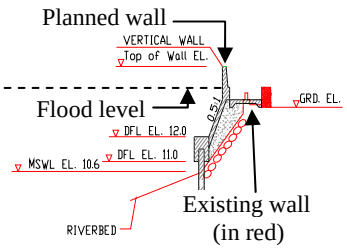
To avoid or minimize the social problem of land acquisition and resettlement, the alternative measures such as (b) deepening of existing river channel (dredging) and (c) construction of higher river walls within river channel are applied for the Phase III Project.

At both river sections, construction materials, machines, and equipments will be brought in and out using river transportation. Most part of the construction works will also be operated using equipments on barge. With this operational plan, temporal resettlements are avoided during the construction works.

Table 3.5.1 Identification of the Alternatives Considered to Avoid or Minimize Resettlement

Goal	Alternatives		Chosen work plan *(Reason for rejection)*
To increase the flow capacity of river channel	a	Widening of channel	*(Land acquisition necessary. Number of resettlement will increase)*
	b	Deepening of channel	Yes
	c	Heightening of river wall	Yes
	d	Short-cut of meandering river channel	*(Land acquisition necessary. Number of resettlement will increase)*
To avoid and minimize the social problem and project cost from land acquisition and resettlement	e	Use of ground transportation and operation on ground.	*(Will cause regional traffic congestion. Will cause temporal relocation of residents at and along access roads.)*
	f	Use of river transportation and barges for construction materials, machines, equipments, and construction works.	Yes

Table 3.5.2 Schematic Images of the Alternatives Considered to Avoid or Minimize Resettlement

		
a. Widening of river channel will require large scale resettlement of formal and informal settlers, businesses, and public facilities.	**b. Deepening of river channel will increase flow capacity without obstacles on ground.**	**c. Heightening of river wall will increase flow capacity without obstacles on ground, and will prevent flood water from overflowing into urban area.**
		
d. Short-cut of meandering river channel will bring the flood water faster down to ocean and effective for flood control, but it requires large scale resettlement of formal and informal settlers, businesses, and public facilities.	e. Use of ground transportation will cause regional traffic congestion with more than 100 dump trucks on regional major roads (mainly 2-lane) per day, and operation on ground will need access road for heavy equipments and stock yard on ground which cause temporal relocation of residents at and along access roads and near river bank.	**f. Use of river transportation and barges for construction materials, machines, equipments, and construction works will minimize disturbance on ground. Impact on regular river transportation is also expected to be minimal.**

Bold : Selected for the Project

3.5.3 Objectives of the Resettlement Action Plan

The Resettlement Action Plan (RAP) for the PMRCIP (Phase III) was formulated to ensure a just compensation and peaceful relocation procedure prior to the commencement of the project in accordance with the appropriate and applicable laws, policies and/or guidelines of the country as well as taking into consideration the policies/guidelines of the International Financing Institution particularly the World Bank and JICA's resettlement guidelines/policies for social considerations, and other related institutions.

The objective of this RAP are as follows:

- Provide project impact assessment to the Project Affected Families (PAFs);
- Quantify the private and public properties which shall not be taken for public use without just compensation;
- Present a strategic scheme/plan to ensure proper resettlement of the PAFs in a timely manner;
- Recognize and consider the involvement of the PAFs in the implementation of the RAP;
- Provide necessary resources that may be needed, particularly the funds needed for the social component of the project which include among other the cost for resettlement of the PAFs;
- Provide livelihood/income restoration.

3.5.4 Scope of Resettlement Impact

(1) Population Census

In total, there are 58 households and population of 204 of the informal settler families to be resettled, since all of them are expected to be affected by the construction works of the project[1]

Table 3.5.3 Number of PAFs / PAPs

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 – 10)	**2**	**148**	**150**	**-**	**204**	**204**

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.

Besides those residents, there are 16 absent structure owners. Detailed information about those absent owners is to be collected during the community participation process before the commencement of actual relocation activities. Along the Lower Marikina River, there are 74 households who are informally using river area for purposes such as cultivation, animal raising, and outdoor cooking. The scope of project and impact will be reviewed during the D/D in 2012.

Current Cut-Off date for this RAP is November 2010. According to the World Bank OP 4.12, the census data will be updated in case no resettlement activities are started in each barangays after 2 years of the Cut-Off Date, which is November 2012.

Table 3.5.4 Dates of Census Commencement (Cut-Off Date)

River	City	Barangay	Starting Date
Pasig River	Manila	894, 897	12 Nov. 2010
	Manila	896, 900	13 Nov. 2010
	Makati	West Rembo	18 Nov. 2010
Lower Marikina River	Pasig	Ugong	5 Nov. 2010
	Pasig	Bagong Ilog	
	Pasig	Maybunga	
	Pasig	Caniogan	4 Nov. 2010

(2) Land and Asset Survey

There is no permanent acquisition of private lands or procedure to change the ownership of land necessary for implementation of the Project.

The Project requires temporary use of 2 parcels of private land for material storage, etc during the construction phase.

Affected structures, improvements, gardens, and trees are required to be removed 100 %. There will be no 'marginally affected structures'.

Table 3.5.5 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 3.5.6 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 3.5.7 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	29	580
Total		59	884

3.5.5 Legal Framework

The objectives of the legal framework are to ensure that all affected households will be compensated for their losses and provide with rehabilitation measures, in order to assist them to improve, or at least maintain, their pre-project living standards and income generating capacity.

(1) 1987 Constitution of the Republic of the Philippines Art. XIII, Section 10 : Eviction and Demolition

The following provisions in the 1987 Philippine Constitution will serve as the basic legal foundation of resettlement policies.

Article II, Section 10: The State shall promote social justice in all phases of development.

Article II, Section 11: The State values the dignity of every human person and guarantees full respect for human rights.

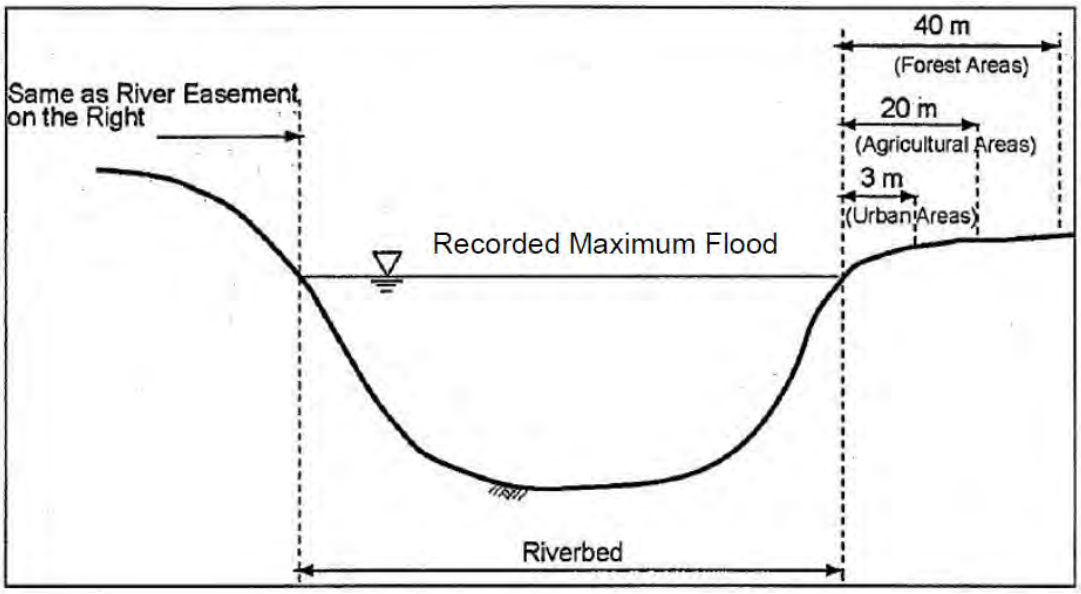
Article III, Section 9: Private property shall not be taken for public use without just compensation.

Article III, Section 11: Free access to the courts and quasi-judicial bodies and adequate legal assistance shall not be denied to any person by reason of poverty.

Article XIII, Section 10: Urban or rural poor dwellers shall not be evicted nor their dwellings demolished, except in accordance with the law and in a just humane manner. No resettlement of urban or rural dwellers shall be undertaken without adequate consultation with them and the communities where they are to be relocated.

(2) Presidential Decree NO. 896, otherwise known as the Water Code of the Philippines Article 51 : River Easement

The banks of rivers and streams and the shores of the seas and lakes throughout their entire length and within a zone of three (3) meters in urban areas, along their margins, are subject to the easement of public use in the interest of recreation, navigation, float, fishing and salvage. No person shall be allowed to stay in this zone longer than what is necessary for recreation, navigation, floatage, fishing, or salvage or to build structures of any kind.



Source: Manual on Maintenance of Flood Control and Drainage Structures, 2005, Department of Public Works and Highways

Figure 3.5.8 River Easement for Non-flood Control Area

(3) Republic Act 7279. Urban Development and Housing Act of 1992

(a) Government Infrastructure Project

Based on Section 28 (b), eviction or demolition as a practice are discouraged, however, it may be allowed when government infrastructure projects with available funding are about to be implemented.

Table 3.5.8 Legal Base for Eviction and Demolition Related to Government Infrastructure Projects

Republic Act 7279 otherwise known as the "Urban Development and Housing Act of 1992"
SECTION 28. Eviction and Demolition. — Eviction or demolition as a practice shall be discouraged. Eviction or demolition, however, may be allowed under the following situations: (a) When persons or entities occupy danger areas such as esteros, railroad tracks, garbage dumps, riverbanks, shorelines, waterways, and other public places such as sidewalks, roads, parks, and playgrounds; (b) When government infrastructure projects with available funding are about to be implemented; or (c) When there is a court order for eviction and demolition.

(b) Resettlement Sites

Section 29. The local government unit, in coordination with the National Housing Authority, shall provide relocation and resettlement sites with basic services and facilities and access to employment and livelihood opportunities sufficient to meet the basic needs of the affected families.

Socialized housing or resettlement areas shall be provided by the local government unit or the National Housing Authority in cooperation with the private developers and concerned agencies with the following basic services and facilities:

(a) Potable water;

(b) Power and electricity and an adequate power distribution system;

(c) Sewerage facilities and an efficient and adequate solid waste disposal system; and

(d) Access to primary roads and transportation facilities.

(c) Livelihood Component

Section 22. To extent feasible, socialized housing and resettlement projects shall be located near areas where employment opportunities are accessible. The government agencies dealing with the development of livelihood programs and grant of livelihood loans shall give priority to the beneficiaries of the Program.

(d) Participation of Beneficiaries

Section 23. The local government units, in coordination with the Presidential Commission for the Urban Poor and concerned government agencies, shall afford Program beneficiaries or their duly designated representatives an opportunity to be heard and to participate in the decision-making process over matters involving the protection and promotion of their legitimate collective interest which shall include appropriate documentation and feedback mechanisms.

They shall also be encouraged to organize themselves and undertake self-help cooperative housing and other livelihood activities. They shall assist the Government in preventing the incursions of professional squatters and members of squatting syndicates into their communities.

In instances when the affected beneficiaries have failed to organized themselves or form an alliance within a reasonable period prior to the implementation of the program of projects affecting them, consultation between the implementing agency and the affected beneficiaries shall be conducted with the assistance of the Presidential Commission for the Urban Poor and the concerned nongovernment organization.

(4) RA 8974. An Act to Facilitate the Acquisition of Right-Of-Way (ROW), Site or Location for National Government Infrastructure Projects (November 2000)

The above act provides the bases for land valuation for the acquisition of ROW Site or Location for National Government Projects through negotiated sale, expropriation and other mode of acquisition.

The law also states that valuation of the improvements and/or structures on the land to be acquired shall be based on the replacement cost which is defined as the amount necessary to replace the structure or improvement based on the current market prices for materials, equipment, labor, contractor's profit and overhead, and all other attendant costs associated with the acquisition and installation in place of the affected improvements/installation.

Standards to determine market value.

Negotiated sale between DPWH and the PAF based on the following standards to determine the market value:

- The classification and use for which the property is suited;
- The development costs for improving the land;
- The value declared by the owners;
- The current selling price of similar lands in the vicinity;
- The reasonable disturbance compensation for the removal and/or demolition of certain improvements on the land and for the value for improvements thereon;
- The size, shape and location, tax declaration and zonal valuation of the land;
- The price of the land as manifested in the ocular findings, oral as well as documentary evidence presented; and
- Such facts and events as to enable the affected property owners to have sufficient funds to acquire similarly-situated lands of approximate areas as those required from them by the government, and thereby rehabilitate themselves as early as possible.

In case of expropriation for Structures:

In the event that the PAF rejects the compensation for structures at replacement cost offered by DPWH, the Department or the PAF may take the matter to court. When court cases are resorted to either by DPWH through expropriation or by the PAFs through legal complaints, the DPWH will deposit with the court in escrow the whole amount of the replacement cost (100%) it is offering the owner for his/her assets as compensation to allow DPWH to proceed with the works. The PAF will receive the replacement cost of the assets within one (1) month following the receipt of the decision of the court.

(5) DPWH Policy and Guideline on Resettlement :

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

Criteria for Eligibility for Compensation Described in LARRIPP is as follows.

1. Landowners

a. Legal owners (agricultural, residential, commercial and institutional) who have full title, tax declaration, or who are covered by customary law (e.g. possessory rights, usufruct, etc.) or other acceptable proof of ownership.

b. Users of arable land who have no land title or tax declaration

c. Agricultural lessees

2. PAFs with Structures

a. Owners of structures who have full title, tax declaration, or who are covered by customary law (e.g. possessory rights, usufruct, etc.) or other acceptable proof of ownership.

b. Owners of structures, including shanty dwellers, who have no land title or tax declaration or other acceptable proof of ownership.

c. Renters

3. Indicators of Severity of Impacts

Properties to be acquired for the project may include the entire area or a portion of it. Hence, compensation for such assets or properties depends on whether the entire property will be affected or just a portion of it.

a. Severe – The portion of the property to be affected is more than 20% of the total land area or even less than 20% if the remaining portion is no longer economically viable or it will no longer function as intended. The owner of this property (land or structures, etc.) shall be entitled to full compensation in accordance to RA 8974.

b. Marginal – the impact is only partial and the remaining portion of the property or asset is still viable for continued use. Compensation will be on the affected portion only.

4. Compensation per category of assets affected.

The classifications or categories of assets to be compensated include Land, Structures, other Improvements and Crops, Trees and Perennials. Described below are the compensation and entitlements provisions for which the PAFs are eligible, per classification of assets affected.

(a) Compensation for Structures

i. Compensation in cash for the affected portion of the structure, including the cost of restoring the remaining structure, as determined by the concerned Appraisal Committee, with no deduction for salvaged building materials.

(b) Compensation for Other Improvements

i. Compensation in cash at replacement cost for the affected portion of public structures to government or non-government agencies or to the community in case of a donated structure by agencies that constructed the structure.

ii. Compensation to cover the cost of reconnecting the facilities, such as water, power and telephone.

(c) Compensation For Crops, Trees and Perennials

i. Cash compensation for perennials of commercial value as determined by the DENR or the concerned Appraisal Committee

ii. PAFs will be given sufficient time to harvest crops on the subject land

iii. Compensation for damaged crops (rice and corn) at market value at the time of taking. The compensation will be based on the cost of production per ha. pro-rata to the affected area.

iv. Entitlement for fruit-bearing trees will be based on the assessment of the Provincial or the Municipal Assessors where the project is located.

d. Other Types of Assistance or Entitlements

i. **Disturbance Compensation** - For agricultural land severely affected the lessees are entitled to disturbance compensation equivalent to five times the average of the gross harvest for the past 3 years but not less than P. 15,000.

ii. **Income Loss.** For loss of business/income, the PAF will be entitled to an income rehabilitation assistance not to exceed P 15,000 for severely affected structures, or to be based on the latest copy of the PAF's Tax record for the period corresponding to the stoppage of business activities.

iii. **Inconvenience Allowance** in the amount of P 10,000.00 shall be given to PAFs with severely affected structures, which require relocation and new construction.

iv. **Rehabilitation assistance** (skills training and other development activities) equivalent to P. 15,000 per family per municipality will be provided in coordination with other government agencies, if the present means of livelihood is no longer viable and the PAF will have to engage in a new income activity.

v. **Rental Subsidy**. Will be given to PAFs without sufficient additional land to allow the reconstruction of their lost house under the following circumstances:

a. The concerned properties are for residential use only and are considered as severely affected.
b. The concerned PAFs were physically residing in the affected structure and land at the time of the cut-off date.
c. The amount to be given will be equivalent to the prevailing average monthly rental for a similar structure of equal type and dimension to the house lost.
d. The amount will be given for the period between the delivery of house compensation and the delivery of land compensation.

vi. **Transportation allowance or assistance**. If relocating, PAFs to be provided free transportation. Also, informal settlers in urban centers who opt to go back to their place of origin in the province or be shifted to government relocation sites will be provided free transportation

(6) JICA policies on Involuntary Resettlement

The key principle of JICA policies on involuntary resettlement is summarized below.

1. Involuntary resettlement and loss of means of livelihood are to be avoided when feasible by exploring all viable alternatives.
2. When, population displacement is unavoidable, effective measures to minimize the impact and to compensate for losses should be taken.
3. 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.

4. Compensation must be based on the full replacement cost[2] as much as possible.
5. Compensation and other kinds of assistance must be provided prior to displacement.
6. 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.
7. 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.
8. Appropriate participation of affected people must be promoted in planning, implementation, and monitoring of resettlement action plans.
9. Appropriate and accessible grievance mechanisms must be established for the affected people and their communities.

Above principles are complemented by World Bank OP 4.12, since it is stated in JICA Guideline that "JICA confirms that projects do not deviate significantly from the World Bank's Safeguard Policies". Additional key principle based on World Bank OP 4.12 is as follows.

10. Affected people are to be identified and recorded as early as possible in order to establish their eligibility through an initial baseline survey (including population census that serves as an eligibility cut-off date, asset inventory, and socioeconomic survey), preferably at the project identification stage, to prevent a subsequent influx of encroachers of others who wish to take advance of such benefits.

11. Eligibility of Benefits include, the PAPs who have formal legal rights to land (including customary and traditional land rights recognized under law), the PAPs who don't have formal legal rights to land at the time of census but have a claim to such land or assets and the PAPs who have no recognizable legal right to the land they are occupying.

12. Preference should be given to land-based resettlement strategies for displaced persons whose livelihoods are land-based.

13. Provide support for the transition period (between displacement and livelihood restoration.

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[2] Description of "replacement cost" is as follows.

Land	Agricultural Land	The pre-project or pre-displacement, whichever is higher, market value of land of equal productive potential or use located in the vicinity of the affected land, plus the cost of preparing the land to levels similar to those of the affected land, plus the cost of any registration and transfer taxes.
	Land in Urban Areas	The pre-displacement market value of land of equal size and use, with similar or improved public infrastructure facilities and services and located in the vicinity of the affected land, plus the cost of any registration and transfer taxes.
Structure	Houses and Other Structures	The market cost of the materials to build a replacement structure with an area and quality similar or better than those of the affected structure, or to repair a partially affected structure, plus the cost of transporting building materials to the construction site, plus the cost of any labor and contractors' fees, plus the cost of any registration and transfer taxes.

14. Particular attention must be paid to the needs of the vulnerable groups among those displaced, especially those below the poverty line, landless, elderly, women and children, ethnic minorities etc.

15. For projects that entail land acquisition or involuntary resettlement of fewer than 200 people, abbreviated resettlement plan is to be prepared.

In addition to the above core principles on the JICA policy, it also laid emphasis on a detailed resettlement policy inclusive of all the above points; project specific resettlement plan; institutional framework for implementation; monitoring and evaluation mechanism; time schedule for implementation; and, detailed Financial Plan etc. (JICA Guidelines for Environmental and Social Considerations (April 2010 Appendix 1. Environmental and Social Considerations Required for Intended Projects).

(7) Gaps Between Philippines' Legal Framework and JICA Guidelines

The existing policy of the DPWH was prepared based on the World Bank resettlement policy.

Therefore, there is no significant difference between Philippines' legal framework and JICA Guidelines.

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.

3.5.6 Policy on Eligibility, Compensation and Other Entitlements

(1) Basic Policy

1. The Government of the Republic of Philippines will adopt the Project Resettlement Policy (the Project Policy) for the PMRCIP Phase III, since, the existing national laws and regulations have gaps with the JICA's policies and guidelines for involuntary resettlement.

The Project Policy aims to fill-in any gaps to enhance the resettlement program for the PAFs/PAPs taking into consideration the JICA policies/guidelines which will be helpful for them to at least rehabilitate/restore their social/economic condition the earliest possible time.

This section discusses the principles of the Project Policy and the entitlements of the PAPs based on the type and degree of their losses.

As mentioned earlier, gaps between the Philippine legal framework for resettlement and JICA's Policy on Involuntary Resettlement will be filled in by appropriate approaches designed which conforms to the Government and JICA's Policies, as follows.

2. Identify project design alternatives, if possible, to avoid and/or minimize the adverse social impact of the project such as land acquisition and/or involuntary resettlement.

3. When displacement of households is unavoidable, all losses of the PAPs (including communities) such as assets, livelihoods or resources shall be fully compensated as well as providing assistance to improve or at least restore their economic and social conditions.

4. Compensation and rehabilitation assistance/support shall be provided to any PAPs that include person, household or business who have the following, which might be affected by the implementation of the project:

   - Standard of living adversely affected;
   - Right, title or interest in any house, interest in, or right to use, any land (including premises, agricultural and grazing land, commercial properties, tenancy, or right in annual or perennial crops and trees or any other fixed or moveable assets, acquired or possessed, temporarily or permanently;
   - Income earning opportunities, business, occupation, work or place of residence or habitat adversely affected ; or
   - Social and cultural activities and relationships affected or any other losses that may be identified during the process of resettlement planning.

5. All affected people shall be eligible for compensation and rehabilitation assistance, regardless of tenure of status, social or economic standing.

   The PAPs shall no be hindered from compensation entitlements and rehabilitation measures due to lack of legal rights to the losses of assets, affected tenure of status and social or economic status.

   All PAPs residing, working, doing business and/or cultivating land identified to be affected by the project as of the date of the latest census and Inventory of Lost Assets (ILA) shall be entitled for compensation of their losses of assets at replacement cost. If possible, restoration of incomes and businesses shall also be provided with sufficient rehabilitation measures to assist them to improve or at least maintain their pre-project living standards, income-earning capacity and production levels.

6. For those affected portion of physical structures of the PAPs, they shall not be left out without any just and humane compensation.

7. People who will be temporarily affected by the project shall also be considered as PAPs with resettlement measures and/or plans.

8. The community to be affected by the development of a resettlement site shall be involved in the resettlement planning and decision-making to minimize the adverse impacts of the resettlement to the said community.

9. The design of the resettlement plans shall be in accordance with the Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy (LARRIPP) of DPWH (April, 2004) and JICA's Policy on Involuntary Resettlement.

10. Resettlement Action Plan translated in local languages shall be made available through brochures/leaflets, etc. for ready reference by the PAPs and other concerned groups and same shall be disclosed to the said PAPs.

11. Payment for land and/or non-land assets will be based on the principle of replacement cost.

12. Compensation for PAPs dependent on agricultural activities will be land-based wherever possible. In this Project, it is found that there is no PAPs dependent on agricultural activities.

13. Resettlement assistance will be provided not only for immediate loss, but also for a transition period needed to restore livelihood and standards of living of PAPs. Such support could take the form of short-term jobs, subsistence support, salary maintenance, or similar arrangements.

14. The resettlement plan must consider the needs of those most vulnerable to the adverse impacts of resettlement (including the poor, those without legal title to land, ethnic minorities, women, children, elderly and disabled) and ensure they are considered in resettlement planning and mitigation measures identified. Assistance should be provided to help them improve their socio-economic status.

15. PAPs will be involved in the process of developing and implementing resettlement plans.

16. PAPs and their communities will be consulted about the project, the rights and options available to them, and proposed mitigation measures for adverse effects, and to the extent possible be involved in the decisions that are made concerning their resettlement.

17. Adequate budgetary support will be fully committed and made available to cover the costs of land acquisition (including compensation and income restoration measures) within the agreed implementation period.

18. Displacement does not occur before provision of compensation and of other assistance required for relocation.

Sufficient civic infrastructure must be provided in resettlement site prior to relocation.

Acquisition of assets, payment of compensation, and the resettlement and start of the livelihood rehabilitation activities of PAPs, will be completed prior to any construction activities, except when a court of law orders so in expropriation cases.

Livelihood restoration measures must also be in place but not necessarily completed prior to construction activities, as these may be ongoing activities.

19. Organization and administrative arrangements for the effective preparation and implementation of the resettlement plan will be identified and in place prior to the commencement of the process; this will include the provision of adequate human resources for supervision, consultation, and monitoring of land acquisition and rehabilitation activities.

20. Appropriate reporting (including auditing and redress functions), monitoring and evaluation mechanisms, will be identified and set in place as part of the resettlement management system.

An external monitoring group will be hired by the project and will evaluate the resettlement process and final outcome. Such groups may include qualified consultants, NGOs, research institutions or universities.

Monitoring reports shall be forwarded directly to the JICA.

(2) Cut-Off Date of Eligibility

The cut-off-date of eligibility refers to the date prior to which the occupation or use of the project area makes residents/users of the same eligible to be categorized as PAFs/PAPs and be eligible to Project entitlements.

According to the DPWH Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy (LARRIP) and Infrastructure Right-of-Way (IROW) Procedural Manual, Cut-Off Date is the starting date of the Census work. Table 3.5.9 shows the Cut-Off Date for each barangay.

Table 3.5.9 Dates of Census Commencement (Cut-Off Date)

River	LGU	Barangay	Cut-Off Dates
Pasig River	Manila	894, 897	12 Nov. 2010
	Manila	896, 900	13 Nov. 2010
	Makati	West Rembo	18 Nov. 2010
Lower Marikina River	Pasig	Ugong	5 Nov. 2010
	Pasig	Bagong Ilog	
	Pasig	Maybunga	
	Pasig	Caniogan	4 Nov. 2010

This date has been disclosed to each affected barangay by the relevant LGU and the barangays have disclosed to their populations. The establishment of the eligibility cut-off date is intended to prevent the influx of ineligible non-residents who might take advantage of Project entitlements

Those listed as follows are not eligible for compensation.

1) Those who sold or bought the structures of PAFs after the cut-off date
2) Those who moved in after the cut-off date
3) Those who moved out after the cut-off date

(3) Principle of Replacement Cost

All compensation for land and non-land assets owned by households/shop owners who meet the cut-off-date will be based on the principle of replacement cost.

Replacement cost is the amount calculated before displacement which is needed to replace an affected asset without depreciation and without deduction for taxes and/or costs of transaction.

a. Existing regulations, methods and market price survey results of DPWH, DENR, DA, and LGUs will be used where ever available for compensation calculations for building, crops and trees.

b. Houses and other related structures based on actual current market prices of affected materials, labor and mark-up cost. Unit cost for the materials are updated every year, using standard price in each region. Labor cost is added as 25 % of the material cost. In addition to the total estimated direct cost, 20 % mark-up is included in the grand total of replacement cost, covering transfer cost and taxes.

c. Annual crops equivalent to current market value of crops at the time of compensation;

d. For perennial crops, cash compensation at replacement cost that should be in line with local government regulations, if available, is equivalent to current market value given the type and age at the time of compensation.

e. For timber trees, cash compensation at replacement cost that should be in line with local government regulations, if available, will be equivalent to current market value for each type, age and relevant productive value at the time of compensation based on the diameter at breast height of each tree.

3.5.7 Measures of Compensation and Assistance

(1) Compensation for Loss of Assets

(a) Compensation for Structures

Owners of structures, including shanty dwellers, who have no land title, but are able to present tax declaration document, receipt of payment for the structure, or Certificate of Title document or other acceptable proof of ownership of the structure to DPWH, shall be compensated by DPWH for full replacement cost assessed by the assessor of DPWH.

The total of 60 structures will be totally removed from existing locations. Out of the 60, 44 structures are owned by the resident PAFs, and 16 structures are owned by absent owners who live outside of project affected areas.

If the owner owns more than one structure, the owner will be compensated for all the structures he/she can prove legal ownership.

Renters, sharers and care-takers will not be eligible for compensation of the structure they live in.

(b) Compensation for Improvements, Crops and Trees

For the improvements, such as dog-pens, wells, outdoor toilets, fences and barges to be affected by the project, replacement cost shall be compensated using market material price and labor and transportation cost.

Also, there are PAFs without land title or tax declaration who cultivate public land (river area) and harvest perennial crops (vegetables) and tree fruits, or raising animals.

With those crop owners, DPWH shall notify the commencement date of the construction work to encourage them to harvest crops.

For those who own fruit trees and non-perennial crops, DPWH will compensate for them by cash according to current market price surveyed and publicized by DENR, LGU, or Agriculture Department unit cost, according to LARRIPP guideline. Before deciding the amount of compensation, however, DPWH will conduct its own survey on market price to validate the price.

(2) Livelihood Assistance

(a) Transportation Assistance

Relocated people will be provided transportation assistance for persons and assets.

(b) Inconvenience Allowance

Inconvenience Allowance in the amount of P 10,000 will be given to PAFs, both the owners of the structures and the renters with severely affected structures, which require relocation and new construction, as livelihood assistance.

(c) Rental subsidy

Rental subsidy, equivalent of 3-month's current rent, maximum P 15,000, will be given to Renters to be resettled.

(d) Livelihood Rehabilitation Assistance

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.

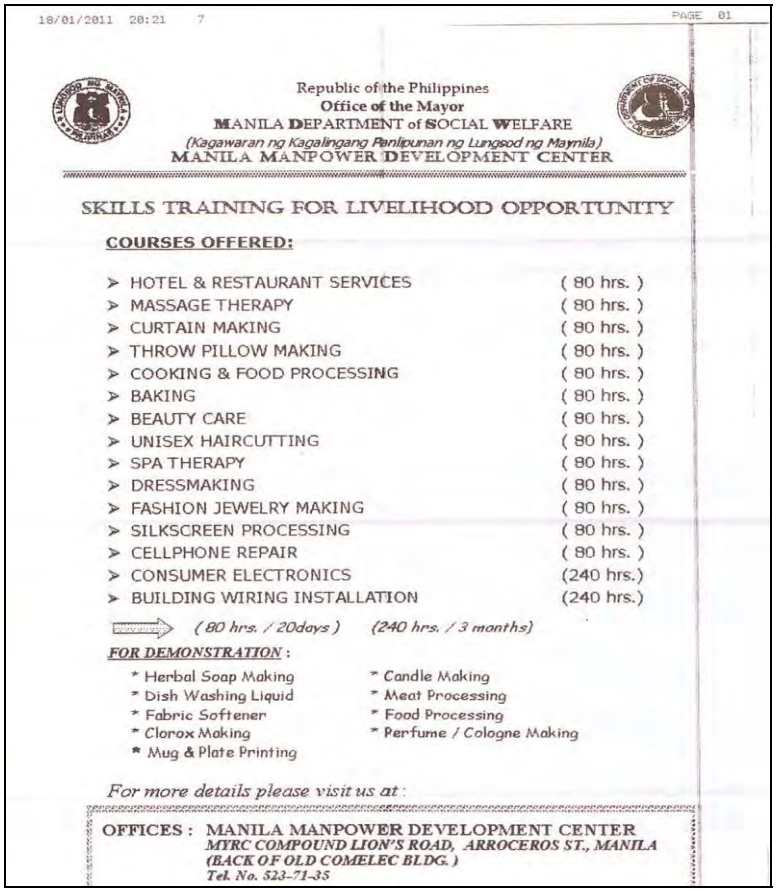
Livelihood rehabilitation programs will be coordinated by DPWH and LGUs considering various training programs conducted in the existing similar socialized housing sites, and opinions that will be expressed by the PAFs during the consultation in the implementation phase. For PAFs in DPWH Option, DPWH is responsible to fund for, and to find suitable partners that will help coordination and operation of those programs in 2012.

Agencies like the DA, DTI, TESDA, Cooperative Development Authority and others have extension programs that should be linked to the strategy. Figure 3.5.9 is a list of training courses given by Manila Manpower Development Center in 2011. All the courses are free of tuition and targeted at youths between 16 to 24 years old. NGOs in Metro Manila and Provinces where relocation housings are located also have significant expertise and resources that the project should utilize. Social welfare department of LGUs and NHA may also have useful information in finding suitable NGOs that can provide requested type of training.

In the development of livelihood rehabilitation program, DPWH shall work together with the assisting institutions and representatives of PAFs.

(3) Temporal Use of Private Land

Unused land parcels located along the bank of Pasig River and Lower Marikina River will be temporary used by DPWH for the material storage, work sites, etc., through renting or leasing. Required land parcels will be in two areas, about 7,500 m^2 each. Suitable land parcels will be chosen at the first part of the construction works in 2013.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Republic of the Philippines
Office of the Mayor
MANILA DEPARTMENT of SOCIAL WELFARE
(Kagawaran ng Kagalingang Panlipunan ng Lungsod ng Maynila)
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Figure 3.5.9 Examples of Livelihood Trainings

(4) Entitlement Matrix

Types of loss caused by the project implementation, entitled compensations and assistances, and qualification of entitled persons are summarized in the entitlement matrixes.

Entitlements adopted are based on the DPWH Land Acquisition, Resettlement, Rehabilitation and Indigenous Peoples' Policy (LARRIP), Infrastructure Right-of-Way (IROW) Procedural Manual, and JICA Guidelines for Environmental and Social Considerations 2010.

When there are PAFs who wishes otherwise, the PAFs may apply for the Resettlement Program provided by PRRC and Makati City, depending on the location of their current residency[3].

[3] Resettlement Programs offered by LGUs are summarized in table below.

PAF with legal ownership of the structure	Relocation to social housing site, or Financial Assistance based on RA 7279 or City Ordinance, and Free transportation of persons and belongings to relocation site if relocating to the social housing. Otherwise, free transportation of persons and belongings to places of the choice of PAF within the Metro Manila, or to original province.
PAF without legal ownership of the structure (Renters, Sharers)	Financial Assistance based on RA 7279 or City Ordinance. If social housing lots are available after allocation of structure owners, renters may be accommodated. And, Free transportation of persons and belongings to relocation site if relocating to the social housing. Otherwise, free transportation of persons and belongings to places of the choice of PAF within the Metro Manila, or to original province.

Table 3.5.10 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 owner **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
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. (Required land : two (2) parcels, about 15,000 m2 in total)	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 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.	DPWH
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

3.6 Mechanism of Land Development

Along the Pasig-Marikina River course, land development projects by both private and public sectors, some of which may cause unfavorable impacts in terms of flooding conditions, have been promoted rapidly. In this section, such land development projects are identified as well as the mechanism under which such land development may be allowed neglecting the unfavorable impacts. Then, improvement of the mechanism will be examined to minimize the unfavorable impacts.

3.6.1 Typical Examples of Unfavorable Land Development

In principle, the following typical cases of the land development are detected in the Pasig-Marikina river basin:

- 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 significant issues to be dealt with, while Case 3 may not be a remarkable serious issue at present, but expected to be significant in the near future.

(1) Case 1: Encroachment to River Channel

There are several examples of land utilization, which encroaches in the river channel hampering the smooth flow of flood discharge in the Pasig-Marikina river channel: (a) Circulo Verde Development Project, and (b). A Structure in front of Eastwood. The locations of such typical examples are as indicated in Figure 3.6.1

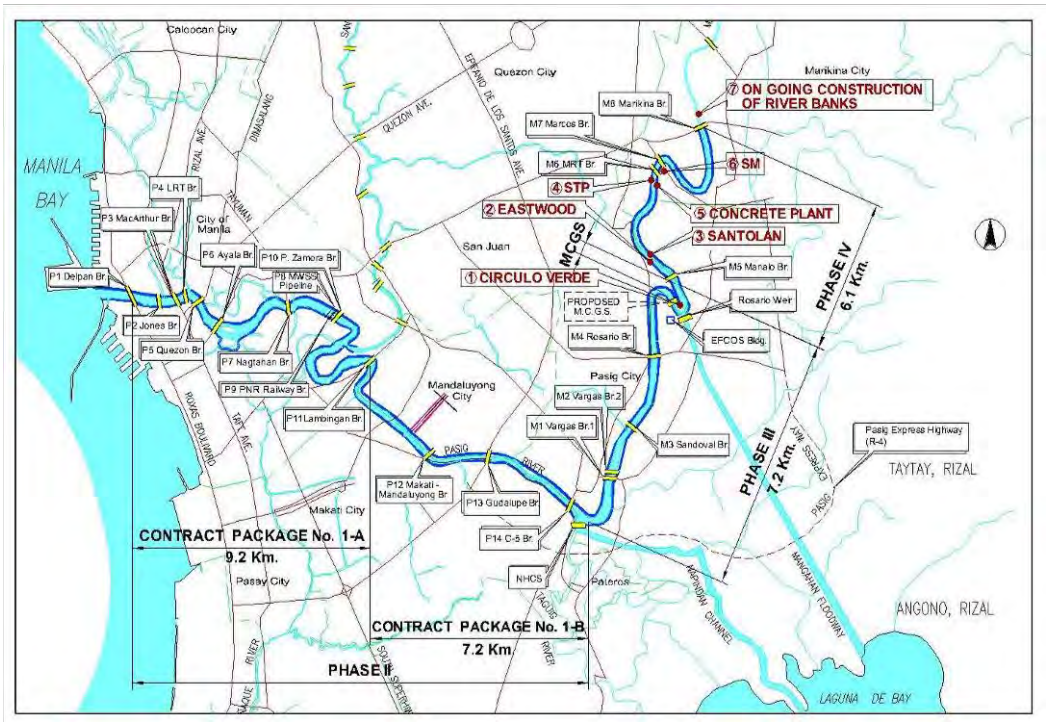


Figure 3.6.1 Location of Land Development Projects in Riverine Area

(a) Circulo Verde Development Project

Regarding this Circulo Verde Development Project (CV), disputes between DPWH and Ortigas & Company Limited Partnership (OCLP) engaged in this construction works have been brewing since 2009. For this land development, mainly, the following two problems have been identified:

- The cross section of Upper Marikina River is narrowed down by the river bank protection works of this land development (in the upper reaches of the diversion point to Mangahan floodway). As the result, flood discharge overflows near/around the upper reaches of the section. (Refer to Subsection 3.1.7.)
- The cross section of the terminal end of Lower Marikina River where the MCGS is proposed to be constructed to regulate the diversion flow toward Mangahan Floodway as well as Pasig River through Lower Marikina River is also narrowed down. As the result, the construction of MCGS could not be implemented at the originally proposed site and also flood may not be regulated under the design diversion ratio.

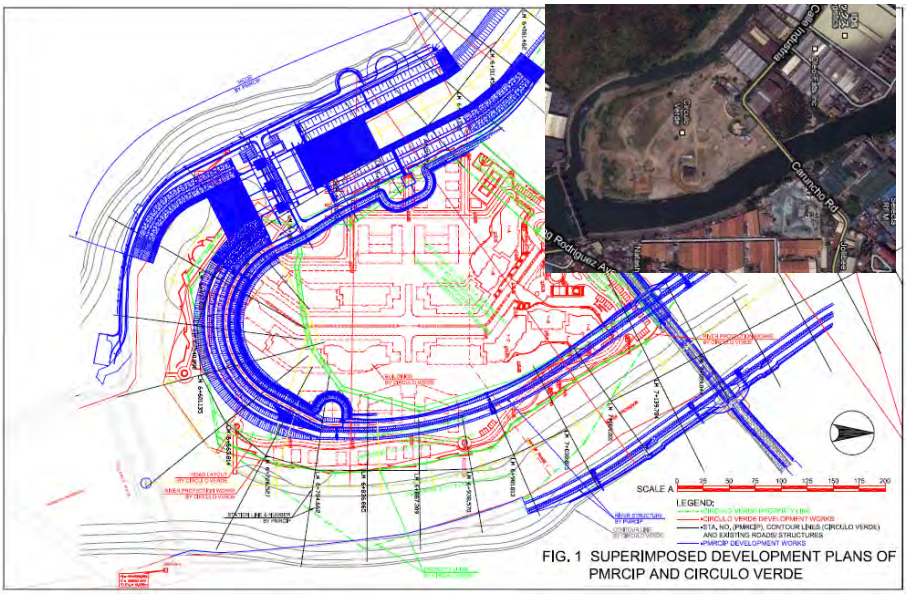


Figure 3.6.2 Circulo Verde Land Development Plan

Regarding the documentation for ECC and building permit, the CV project received the approval from DENR and the Quezon City Government in November 2008 and April 2009, respectively (refer to Table 3.6.1).

Table 3.6.1 Issuance Dates of ECC and Building Permit

Document	Development Project	The day of Issue	Remarks
Building Permit	Sue Mart in Marikina	Jan. 26 2007 (Permitted)	
	Sewerage Treatment Plan	Oct. 2 2008 (Permitted)	
	Cilculo Verde	April 17, 2009(Permtted)	Nov. 5, 2010 Work Stoppage by Quezon City
			(Concrete riverbank protection wall has not been issued by any building permit.)
			(Hence, the construction is in violation of the Building Code Sec. 301)
			(Ortigas and Company needs to secure the necessary building permit within 15 days upon receipt of this order.)
			* Quezon City asked Ortigas and company to endorse by DPWH for building permit (submit drawing)
	Cement Factory	-	No information available
ECC	Sue Mart in Marikina	Jan. 10, 2008	
	Sewerage Treatment Plan	Aug. 27, 2009	
	Cilculo Verde	Nov. 5, 2008	Nov. 5, 2008 (through LLDA)
	East Wood	Sep. 27, 1999	
	Cement Factory	-	No information available

For the above situations, DPWH issued a letter to OCLP on March 24, 2010 with the following contents in order to stop the bank protection works:

- According to the typical cross-section furnished by OCLP, construction of the protection works would constrict the portion of existing waterway of the Marikina River.
- The channel constriction will aggravate the flood situation upstream since flood levels will rise due to backwater effect, which was evident during Typhoon Ondoy.
- The CV project affects the project of MCGS (Marikina Control Gate Structure) and put to naught whatever widening schemes will be done on the Manalo Bridge to ease the flood levels upstream.

For these comments, OCLP replied in its letter dated April 21, 2010, as follows:

- The entire CV project and the riverbank protection works are all within the bounds of OCLP's property, and what are being undertaken are simply riverbank protection works (there are no reclamation works).
- According to DPWH plan, PMRCIP is still under evaluation by DPWH at this time, and in the event that PMRCIP is eventually implemented sometime in the future, the CV Project will only be affected in Phase III. In the meantime, it is critical for the CV Project that the riverbank protection works be implemented and completed as soon as possible.
- DPWH project office has once interposed no objection to the riverbank projection works.
- The riverbank protection of the CV Project is actually a better technical solution to the flooding problems cited as compared to the DPWH proposed scheme.

In response, DPWH issued to OCLP a letter dated June 3, 2010, with the following contents:

- DPWH reiterates the Department's previous position of not being able to grant OCLP's request for the issuance of necessary clearance/permit for the construction of the said riverbank protection works citing the numerous reasons mentioned in its previous letter.
- DPWH also emphasizes that the development works being undertaken by OCLP will greatly affect the succeeding phase of PMRCIP as it will constrict the existing waterway of the Marikina River, particularly, the location of the proposed MCGS.
- DPWH have observed that OCLP have continuously constructed the above river walls, despite DPWH request for OCLP's cooperation to harmonize OCLP's scheme with the DPWH's proposed plan.
- DPWH requested OCLP that the riverbank protection works be immediately stopped and/or removed at OCLP expense, since DPWH is already in its initial stages of requesting the funding institution for possible financing of the succeeding phase of the PMRCIP.

Based on the dispute, Quezon City issued a "Work Stoppage Order" in November 2010 for the following reasons: Concrete riverbank protection wall has not been issued any building permit. Furthermore, the Quezon City Government requested OCLP to obtain an endorsement from DPWH for the further issuance of a building permit for the river protection wall.

As of January 2011, it was scheduled that UP-NHRC, the agency entrusted by OCLP, will examine the influence of the river protection wall by April 2011 to confirm whether or not the CV project is acceptable. To date, however, no clear resolution of the dispute has been conveyed to the JICA Study Team from both entities concerned. Although the consequence of the dispute has yet to be clarified, it seems to be necessary that the issues on the current system causing these problems which may put to naught whatever improvement schemes will be done are resolved. The impacts caused by the CV project toward the PMRCIP Phase III stretch may not be severe so that this issue may not require urgent solution; however, it is desirable to settle the issue as early as possible and at least before arrangement of the Phase IV project which will follow after the Phase III project.

(b) A Structure in front of Eastwood

There exists a structure in front of Eastwood encroaching on the river channel, as shown in Figure 3.6.3. The width of the structure toward the river channel is about 15 m, while the river channel width is about 70m. Thus, this structure narrows the river channel width and causes inundation in the upper stream.

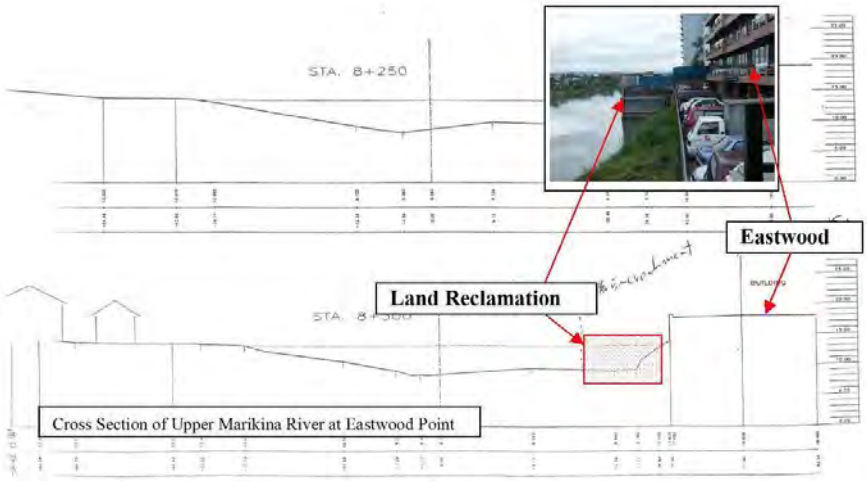


Figure 3.6.3 Land Development at Eastwood

Regarding the documentation for ECC, only that for a 20-storey residential condominium of Eastwood Property Holdings, Inc. located in a 900 m^2 lot issued in September 1999 was found. As for the other buildings and structures, nothing could be found. Thus, it is not clear if permits for the construction of such structures have been issued or not. Unfortunately, the responsible agency (Quezon City Government) had not recognized the existence of such structure as of October 2010 and investigation is to be conducted sometime in 2011.

(c) Construction of SM Mall

There exists SM Mall near Marcos Bridge in Marikina City, which was constructed in 2008 on part of the land of the design bank alignment. When the construction was discovered by DPWH, a consultation meeting was held with the Marikina City Government so as not to narrow the river channel through the modification of the mall design, but the SM Mall continued to be built according to its original design without any modification.

Regarding the documentation for ECC and building permit, the SM project received the approval from the Marikina City Government and DENR in January 2007 and January 2008 , respectively.

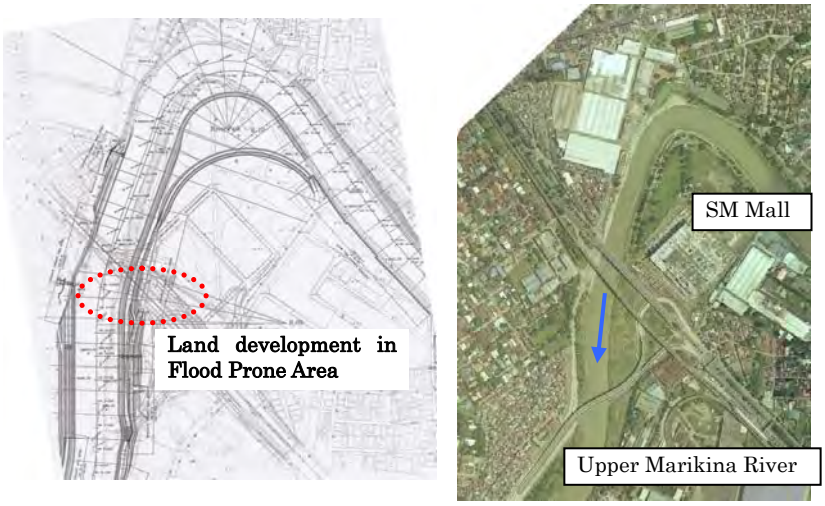


Figure 3.6.4 Land Development for SM Mall

(d) Ferry Station in front of Eastwood

In front of Eastwood, there exists one ferry station, which is not operational yet. Compared with the other ferry stations where the floating type of structures with less disturbance to flood flow were applied, the ferry station in front of Eastwood adopted the building on the reclaimed land which narrows the river section. Unfortunately, no document regarding ECC and building permit was available for the Study.

(e) Sewerage Treatment Plant near Marcos Bridge

Near Marcos Bridge, one sewerage treatment plant (STP) has been constructed, in which river bank alignment was planned. When the plan of construction of STP was scrutinized by DPWH, a meeting to modify the project layout was held, but the construction was completed under the original design.

Regarding the documentation for ECC and building permit, the STP project received the approval from the Marikina City Government and DENR in October 2008 and August 2009, respectively.

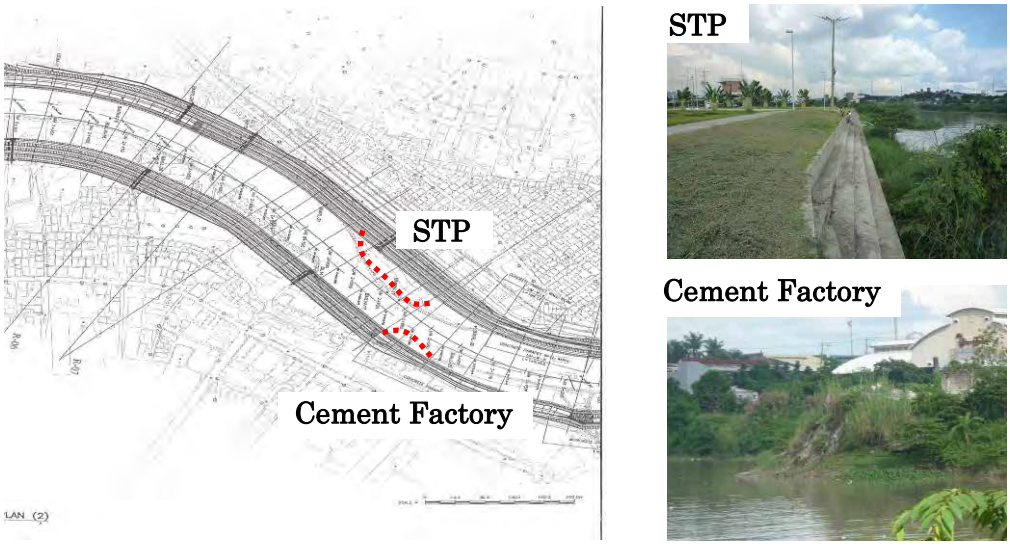


Figure 3.6.5 Construction of STP in the Riverine Area

(f) Encroachment by Informal Settlers

Issues on encroachment by informal settlers have been discussed among agencies concerned for a long time but the way to settle the issue is still far from the target in spite of the effort so far taken.

In case of Pasig-Marikina River, a large number of informal settlers have been relocated to the resettlement areas through the effort of agencies concerned including PRRC and LGUs. However, there are still remaining informal settlers along the Upper Marikina river course, especially in Santolan. The existence of these informal settlers results in the increase of flood damage and decrease of flow capacity of the river channel.

(g) Basic Idea to cope with the Development Issues

The development activities in the river area will, in general, cause the rise of water level in the channel upstream of from the development site, and the influences are as shown in the next table. The basic idea to cope with the development issues from the river planning points of view are the restoration of the previous original condition before development through demolition of the structures provided for the development and the promotion of river channel improvement works in accordance with the alignment proposed in the D/D (refer to the same table below).

However, it may not be realistic in certain development works to restore the previous condition, so that modifying the channel alignment is considered as the second option to keep the design water level at the original design.

Table 3.6.2 Basic Idea to deal with the Development Issues

Development	Maximum Water Rising	Extent of the Influence	Remarks	Basic Idea to deal with the Issues	
				1st Option	2nd Option
CIRUCLO VERDE Project	50.3cm	11.4km (over 1cm), 3.6km (over 10cm)	Largely affected. That is the high possiblity to endanger the upstream area and to change the	Restoration to previous conditions before development	-
East Wood	11.1cn	6.8km (over 1cm)	Affected	Do	-
		2.05km (over 5cm)			
SM Mole	1.0cm	200m (over 1cm)	Lightly affected	Do	Modification of Bank Alignment
STP (sewage facility)	9.5cm	6.58km (over 1cm)	Affected	Do	Modification of Bank Alignment
Cement Factory	2.5cm	2.5km (over 1cm)	Lightly affected	Do	

(2) Case 2: Land Development in Flood Prone Area

In general, land development is promoted in flood prone area minimizing the risk of flood damage through introduction of flood protection works. In the case of Pasig-Marikina River Basin, however, land development has sometimes been conducted in flood prone area without any consideration to the risk of flood damage; namely, without introduction of any flood protection works.

Such examples can be detected in several places along the Pasig-Marikina River course as listed below (refer to Figure 3.6.6):

- Tañong
- Malanday
- Nangka

Land development in these areas, where flood damage is expected even in a flood with the scale of only 5-year return period, has been promoted without any flood protection works, and thus it is natural that such areas habitually suffer from flood damage.

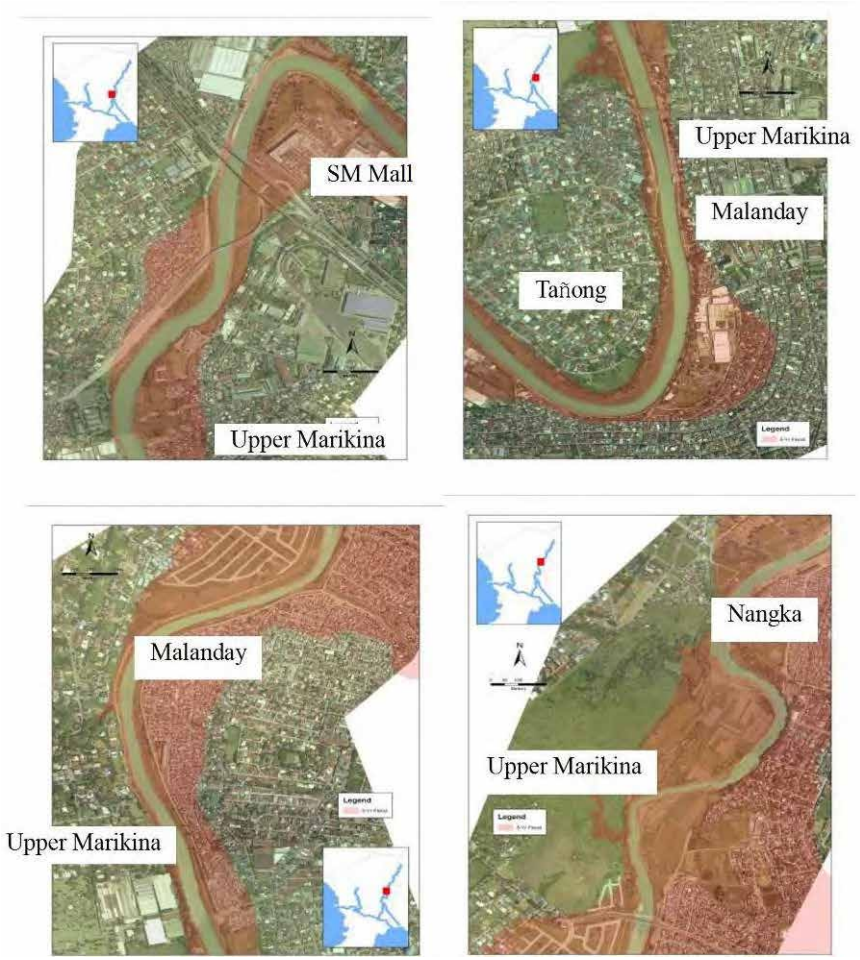


Figure 3.6.6 Images of Land Development in Flood Prone Area

These disorderly land developments should be controlled or land development should be conducted together with the provision of adequate flood protection works.

(3) Case 3: Land Development in Upper Areas of Pasig-Marikina River Basin

In the upper areas of the Pasig-Marikina river basin, land development for not only residential but also other purposes such as mining and logging has been promoted. Since urban areas are very limited in the downstream, the expansion of area for land development toward upstream is natural, and deforestation activities due to mining and logging will be continue unless strict control measures for such land development activities are taken.

These land development activities cause the loss of retention function of the upper river basin resulting in the increase of flood discharge and sediment. To alleviate such influence, it is necessary to take actions for the control of disorderly land development in the upper areas in advance before such activities in the upper basin are expanded.

Figure 3.6.7 Deforestation in the Upper Pasig-Marikina River Basin

3.6.2 Outline of Current Land Development Mechanism

At present, the current land development mechanism can be expressed, in general, as follows:

(1) Procedure for Formulation of Comprehensive Land Use Plan

As discussed in Section 2.2, Republic Act No.7160, the Local Government Code of 1991, mandates local government units to adopt a comprehensive land use plan and enact an integrated zoning ordinance. Republic Act No. 7279, Urban Development and Housing Act (UHDA) also mandates local government units, under Section 6 and 39, to prepare a comprehensive land use plan in pursuance of the objective of UDHA.

Under the mandate, the comprehensive land use plan in Metro Manila is formulated under the following agencies concerned:

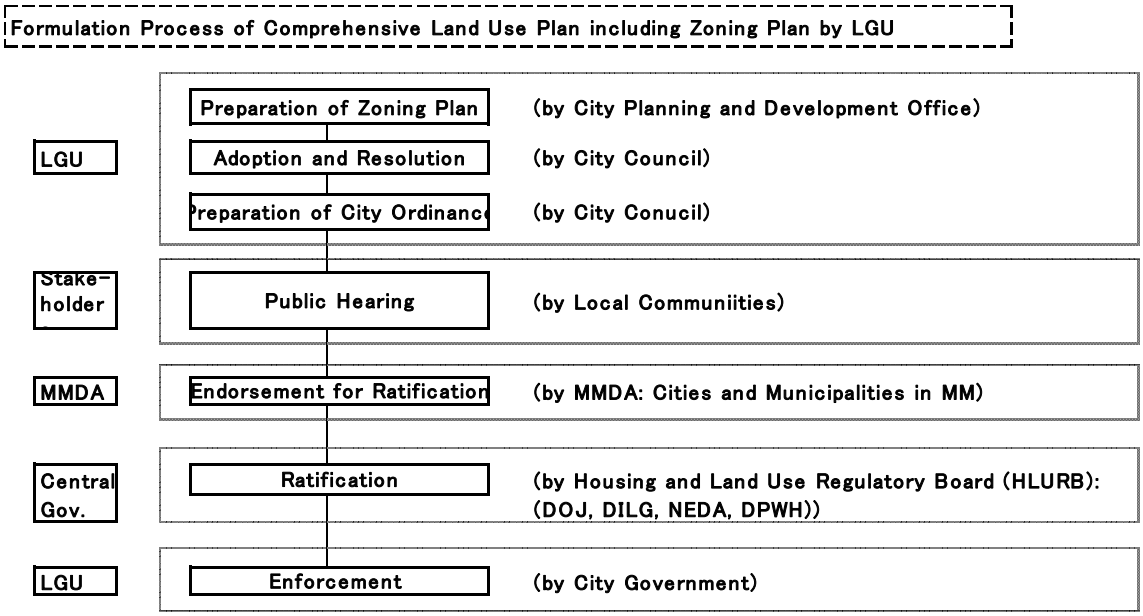


Figure 3.6.8 Procedure for Formulation of Land Development Plan

(2) Application and Approval for Land Use

Under the framework of the comprehensive land use plan, individuals, enterprises or the public apply a land use plan for each purpose and receive approval in the following procedure:

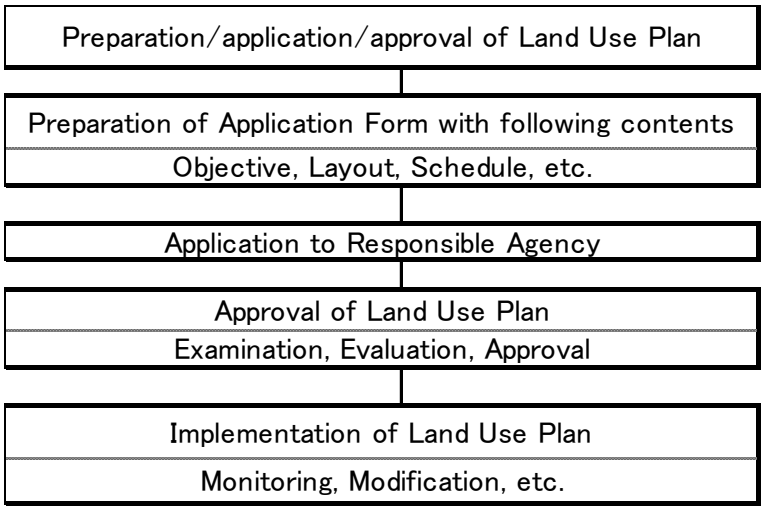


Figure 3.6.9 Process for Application and Approval of Land Use Plan

3.6.3 Issues on Current Mechanism

For the aforementioned land use mechanism, there are several examples on illegal activities and land development in flood prone areas without introduction of any flood protection works. Thus, there may be some issues in the current mechanism for land development.

(1) Interview Survey Results

To detect the issues, interview survey on the present process of land development was conducted for four (4) cities (Manila, Pasig, Quezon and Marikina), where examples of illegal land use have been observed along the Pasig-Marikina River. The outline of the interview survey results are as discussed below.

(a) Consequence of Land Development

Each city has prepared its land use plan in the 1990's (Manila and Quezon) or 2000's (Pasig and Marikina) and renewed individually under the following motivation; namely, increase of population, industrial and commercial development, introduction of national significant projects and so on.

As for the question on "the consequence of land development based on the land use plan," the answer of each city is as summarized below.

City Government	Answer	
Manila City	Consequence on land development arises if such development did not undergo strategic planning or if it fails to comply with a well-crafted and responsive Land Use Development Regulations, one of the consequences of which is the depletion of the carrying capacity of the land occupied by such development thereby creating adverse negative environmental impacts.	
Quezon City	✓Successful	Suspended
Pasig City	✓Successful	Suspended
Marikina City	✓Successful	Suspended

(b) Current Mechanism of Formulation of Zoning Plan

In principle, each city formulates its zoning plan together with its comprehensive land development plan, which are prepared by the office handling city planning, development and engineering in accordance with the stipulation in RA 7160.

As for the question "when the city prepares a zoning plan along the river course, is there any point to consider about flooding condition?", the answer from each city is as follows:

City Government	Answer
Manila City	In the preparation of a zoning plan along the river course, existing national laws and guidelines are being adopted like the Water Code of the Philippines, which stipulates the required easements on the banks of rivers and esteros.
Quezon City	Right-of-Way as per Water Code of the Philippines
Pasig City	Easement of 10.00 m is required along rivers and 3.00 m from creeks.
Marikina City	96 m river easement (total 186m); Road dike carriageway

Furthermore, for the question "Is there any issues of the current mechanism of preparation and formulation of a zoning plan?", the answer is as follows:

City Government	Answer
Manila City	Since clear-cut laws and guidelines regarding the zoning plan preparation and formulation process are present and there is no major significant issue regarding that matter. However, due to the concept of autonomy and decentralization set forth by the Local Government Code, issues on the ratification of zoning ordinance, the implementing tool of land use plan, emanate in the stage of approval and adoption of the zoning plan.
Quezon City	Creation of the zoning appeal and adjustment board
Pasig City	No Zoning Ordinance
Marikina City	Budget, public hearing and politics

(c) Application for Approval of Land Use Plan by Public Sector and Private Sector

Regarding the application for approval of land use plan applied from land users, the following questions are inquired: "When the responsible agency examines the application form, does it consider flood damage aspects and the impact of river channel conditions such as decrease of flow capacity and increase of flood damage? (Do you consult with river management agency?)"

The answers to these questions are as showing in the following table:

City Government	Question	Answer
Manila City	Consideration of Flood Damage	—
	Consultation	Consultations are made on case to case basis.
Quezon City	Consideration of Flood Damage	—
	Consultation	—
Pasig City	Consideration of Flood Damage	None
	Consultation	—
Marikina City	Consideration of Flood Damage	—
	Consultation	Yes, since Ondoy

Similarly, as for the question "Is there any issue on the current mechanism of examination and ratification of the application form", the answer is as follows:

City Government	Answer
Manila City	The major issues encountered on the current mechanism and ratification of the application forms are the shortage of human resources and financial difficulties.
Quezon City	None
Pasig City	Manpower
Marikina City	Political

For the question "Is there any idea to improve the current mechanism (evaluation, approval and monitoring", the answer is as follows:

City Government	Answer
Manila City	The mechanism is substantially responsive and effective but the resources are not sufficient.
Quezon City	Computerization and GIS
Pasig City	There is always room for improvement
Marikina City	None

(d) Restriction of Illegal Land Development Activity along the River Course

As for the question "Is there any exclusive section to monitor and control illegal land development activities (especially along/inside river course)?", the answer is as follow:

City Government	Answer
Manila City	Aside from several national agencies, a number of City line agencies are involved in monitoring and controlling illegal land development activities, like the CPDO Zoning Inspection Team, Building Official's Inspection Group, Department of Engineering and Public Works, among others.
Quezon City	Office of the Building Office
Pasig City	Building Official's office
Marikina City	Yes, River Banks Office, Marikina Settlement Office

For the question "Is there any regulation to control illegal activities in this city", the answer is as follows:

City Government	Answer
Manila City	The National Building Code of the Philippines (NBC) and City Ordinance 8119 are among the regulations being enforced to control illegal activities in Manila. Several measures such as imposition of penalties, imprisonment and closure of establishments are already stipulated in the cited regulatory laws.
Quezon City	Water Code / Anti-Squatting Law
Pasig City	Building Code
Marikina City	BPLO, Engineering Office, MSO

Then, for the question "what are the major issues on illegal land development activities?", the answer is as follows:

City Government	Answer
Manila City	The major issues encountered on the monitoring and controlling of illegal land development activities are the shortage of human resources and financial difficulties.
Quezon City	-
Pasig City	--Squatting
Marikina City	Squatting; Construction without Permit

(2) Issues identified from the Interview Survey Results

(a) Consequence of Land Development

As the engineering judgment by city engineer, every city evaluates, in general, that land development has been successfully promoted to meet with the requirement of the city, though it may create adverse negative environmental impacts partially.

(b) Current Mechanism for Formulation of Zoning Plan

(i) Consideration of Flooding Point

As for the point to consider about flooding conditions, city engineers apply the required easement on the bank and esteros based on the national law and guideline. Hence, as long as this point is strictly considered, the issues on land development, which may cause the adverse influence to flood conditions, can be at least minimized.

However, judging from the fact that there exists illegal land use along the river course, such situation may have been caused after the formulation of the zoning plan.

(ii) Issues recognized by City Engineers

As the issues recognized by city engineers, it is commented that issues emanate in the stage of approval and adoption of zoning plan as well as issues on budget, public hearing and politics and also creation of the zoning appeal and adjustment board. The answers imply that the zoning plan is formulated from not only the technical point of view but also political reasons.

(c) Application for Approval of Land Use Plan by Land Users

In the context of the zoning plan and comprehensive land use plan, land users apply the land utilization filling the appreciation form with supplemental materials and receive the approval from LGUs. In this process, the following points are taken up as the issues judging from the previous interview results:

- When the responsible agency examines the application form, it may not carefully consider about the flood damage aspects, although consultation with the river management agency is made on case by case basis.
- Mechanism itself is substantially responsive and effective, but the resources such as human and financial resources are not enough.
- Utilization of computer and GIS data is not enough.
- Existence of political power is also one of the issues.

(d) Restriction of Illegal Land Development Activity along the River Course

As for the restriction of illegal land development activity along the river course, the following issues are pointed out:

- In general, each LGU has an exclusive section to monitor and control illegal land development activity along the river course.
- The National Building Code of the Philippines has been enforced to control illegal activities including the stipulation on the imposition of penalties, imprisonment and closure of establishments.
- Again, it is pointed out that the major issues encountered by LGUs are the human resources and financial difficulties.

3.6.4 Consideration of Improvement of Current Mechanism

As discussed in the preceding Subsection 3.6.3, the following points on the current mechanism are summarized:

- In principle, the mechanism for the control of illegal land development has been set up in each LGU and serious defect cannot 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 such activities is pointed out.
- On the other hand, there is no specific law to designate the river area together with the responsible agency to manage and control illegal activities in the river area.

(1) Short Term Improvement

From the above discussion, it is necessary to solve one of the essential issues, i.e., "shortage of human and financial resources." In this context, to assure enough human and financial resources, the following scenario is conceived:

- It is necessary to recognize the necessity of controlling illegal land activities from the flood control point of view and give high priority to the settlement of issues. However, such recognition may be different among LGUs and the other agencies concerned.
- The different recognitions is because the influence of flood damage caused by such illegal activities may emerge in areas other than the original area where the illegal activity is taking place; namely, damage may emerge in another LGU's territory. (e.g. Influence by land development in Quezon City may emerge in the territory of Pasig City.)
- Therefore, it is necessary among LGUs as well as other agencies concerned to exchange information on such causes and influences by illegal land development activities in order to recognize or confirm the significance of influence on flood damage due to illegal land development activities.
- For the exchange of information among LGUs as well as the other agencies concerned, it is considered to establish a coordinating committee such as the flood mitigation committee (FMC), or to strengthen the capacity of existing organizations to perform such coordinating function in the Pasig-Marikina River Basin.
- Besides, information and educational campaign, which is proposed to be applied in the Study as one of the non-structural measures, will also contribute to monitor and control illegal activities in the river channel.

Through the setup of FMC or the strengthening of existing organizations as mentioned above, the following improvements are expected:

- Enough exchange of information on cause and influence by land development to flood damage among the LGUs and other agencies concerned.
- Enough recognition among the LGUs and other agencies concerned on the necessity to control disorderly land development.
- Assurance of human and financial resource sharing of the necessary human resources and expenses among the LGUs and other agencies concerned.
- As the result, the target of strict control of encroachment and disorderly land development can be achieved.

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

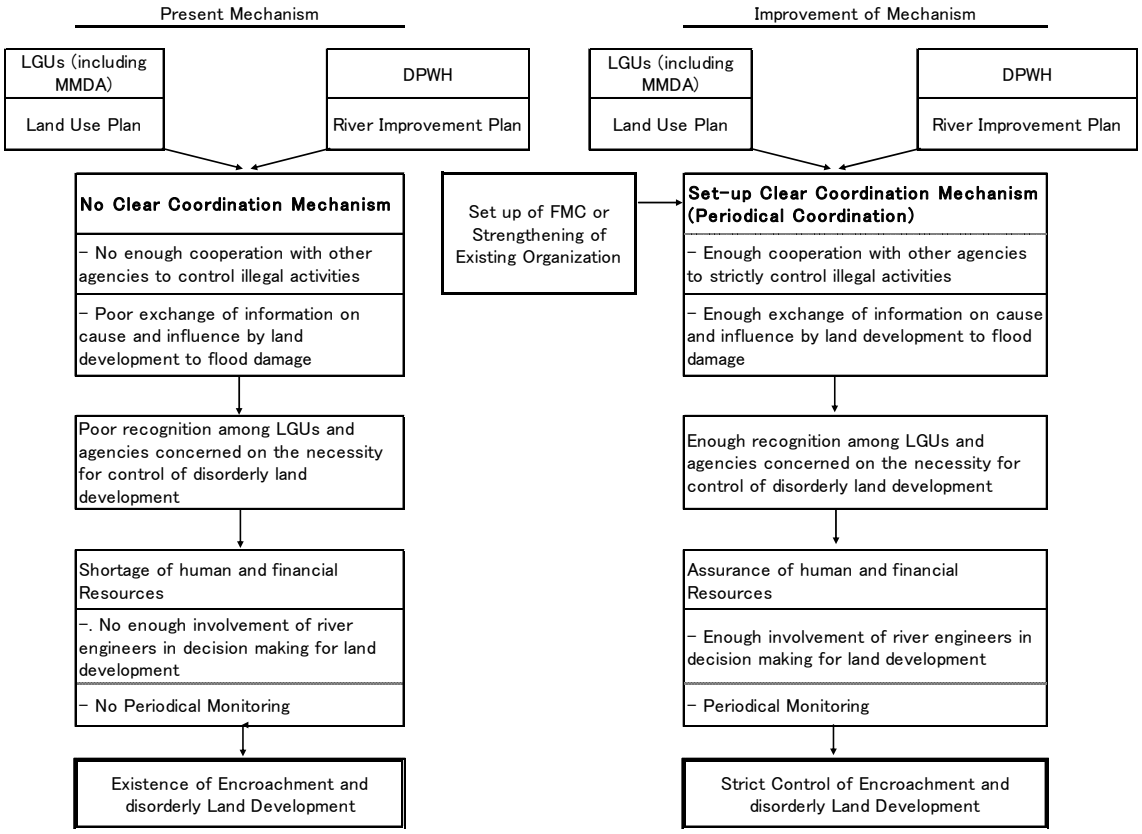


Figure 3.6.10 Basic Scenario for the Improvement of Current Mechanism

(2) Middle to 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 may cause adverse influence to the flooding condition, since these issues need to be urgently settled in parallel with the promotion of the PMRCIP. As for the measures to thoroughly solve these issues, it is necessary to promulgate a law which will designate the river range together with the responsible agency, like for example, "the Japanese River Law" from the middle and long-term views, since only the Water Code is currently available in the Philippines, in which the designation of river range as well as the responsible agency to manage the river channel is not clearly stipulated. Then, under such a new law, strict management of river channel can be achieved.

3.7 Arrangement of Flood Mitigation Committee

3.7.1 Necessity of Flood Mitigation Committee

(1) Necessity identified through Previous Studies

Based on past experiences regarding disaster prevention activities, there are several related issues as emphasized with the following lessons obtained through "The Study on Program Formulation in the Disaster Prevention Sector in the Philippines (JICA; March 2008)."

- Lessons Learned 1: Manner of River Improvement covering whole river basin requiring a long term
- Lessons Learned 2: Less direct contribution to poverty reduction
- Lessons Learned 3: Limited assistance to local community
- Lessons Learned 4: Less involvement of LGUs
- Lessons Learned 5: Limited coordination with other sectors

In connection with such lessons learned, the following composition of issues is detected as the summary of issues through "The Preparatory Study for Sector Loan on Disaster Risk Management in the Republic of the Philippines (JICA; January 2010)."

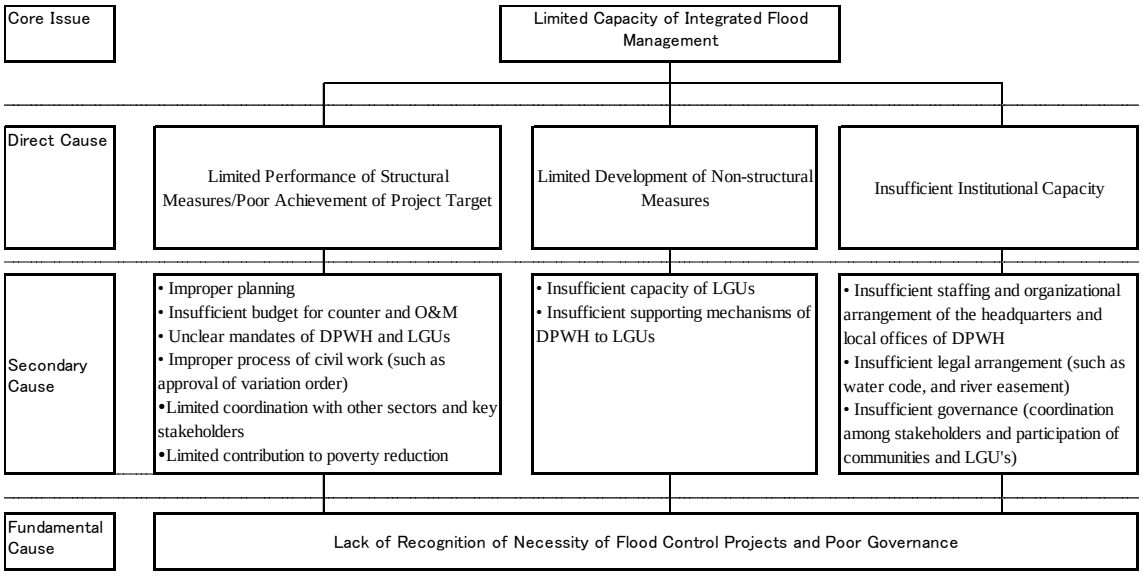


Figure 3.7.1 Core Issues and Causes regarding Disaster Risk Management

In the case of Pasig-Marikina River Basin, the necessity of a flood control project and appropriate governance which were pointed out as the fundamental causes of the core issues on the "limited capacity of integrated flood management," has been recognized through the severe flood damage caused by Typhoon Ondoy in 2009. Now is a great opportunity to resolve these issues which hamper the smooth promotion of a flood control project, since some of these issues are still observed in terms of disaster risk management in the Pasig-Marikina River Basin.

One of the significant points to improve these issues is to enhance the coordination and cooperation among stakeholders through the clarification of roles and responsibilities of each stakeholder. For this purpose, it is indispensable to setup a flood mitigation committee (FMC) or to strengthen the existing organization(s) to encourage, through adequate understanding and recognition of the necessity of the flood control project in the Pasig-Marikina River Basin, the prompt realization of the flood control project, as well as

the execution of Memorandums of Agreement (MOAs) which will specify the roles and responsibilities of each stakeholder concerned.

(2) Necessity identified through this Study

As discussed in Section 3.6, Mechanism of Land Development, it has been identified that setting up of a flood mitigation committee (FMC) in Pasig Marikina River Basin is necessary to control the disorderly land development. In addition, the necessity of the FMC shall be considered as to the following coordination:

- Coordination of necessary activities for the implementation of the project such as land acquisition, implementation of RAP, and monitoring of social and natural environmental issues.
- Coordination of necessary activities relating to implementation, operation and maintenance of the project.
- Coordination of the introduction and operation of nonstructural measures.
- Others

The necessity of the setup of FMC or the strengthening of existing organization is illustrated in the **Figure A3.7.1** in **ANNEX**.

3.7.2 Current Arrangement of Coordination Organization for Disaster Mitigation

In connection with the arrangement of the Flood Mitigation Committee (FMC) or the strengthening of existing organizations, it seems necessary to confirm the condition of the existing organizations concerned which will play similar roles of coordination for disaster mitigation (refer to **Table A3.7.1** in **ANNEX**).

(1) Nationwide Level of Arrangement

As the nationwide level of arrangement of the organization for coordination of disaster mitigation, there exist the following organizations:

- National Disaster Risk Reduction Management Council (NDRRMC)
- River Basin Control Office (RBCO)
- Flood Mitigation Committee (FMC)

(a) National Disaster Risk Reduction Management Council (NDRRMC)

As introduced in Section 2.5 of Chapter 2, this council, which previously existed as the National Disaster Coordination Council (NDCC), has been set up under Republic Act No. 10121 enacted in May 2010 in order to strengthen the Philippine disaster risk reduction and management system, providing for the national disaster risk reduction and management framework and institutionalizing the national disaster risk reduction and management plan, appropriating funds therefore and for other purpose.

Under the National Council, the Regional Disaster Risk Reduction Management Council (RDRRMC) in the regional level as well as the councils in the provincial, city, municipal and barangay level have been also set up.

(b) River Basin Control Office (RBCO)

The RBCO was established through Executive Order No. 510 dated March 5, 2006 as an agency attached to DENR. The RBCO is the core agency for the direction, control, regulation, rationalization and harmonization of all water related programs and projects, including those for flood mitigation.

The RBCO formulated the Master Plan of Nationwide Integrated River Basin Management and Development in 2007, and proposed the following items:

- The NWRB is to be reorganized into the Water Resources Management Bureau of DENR. Upon the reorganization, the functions of policy-making for water related programs and projects are likely to be transferred from the aforesaid NWRB to the RBCO.
- The River Basin Management Office (RBMO) and the River Basin Council (RBC) are to be newly established to strengthen the functions of the RBCO. The RBMO shall be the unit of DENR to support the roles of RBCO at the river basin level. On the other hand, the RBC shall be composed of representatives from the existing water related agencies serving as entities for policy governing and fund sourcing for the river basin program.
- The RBMO shall organize and facilitate the local multiple sector river basin committees and task forces.

(c) Flood Mitigation Committee

The Water Code of the Philippines (PD 1067) of 1976 is a decree instituting a water code, thereby revising and consolidating the laws governing the ownership, appropriation, utilization, exploitation, development, conservation and protection of water resources. Furthermore, the 2005 amended implementing rules and regulations (IRR) of the said Water Code provides that an inter-agency flood plain management committee (hereinafter, referred to as "FMC: Flood Mitigation Committee") for declared flood control area shall be formed by the Secretary of DPWH, with members from the representatives of concerned agencies.

The objectives of creating the said Committee are as follows:

- To lead all agencies and people for flood disaster mitigation;
- To integrate all efforts and investments to be effective for flood disaster mitigation; and
- To coordinate all activities related to flood and water resources.

The proposed NFMC consists of DPWH as chair with DENR as co-chair, while the members are DILG, NEDA, DA-NIA, PAGASA, NWRB, NHRC, PHIVOLCS, OCD-NDCC and the League of Governors. At the regional level, the RFMC consists of DPWH as chair with DENR as co-chair, while the members include NEDA, DA-NIA, Provinces, Cities, Municipalities and private sector representatives.

(2) Regional Level Arrangement for Coordination Organization of Disaster Mitigation to cover the Pasig-Marikina River Basin

In the case of regional level arrangement which can cover the Pasig-Marikina River Basin, the following existing coordination organizations are conceived to be utilized:

- Metro Manila Development Authority (MMDA)
- Regional Disaster Risk Reduction Council (RDRRC)
- Pasig River Rehabilitation Commission (PRRC)

(a) Metro Manila Development Authority (MMDA)

As outlined in Section 2.5 of Chapter 2, the Metro Manila Development Authority (MMDA) was created in May 1995 embracing 16 cities and one municipality (town), which covers most of the Pasig-Marikina river basin. The MMDA is responsible for services including planning, implementation and O&M of flood control projects. In

this connection, MMDA may have enough function to play the role as Flood Mitigation Committee.

(b) Regional Disaster Risk Reduction Management Council (RDRRMC)

Under Republic Act No. 10121, the Regional Disaster Risk Reduction Management Council (RDRRMC) is setup in each region including NCR. In the case of NCR, however, the RDRRMC is setup in MMDA while the RDCC is in NCR. The scope and functions of the RDRRMC are similar to the NDRRMC, but the territory covered by the RDRRMC is limited the area covered by MMDA.

(c) Pasig-River Rehabilitation Commission (PRRC)

As discussed in Section 2.5, the Pasig-River Rehabilitation Commission (PRRC) has been created to restore the Pasig River to its historically pristine condition including flood control function. In this connection, PRRC may have the function of FMC, though the coverage area at present is limited to the Pasig River and does not include the Marikina River Basin.

(3) Establishment or Proposal of Flood Mitigation Committee in other Basins

Besides the above, the following coordination committees relating to flood mitigation have been established or proposed in several river basins:

- Flood Mitigation Committee established in Ormoc City (Anilao and Malbasag river basins)
- Flood Mitigation Committee proposed in Iloilo
- Flood Mitigation Committee proposed in other river basins (Cagayan and Tagoloan river basins)

(a) Flood Mitigation Committee established in Ormoc

The City of Ormoc was devastated by Typhoon Uring in 1991, which resulted in the death of about 8,000 individuals and the destruction of nearly 14,000 houses, and costing nearly PHP620 million of damage to agriculture, livestock, fishery, commerce and infrastructure. The national government, through the DPWH, with funding support from the Government of Japan, embarked on the construction of flood control structures, river improvement and reconstruction of bridges.

When the project was completed, the city government accepted the responsibility of maintaining the structure when it was turned over by the DPWH. Maintenance activities performed by the city government include removal of deposits, vegetation control, repainting of steel components and enhancement of river environment.

The general strategy adopted by the LGU was the creation of a central coordinating body that oversees the monitoring and maintenance activities on the flood control facilities. Thus, the Flood Mitigation Committee (FMC) was created with the following responsibilities:

- Evaluate the magnitude of any damage during disaster or every other flood and recommend to the concerned agencies the appropriate repair and rehabilitation activities to be undertaken;
- Monitor the progress of maintenance, repair and rehabilitation activities;
- Act as the main coordinating body/council for all technical, physical and socially related activities of the two main rivers;

- Conduct regular monitoring activities for the river improvement structures at the Anilao and Malbasag rivers;
- Inform/recommend appropriate regular maintenance activities to all concerned agencies; and
- Collect and maintain data of the activities undertaken.

(b) Flood Mitigation Committee proposed in Iloilo River Basin

In Iloilo River Basin, the flood control project has been initiated by DPWH with JICA's financial assistance. The outline of the Project is as follows:

- The major contents of the project include river channel improvement and construction of diversion channel.
- For the construction of the project, DPWH has the responsibility and for O&M after completion, the responsibility will be turned over to the Iloilo City Government.
- To clarify the responsibility among DPWH and the Iloilo City Government, a Memorandum of Agreement (MOA) is to be executed between both agencies.
- Furthermore, to assure the realization of the MOA, it was proposed to set-up the Flood Mitigation Committee, which was under the preparation stage as of January 2011.

(c) Flood Mitigation Committee proposed in Cagayan and Tagoloan River Basins

(i) Background of the Project

The project was proposed under the "The Preparatory Study for Sector Loan on Disaster Risk Management in the Republic of the Philippines (JICA, January 2010)." As a follow-up to the proposed project, the dispatch of a short term JICA expert from April 2010 to November 2010 was arranged.

(ii) Setup of a Flood Mitigation Committee

The to setup flood mitigation committee (FMC) was proposed in accordance with the DPWH's "Procedural Guidelines on Project Cycle for Flood Risk Management" prepared in November 2010, which stipulates the creation of the Flood Mitigation Committee.

3.7.3 Consideration of Setup of Flood Mitigation Committee or Strengthening of Existing Organization

(1) Selection of Candidate Coordinating Organizations for Setting-up of Flood Mitigation Committee or Strengthening of Existing Organization

As discussed in the preceding section, there exist several coordination organizations on the nationwide and regional level covering the Pasig-Marikina River Basin and those to be set up or proposed for the other river basins. Among the existing ones, it seems realistic to select candidate coordination organizations from those of regional level covering the Pasig-Marikina River Basin; namely, MMDA, RDRRMC and PRRC, and newly set up an FMC for the Marikina River Basin.

(2) Conceivable Alternatives and Selection of Suitable Organization

For the above candidate coordination organizations, RDRRMC and MMDA can be regarded to belong to the same organization. Therefore, the following three case alternatives are conceived:

- Case 1: MMDA plays the role of FMC with the setup of a subcommittee in MMDA.

- Case 2: PRRC expands its coverage area to Marikina River Basin, together with strengthening of its existing function on flood control.
- Case 3: Setup of FMC for Marikina River Basin

Advantages and disadvantages of these cases are as shown in **Table A3.7.2** in **ANNEX.** To select the adequate one, a meeting with MMDA and the Study Team and another meeting with NDRRMC and the Study Team were held. The recommendations through these two meetings are as follows:

- Coordination among the agencies concerned in flood damage mitigation in Pasig-Marikina River Basin is essential.
- In principle, MMDA can play the role as FMC for Pasig-Marikina River Basin.
- However, MMDA does not substantially get involved so much in the work during the project stages from planning, D/D and S/V, which are in general handled by DPWH and, therefore, it is necessary to share the role of FMC with DPWH in these stages.
- In this connection, the FMC should be set up with the occasional participation of agencies concerned as necessary and chaired by DPWH during the project stages from planning to S/V and, after turning over to the finished project to MMDA for operation and maintenance, the FMC should be chaired by MMDA.

3.7.4 Setup of Flood Mitigation Committee (FMC)

The Setup of FMC is outlined as follows (refer to **Fig. A3.7.2 in the ANNEX**):

(1) Policy

In principle, the FMC to be established shall make every effort for the prompt realization and appropriate O&M of the flood control project which will consist of structural and nonstructural measures, as well as efforts to minimize unfavorable activities that will adversely influence the control of flood discharge and/or hamper the smooth flow in the river channel.

(2) Basic Function of FMC

FMC should in principle have the following two functions:

- To coordinate the activities of agencies concerned in issues related to flood control; and
- To issue instructions to responsible agencies to take necessary actions to cope with such issues.

(3) Role and Responsibilities of FMC

The FMC should have the following roles and responsibilities:

- To enhance/strengthen the publicity and awareness on the Project;
- To coordinate among LGUs to facilitate the activities for the resettlement and acquisition of ROW;
- To facilitate and assist in the introduction and operation of nonstructural measures by MMDA and the LGUs;
- To facilitate and assist in the monitoring of the O&M activities and all illegal activities for the Phase III stretch and potential areas in the Phase II stretch;
- To set-up a “query window” for the Project;

- To control the illegal land use and disorderly land development in the whole Pasig-Marikina River Basin; and
- Others

(4) Members of FMC

FMC should in principle be composed of members with the following roles and responsibilities:

(a) Composition of Members

- DPWH shall act as Chairperson of the FMC in the planning, detailed design and implementation stages, while MMDA will be the Chairperson after the turn-over of the finished project or during the O&M stage.
- As standing members of FMC, PRRC and LGUs in the cities of Manila, Makati, Mandaluyong, Pasig and Quezon directly related to the target stretches of Phase III and the potential areas in Phase II are to be included.
- As observer members, agencies concerned in flood risk management as well as river basin development such as DENR, LLDA, OCD, NEDA, HUDCC and PAGASA are to be involved.
- LGUs administratively related to the Pasig Marikina River Basin such as Marikina, San Juan, San Mateo, Antipolo, Tanay and Rodriguez are to be involved.
- LGUs administratively related to the Mangahan Floodway and the Napindan Channel such as the municipalities of Cainta, Taytay, Pateros and Taguig City shall also be involved.

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

Table 3.7.1 Members of FMC

Stage	Assignment	Name of Office
(Planning, D/D, Implement-ation 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	DENR, LLDA, OCD, NEDA, HUDCC, PAGASA and LGUs (Antipolo, Cainta, San Juan, Marikina, Rodriguez, Pateros, San Mateo, Taguig, Tanay and Taytay cities))
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)
	Observer Member	DENR, LLDA, OCD, NEDA, HUDCC, PAGASA and LGUs (Antipolo, Cainta, San Juan, Marikina, Rodriguez, Pateros, San Mateo, Taguig, Tanay and Taytay cities))

(b) Role and Function of Members

(i) Chairperson, Co-Chairperson and Standing Members

The Chairperson, Co-Chairperson and standing members shall in principle play the following roles:

- To hold periodical FMC meetings, as required;

- To discuss issues on the implementation and O&M of the PMRCIP Phase II and Phase III projects, including potential areas, as well as issues on encroachment and disorderly land development;
- To act as coordination body among the agencies concerned to search for or solicit solutions to the issues; and
- To issue instructions on the necessary solutions to the responsible agency/agencies and to request them to cooperate in implementing the solutions.

(ii) Observer Members

Observer members shall in principle play the following roles:

- To participate in FMC meetings, when required;
- To provide information, comments and solutions depending on the issues relating to the office of any observer member; and
- To cooperate in taking the necessary actions as instructed by the FMC.

(5) Organization of FMC

The FMC shall, in principle, be composed of one (1) committee, one (1) standing Secretariat, and one (1) query window, considering the following points of view:

- The organization with minimal requirement should be set up to achieve the above functions, roles and responsibilities; the early set-up and minimum cost shared by the agencies concerned are desirable.
- As the minimum requirement, committee meetings should be held periodically; therefore, a Secretariat, which shall be one of the standing members/organizations, needs to be arranged.
- A query window shall be arranged as one of the standing members/organizations.

(6) Holding of Periodical Meetings and other Meetings

Periodical meetings shall be held every two (2) months; other meetings shall be held as they become necessary.

(7) Budget and Source of Funds for the Operation of FMC

Operational expenses of FMC shall, in principle, be required, as follows:

- Expenses in holding periodical FMC meetings.
- Expenses for the activities of the Secretariat and the query window.
- Miscellaneous expenses

Funds shall be allocated as follows:

- For the issues relating to planning up to the construction implementation stage which will be chaired by DPWH, funds shall be allocated from the project's implementation budget.
- For the issues relating to O&M stage which will be chaired by MMDA, funds shall be allocated from the budget for O&M of MMDA.

(8) Further Consideration for the Set-up of FMC

In this preparatory study, the main target stretches of the project are the PMRCIP Phase III stretch and the potential areas in the Phase II stretch. In this connection, the FMC will be set up mainly to cope with the issues relating to the detailed design and implementation stage to be undertaken by DPWH, while the issues relating to O&M will emerge only after the

finished project is turned over by DPWH to MMDA. It should be pointed out that issues relating to encroachment and disorderly land development will exist continuously during both stages.

At present, the PMRCIP Phase II project is ongoing and expected to be completed in 2012. Therefore, the proposed FMC shall cover also the issues relating to the Phase II project.

Implementation Schedule (Tentative)

Project Pahse	Stage	2011	2012	2013	2014	2015	2016
Phase II	Implementation Transition O&M	———	----- ----------	------			
Phase III	D/D, Impl. Transition O&M		———				

Figure 3.7.2 Implementation Schedule of Phase II and Phase III

In this connection, the following alternatives are considered for the set-up of FMC:

- Case 1: FMC will cover only the Phase III project stretch
- Case 2: FMC will cover both the Phase II and Phase III project stretches

The FMC in Case 1 will cover only the D/D and construction implementation stage of the Phase III project stretch for the time being, while the FMC in Case 2 will cover not only the D/D and construction implementation stage of the Phase III project stretch, but also the O&M of the Phase II project stretch.

For these situations, the following two alternatives of composition of the FMC are conceived:

- Case 1: FMC will be composed of one (1) committee to cover all issues, and only the chairperson will change depending on the contents of the issue.
- Case 2: FMC will be composed of two (2) subcommittees: the first one to handle the issues during the planning up to the construction implementation stage and the second one, during the O&M stage.

The above two alternatives are as diagrammatically shown below:

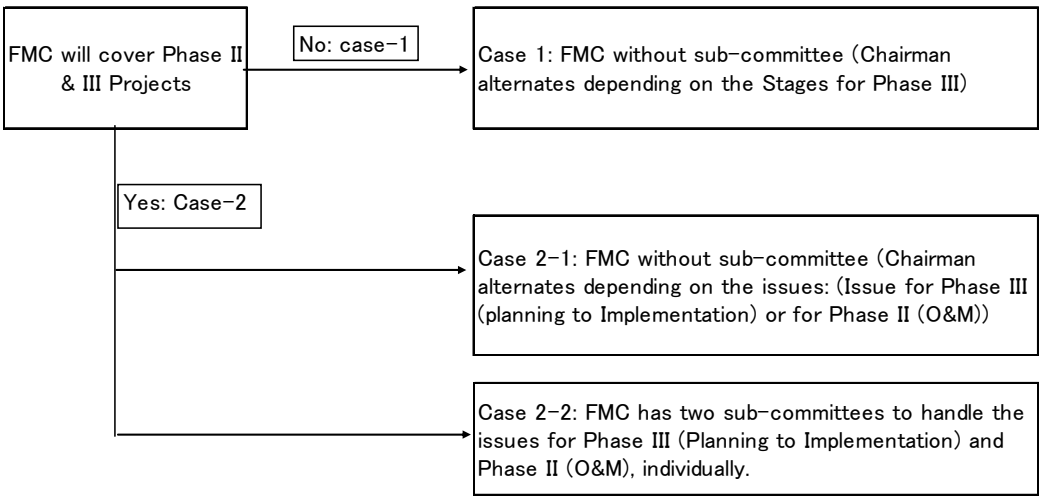


Figure 3.7.3 Diagram of Alternative Set-ups of FMC

Based on the considerations on the setup of FMC stated earlier above and considering also the above two cases, it is proposed to set up the FMC with only one committee for the the following reasons:

- The committee should be operated in a flexible manner with only one committee to cope with frequently emerging issues by simply alternating the chairperson depending on the issues concerned.
- The setup of two sub-committees is not preferable, since responsibilities may be transferred from one sub-committee to the other while the standing members remain the same.
- Therefore, the alternation of designated chairpersons would be enough through arrangements made by the Secretariat depending on the issues to be taken up in each of its meetings.

3.7.5 Timing for the Setup of FMC

The setup of FMC seems to be necessary before the financial arrangement is executed for the Phase III project to ensure that the responsible agencies would cope with the issues relating to land development as well as the implementation of the project and the O&M. In this connection, it is expected that of the establishment of the FMC should be finished by the time the loan agreement to apply the loan proceeds for the project is executed (by February 2012 according to the currently expected schedule, refer to Figure 6.3.1).

3.7.6 Other Information related to FMC

As discussed in the preceding Subsection 3.7.3, there are three (3) existing coordination organizations related to flood management: MMDA, RDRRMC and PRRC. Regarding the coordination organization related to the Pasig-Marikina River Basin, the following information has been newly obtained:

The Supreme Court of the Philippines had rendered a decision, under G. R. Nos. 171947 and 171948 on February 15, 2011, ordering the responsible agencies to clean up, rehabilitate and preserve the Manila Bay, and to take necessary actions to remove all informal settlers (ISs) along the rivers flowing into Manila Bay including the Pasig-Marikina River, which shall be fully implemented not later than December 31, 2015 (refer to **Table A 3.7.3** in **ANNEX**). To comply with the decision, DILG had established a task force to remove ISs and is preparing an action plan for the purpose. However, detailed information on the task force such as role, responsibility and the action plan were not obtainable during this Study.

In principle, the main objective of the task force is to improve the environmental condition of the Manila Bay as well as the river channels flowing into the Manila Bay and, therefore, the task force, which does not cover flood control issues as a primary purpose, may not be directly concerned with the FMC for Pasig-Marikina River proposed in this Study.

However, as far as control of disorderly land development along the river course as well as removal of ISs is concerned, it is expected that the target of the task force and FMC can be coordinated through the cooperation of agencies concerned. It is therefore necessary to clarify the similarities and differences through the collection of more information about the DILG task force such as role, responsibility and action programs for further coordination and cooperation with the proposed FMC.

3.8 Arrangement of Memorandum of Agreement (MOA)

3.8.1 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) on project implementation between the Central Government (DPWH) and the LGUs was initiated after the 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 concerned LGU after the completion of project construction by the DPWH.

As for the previously arranged MOA, the following issues are pointed out:

- No clear stipulation of responsibility in the legal arrangement;
- Insufficient consideration of river basin management and environmental improvement; and
- Insufficient budget for O&M and no source of funds to cover the O&M works.

To facilitate the implementation of project construction, it is necessary to improve the provision of previous MOAs considering the resolution of these issues. In this connection, a draft MOA has been arranged in the Study by referring to the contents of previous MOAs.

3.8.2 MOA arranged for the Phase II Project

The "Memorandum on Pasig-Marikina River Channel Improvement Project (Phase II)" was executed by JICA (then JBIC), DPWH and MMDA in July 2007.

(1) Contents of the Memorandum for the Phase II Project

The Memorandum consists of the following items:

- Description of the Project
- Implementation Plan
- Estimated Cost and Financing Plan
- Operation and Maintenance (O&M)
- Environmental Issues and Social Consideration
- Investment Coordination Committee (ICC) Clearance
- EIRR
- Budget Appropriation
- Coordination between DPWH and MMDA
- Expected Utilization of the Project Facilities and Expected Project Benefit
- Measures to be adopted and points which require special attention
- Progress Report
- Project Completion Report
- Ex-ante Project

(2) Description of Major Contents among the above Items

Among the above items, the three major contents are described, as follows:

(a) Operation and Maintenance (O&M) (Item 4)

MMDA shall take all the necessary measures to ensure proper and efficient operation and maintenance of the Project including securing budget, competent personnel and materials/equipment.

(b) Coordination between DPWH and MMDA (Item 9)

DPWH and MMDA shall establish a joint technical working group for the purpose of vitalizing coordination between both agencies. Members of the joint technical working group shall report to JICA (then JBIC).

(c) Measures to be adopted and points which require special attention (Item 11)

Resettlement: According to the latest schedule of the Pasig River Commission (PRRC), relocation will be completed by the end of 2007. DPWH shall submit a letter stating the completion of relocation or removal of the identified families from each barangay in the project area; namely, North Nagtahan, MJ Rizal, Punta, Blue Water and Vulcan. However, the latter three barangays have yet to be revalidated during the Review of Design Stage to determine whether these barangays are within the project area. The letter shall be submitted to JICA (then JBIC) immediately after the completion of relocation/removal, and submission of such letter is a condition for the concurrence of JICA on the contract for civil works in the related area. The letter stating the completion of relocation or removal of the identified families from Barangay San Agustin was submitted by PRRC to JICA on May 6, 2003.

3.8.3 Items included in the MOA for Phase III Project

(1) Reference Materials for Preparation of MOA

For the preparation of MOA for Phase III, the following materials in principle were made as reference:

- MOA between DPWH and the Municipal Government of Tagoloan prepared for the Tagoloan Flood Control Project as one of the Project Components of FLIMP Phase 1.
- Sample MOA prepared in the "The Preparatory Study for Sector Loan on Disaster Risk Management in the Republic of the Philippines (JICA; January 2010)."
- MOA prepared for the PMRCIP Phase II.
- Others

(2) Items stipulated in the above Reference Materials

Items stipulated in the above reference materials are as summarized in Table 3.8.1. As noticed from the table, the MOA for Tagoloan river basin is derived from the sample MOA and the items stipulated in both MOAs almost coincide with each other. In this connection, the items stipulated in the MOA for the PMRCIP Phase III were resourced from the MOA for Tagoloan and the MOA for the PMRCIP Phase II.

(3) Items to be involved in the Phase III Project

(a) Points for Consideration

To identify the necessary items to be involved in the Phase III project, the following points have been conceived with regard to reference materials:

- In principle, a MOA is prepared for a project implementation. In this connection, the MOA should at least cover items related to the project area of Phase III and the potential areas in Phase II. However, it is essential to consider the basin wide land development activities as well as other development activities which affect the flooding condition in Pasig-Marikina River Basin, so that some items related to the basin-wide area should be involved.
- According to the MOA prepared for the Phase II project, the role of LGUs represented by MMDA is limited to O&M works and to establish the joint technical working group with DPWH, while the MOA for Tagoloan stipulates the role of LGUs in more detail.
- It seems to be 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 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 the agencies concerned and to receive approval and agreement. However, it may take a long time to obtain signatures for 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 LGUs are obtained in a manner of "Individual Certification" to be executed between DPWH and each LGU.

(b) Items to be Included in MOA and Certificate

Considering the above points, the items to be included in the MOA and the Certifications will be as shown in the following tables:

Table 3.8.1 Items to be included in the MOA

Agencies		Items to be involved
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
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 on 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
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 3.8.2 Items to be included in Individual Certifications

Items to be involved		LGUs				
		Manila	Makati	Mandaluyong	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	○	○	○	○	○

○: Item involved in each LGU

*: Resettlement of currently existing I/Ss in Pasig City will be undertaken by the other resettlement program provided by Pasig City..

In principle, the MOA and the Certifications should be prepared covering the above items.

3.8.4 Timing of Execution of MOA

Execution of the MOA seems to be necessary before the financial arrangement for the Phase III project is finished to assure the roles and responsibilities of the agencies concerned in coping with the issues related to land development, as well as the implementation of construction of the Project and O&M. In this connection, it is considered that signing of the MOA should be finished at the time of establishment of the FMC; namely, by the time the loan application for Phase III Project is submitted (by November 2011, refer to Figure 6.3.1).

CHAPTER 4 PROJECT FORMULATION

4.1 Objectives of the Project

4.1.1 Objectives of the Overall PMRCIP Project

The objectives of the overall project are to mitigate the flood damage caused by channel overflow of the Pasig-Marikina River, to facilitate urban development, and to enhance the favorable environment along the river, as itemized below:

(1) To mitigate the frequent inundation or massive flooding caused by the overflowing of Pasig-Marikina River resulting in severe damages to lives, livestock, properties 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; and

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

The Pasig-Marikina River Channel Improvement Project has been envisioned to make a significant contribution to the achievement of urban environment for Metro Manila by means of rehabilitation of revetments along the Pasig Riverbanks in addition to the main purpose of flood control. The project activities including drainage outlet improvement along the river channel will bring about urban improvements in living conditions and public health standards for riverside communities.

4.1.2 Objective of the Phase III Project

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

4.2 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. To formulate the Phase III Project, the Detailed Design completed in 2002 and the results of review in 2008 are reassessed in this Study, considering the present site conditions.

Through the studies of the M/P, F/S and D/D, the overall flood control plan for the Pasig-Marikina River for a stretch of about 29.7 km from the river mouth to Marikina Bridge has been prepared. This plan consists of the construction of Marikina Multipurpose Dam and MCGS as well as channel improvement at the project scale of a 100-year return period flood.

For the urgent flood control of the Pasig River-Marikina River, it has been proposed that the river channel is to be improved aiming to increase its flow capacity in order to cope with design discharges of a 30-year return period as illustrated below.

Under the condition that the construction of MCGS is not included in the Phase III Project but to be 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.

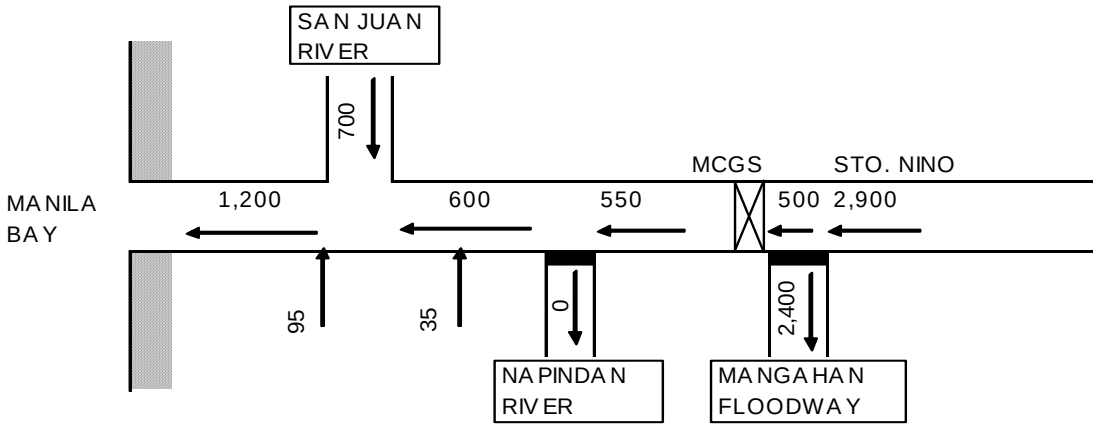


Figure 4.2.1 Design Discharge Distribution (30-Year Return Period)

4.3 River Improvement Plan of Pasig River and Lower Marikina River

The river improvement plan prepared in the Detailed Design was prepared 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, without any change, the said plan is applied for the Phase III Project. The basic plan of the Pasig-Lower Marikina River Channel Improvement Project is summarized, as follows:

(1) Design High Water Level (DHWL)

The currently applied design high water level for Pasig-Marikina River has been set through the detailed design stage (D/D) in 2002. Before the D/D, the structures provided in the Pasig-Marikina River Channel such as bridges, drainage facilities and navigation facilities were designed with reference to the ground height, recorded maximum flood level and so on around the site of each structure, leading to the provision of so many facilities and structures along the Pasig-Marikina River Channel.

In the detailed design stage, the Design High Water Level was set by mainly considering the following points:

- To minimize the effect to existing river related structures (bridges, drainage facilities, port facilities and navigation facilities).
- To minimize damage in case collapse of dike by minimizing the difference between the ground height and design high water level.
- To keep the design high water level within the 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.

Since the proposed structures related to Pasig-Marikina River will be provided based on the design high water level, it is assumed that this height will be maintained without any change in the future.

(a) Existing River Structures

In the Pasig-Marikina River, major existing river structures are bridges, drainage facilities, navigation facilities and so on. Among these structures, the condition of existing bridges and drainage facilities are as follows:

(i) Existing Bridges

At present, there exist 15 bridges across the Pasig-Marikina River as shown in **Fig. A 4.3.1** in **ANNEX**. The clearance of these bridges is in the range between 3.5m at minimum and 8.3m at maximum (refer to **Table A 4.3.1** in **ANNEX**).

On the other hand the regulated vertical clearance specified in Philippine Coast Guard (PCG) Memorandum Circular No. 05-97, the Navigation Clearance for Road Bridges of 3.75m (10ft) should be applied to Pasig-Marikina River for transportation by barge and, according to the interview survey with the PCG, the ideal vertical clearance between girder bottom and the highest water level actually required is 5.0m for the Pasig River (refer to **Table A 4.3.2** in **ANNEX**). As noted from the comparison between **Table A 4.3.1** and **Table A 4.3.2**, the design high water level has been set considering the preferable clearance, in general.

However, clearances of 7 bridges out of 15 are only between 10cm and 1m. (Ayala Bridge, which does not currently satisfy the clearance requirement, needs to be reconstructed, but there is no schedule at present.) Thus, it is very difficult to further raise the design high water level judging from the condition of these existing bridges.

(ii) Comparison with the Existing Drainage Facilities

Likewise, the design high water level has been set considering the height of existing drainage facilities. Along the Pasig-Marikina River, there are 12drainage facilities corresponding to almost every 1.5km as shown in **Table A 4.3.3** and the design features of these drainage facilities are as shown in **Table A 4.3.4**. As could be noted from these tables, the clearances of these drainage facilities are about 0.5m and only 0.1m at minimum. Thus, additional works are required for the replacement or adjustment of the height of existing drainage facilities to further heighten the design high water level, which would require and enormous cost (refer to **Fig. A4.3.2**).

(b) Consideration of Ground Height

In general, the design high water level along the river course is maintained at the ground height in order to minimize the flood damage potential in case of collapse of dike due to overflow flood. From this point of view, the design high water level has been set considering the existing ground height in the Pasig-Marikina River and the flood water level of a 30-year return period flood, as shown in **Fig. A 4.3.3** and **A 4.3.4**.

As noted from the figures, the water level of a 30-year return period flood almost corresponds to the average ground level of both banks, though there are some gaps depending on the site. Since the proposed structures in this river channel will be constructed with reference to this design high water level, it is considered that this design high water level will not be changed any further.

(2) Design Channel Alignment

Metro-Manila has been developed along the Pasig-Marikina river course since the ancient time where the area is fully utilized with houses, factories, commercial buildings and many infrastructures, so that the widening of river channel is almost impossible without drastically setting back the existing buildings or facilities. In this connection, the channel alignment follows the existing awkward river alignment, though it is desirable to modify the existing river alignment to smoothen the design alignment from the flooding point of view (refer to **Fig. A 4.3.5** in **ANNEX**). Since this channel alignment set-up in the Detailed Design Stage seems to be the limit, it is assumed that this alignment will be maintained without any change in the future.

(3) Design Longitudinal Profiles of Riverbed and DHWL

Pasig River, which is drains into Manila Bay, remarkably receives tidal influence and the flow capacity is not expected to increase so much by dredging and maintenance of the dredged river bed requires maintenance dredging 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, the riverbed of Lower Marikina River is required to be dredged for about 2m for navigation purpose and maintenance dredging also is required to assure the flow capacity of the Lower Marikina river channel which tends to decrease due to siltation by sediment from the upper stream judging from the increase of riverbed height from 1990 to 2002 by around 2-3 m. Considering this requirement and also the difficulty of heightening the design high water level, the following four (4) case alternatives were examined in the Detailed Design stage to increase the flow capacity:

- Case A: Dredging only
- Case B: Dredging with partial embankment accepting a certain area of inundation, since such inundation is to be confined in a certain range.
- Case C: Dredging with a wide range of embankment accepting a certain area of inundation, since such inundation is to be confined in a certain range.
- Case D: Dredging with embankment for all stretches where flood damage is expected.

It was finally concluded that Case B shall be employed from the practical viewpoint considering that a wide range of embankment would require a large number of relocation and is not acceptable. Thus, the design longitudinal profile was setup on the basis of dredging. Since river structures especially for navigation will be provided based on the design longitudinal profile of the channel, the longitudinal profile set-up in the Detailed Design stage seems to be maintained without any change in the future.

(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. The width of the lower Pasig River Channel downstream from the junction with San Juan River, except the sharp curve portion at the area of Sta. Ana, Manila, is generally designed with a design minimum width of 100m, while the upstream of the junction is designed with the minimum width of 60m. The design minimum width of Lower Marikina River is to be 90m.

(5) Design Freeboard

Freeboard is applied to the design of flood control structures corresponding to the design discharge in accordance with the "Design Guidelines, Criteria and Standard" of DPWH, as follows:

Table 4.3.1 Design Discharge and Freeboard of Flood Control Structures

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

The freeboard of 1.0 m is applied to the Pasig River where the design discharge is between 1,200 m^3/s and 600 m^3/s, while the freeboard of 1.0 m is applied to the 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.

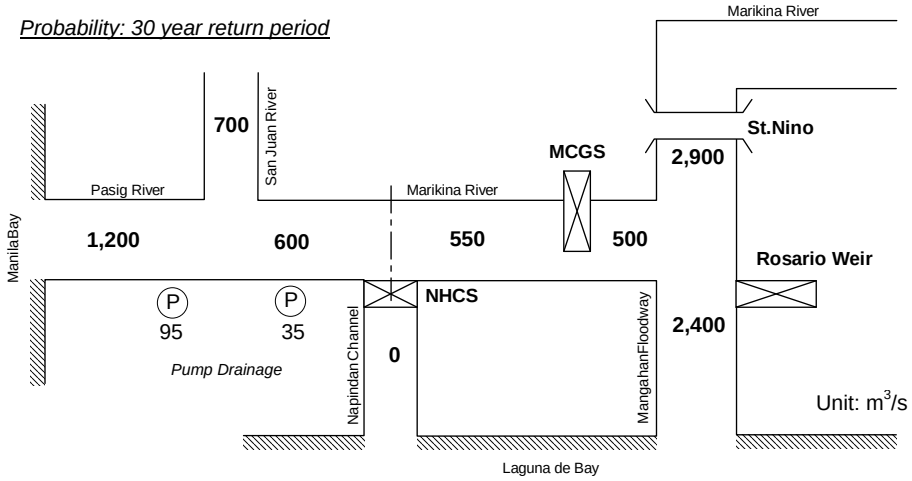
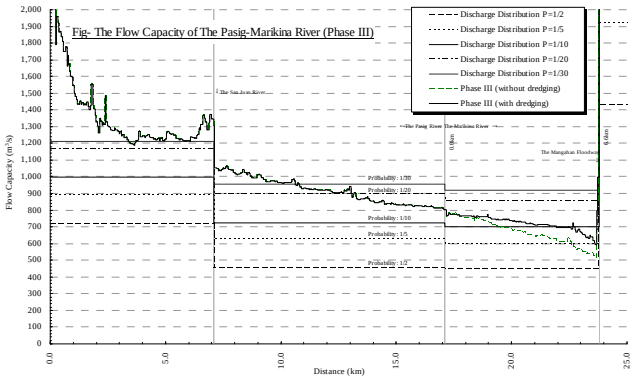
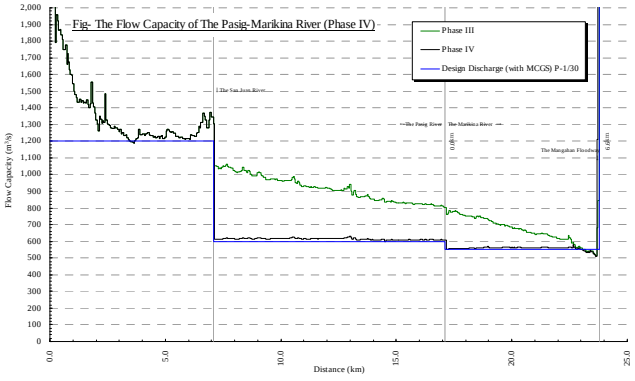


Figure 4.3.1 Revised Design Discharge



After the completion of Phase II and III
Flow capacity will be improved more than design discharge distribution.



After the completion of the MCGS
Discharge distribution will be changed significantly and flow velocities from the MCGS to the junction of San Juan River decrease. As a result, the flow capacity become low and it correspond the design flood level.

Figure 4.3.2 Flow Capacity

The design features for the river channel improvement expressed by the design high water level, alignment, longitudinal profile and cross-section is almost the limit for the Pasig-Marikina River and further improvement is difficult so that it will be difficult also to increase the flow capacity in a manner of river channel improvement. In this connection, it would be necessary to provide storage facilities in the upper river basin such as dam and retarding basin to store the excess discharge, and to further enhance the safety level as well as introduce nonstructural measures in the Pasig-Marikina River basin.

(7) Consideration for Operation and Maintenance

Boundary Bank between private lots where houses and factories are located and the public river areas are proposed for the Lower Marikina River. Construction of Boundary Banks will prevent encroachments and provide ease of maintenance of the river channel. It is proposed to utilize dredged materials contained in geo-textile bags for the Boundary Banks. For periodical inspection on maintenance of the Pasig River Channel, PRRC-constructed Linear Parks can be utilized.

4.4 Review of River Structures in the Detailed Design

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

Since improvement works of the Pasig River is presently ongoing as the Phase II Project, the preliminary design for revetment at the Priority Areas selected from the Potential Areas in the Phase II stretch, 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 beginning of the Phase II Project and construction is being carried out based on the results of the said review.

(a) Revetment and River Wall

In the contracts for Phase II Project, the contractor carried out subsoil exploration works to complement the Detailed Design. Taking the additional soil data into consideration, the preliminary design for new revetments/river walls for the Priority Areas was conducted.

New revetments consist of combined structures such as steel sheet pile foundation with inclined/vertical reinforced concrete wall on top (refer to Figure 4.4.1).

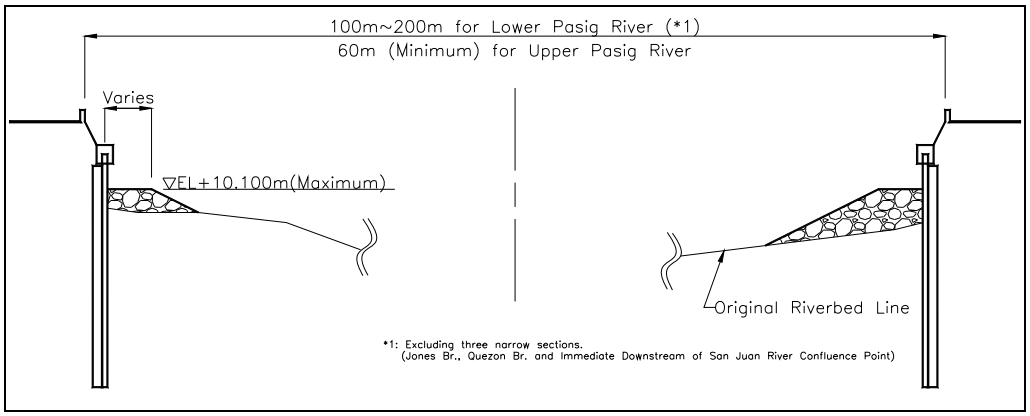


Figure 4.4.1 Typical Section of Proposed Revetment

Steel Sheet Pile foundation has two types: a) Steel Sheet Pile only (SP Type) and b) more strong Steel Sheet Pile combined with H-steel Beam (SP with H-Beam Type), as shown below (Figure 4.4.2). The type of pile applied depends on the subsoil condition.

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

Figure 4.4.2 Cross-section of Steel Sheet Pile Foundation

The following Table 4.4.1 shows the result of preliminary design of revetment of all Potential Areas. Priority Areas (Priority Group No. 1 and No. 2) selected among the potential Areas are as indicated in Figure 4.4.3

Table 4.4.1 Preliminary Design for Revetment at Potential Areas along the Pasig River

No.	Channel Bank (Right or Left)	Station		Length of Bank (m)	Foundation	
		Sta.	Sta.		Type	Pile Length (m)
I. Priority Groups 1 & 2						
1A	R	2+283	2+341	65	Revetment (SP)	12.5
1B	R	2+341	2+530	230	R.C. Floodwall only	
1C	R	2+530	2+540	55	Revetment (SP)	12.0
2	L	2+406	2+651	258	Revetment (SP)	12.0
3	R	2+550	2+950	400	R.C. Floodwall only	
4	L	2+850	3+076	238	Revetment (SP)	12.0
5	R	3+160	3+280	108	Revetment (SP)	12.0
6	R	3+300	3+400	91	Repair of Stone Revetment	
7	L	3+480	3+560	82	Repair of Stone Revetment	
8	R	3+645	3+753	105	Revetment (SP)	10.0
9	R	5+030	5+217	171	Revetment (SP with H-Beam)	13.5
10	R	5+270	5+410	164	Revetment (SP with H-Beam)	13.5
11	R	5+543	5+630	102	Revetment (SP)	12.0
12	L	6+119	6+219	101	Revetment (SP)	10.0
13	L	6+248	6+269	27	Revetment (SP)	9.5
14	R	6+350	6+510	150	Revetment (SP)	12.5
15	L	6+360	6+515	166	Revetment (SP)	9.0
16	L	7+344	7+439	96	Revetment (SP)	11.0
17	R	7+518	8+220	632	R.C. Floodwall only	
18	R	8+220	8+500	280	Revetment (SP)	11.0
19A	R	8+510	8+800	286	Revetment (SP with H-Beam)	12.5

19B	R	8+800	9+150	350	Revetment (SP)	10.5
19C	R	9+150	9+200	50	Revetment (SP with H-Beam)	18.0
19D	R	9+200	9+341	141	Revetment (SP)	10.5
20	R	9+430	9+722	301	Revetment (SP)	11.0
21A	R	9+750	9+770	20	Revetment (SP)	9.5
21B	R	9+770	9+790	21	Revetment (SP with H-Beam)	15.5
22	R	9+810	9+950	202	Revetment (SP)	11.0
23	R	10+957	11+263	320	Revetment (SP with H Beam)	20.0
24	L	11+500	11+628	128	Revetment (SP with H	12.0
25	R	11+602	11+653	52	Revetment (SP with H	14.0
26	R	11+787	11+802	15	Revetment (SP)	11.0
27	L	12+024	12+173	149	Revetment (SP with H-Beam)	19.0
28A	R	13+534	14+700	166	Revetment (SP)	10.5
28B	R	13+700	13+800	100	Revetment (SP)	10.0
28C	R	13+800	14+000	200	Revetment (SP)	10.5
28D	R	14+000	14+100	100	Revetment (SP)	10.0
28E	R	14+100	14+250	150	Revetment (SP)	10.5
28F	R	14+250	14+397	147	Revetment (SP with H-Beam)	11.5
32	R	14+985	15+072	87	Revetment (SP with H	13.0
38	R	15+505	16+469	970	R.C. Floodwall only	
40	L	15+965	16+562	597	Revetment (SP with H-Beam)	12.0
42	R	16+776	16+828	52	Revetment (SP)	9.0
Sub-Total				8,125		
II. Priority Group 3						
29A	L	13+806	14+250	444	Revetment (SP)	11.0
29B	L	14+250	14+442	192	Revetment (SP with H	12.5
30	R	14+450	14+730	280	Revetment (SP with H	13.0
31	R	14+837	14+944	107	Revetment (SP with H	14.5
33	R	15+196	15+246	50	Revetment (SP with H	11.5
34	L	15+236	15+424	188	Revetment (SP)	9.5
35	R	15+410	15+439	29	Revetment (SP with H-Beam)	17.0
36	L	15+443	15+547	104	Revetment (SP)	11.0
37	R	15+477	15+505	28	Revetment (SP with H-Beam)	14.0
39	L	15+747	15+870	123	Revetment (SP)	11.5
41A	R	16+469	16+593	124	Revetment (SP)	10.5
41B	R	16+593	16+722	129	Revetment (SP)	9.0
Sub-Total				1,798		
Total				9,923		

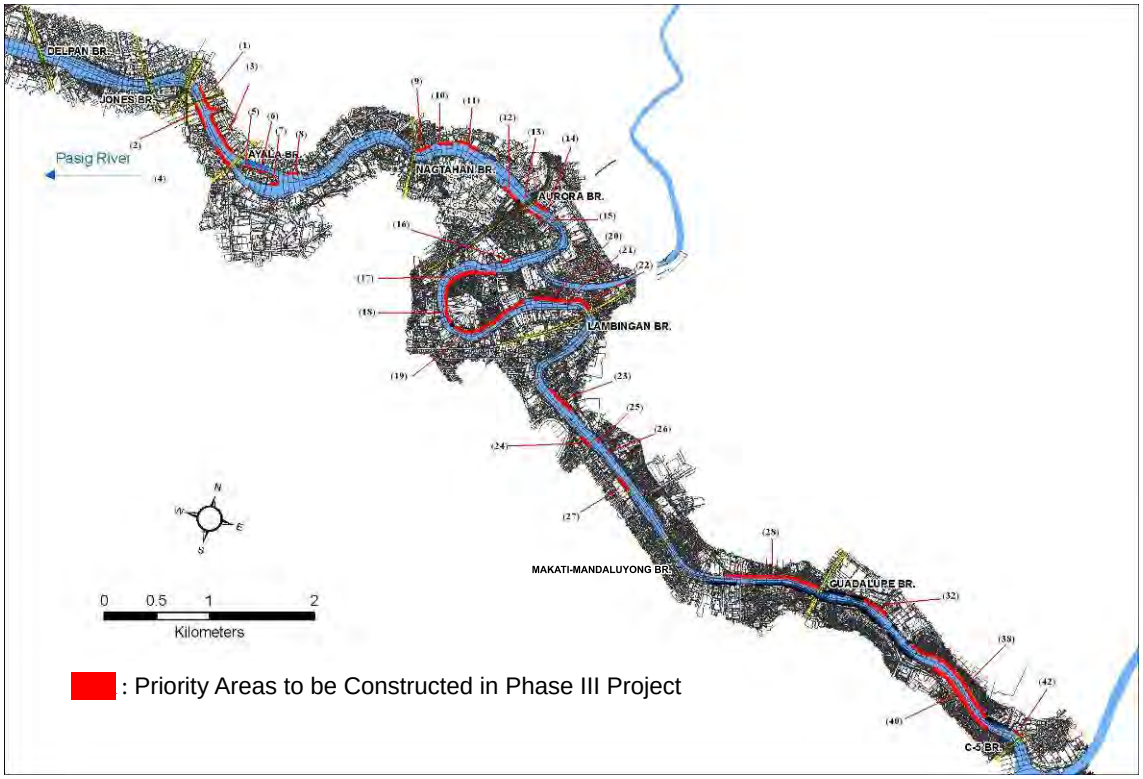


Figure 4.4.3 Location of Prioritized Potential Areas for Implementation in Phase III Project

(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 0.3m to 1.52m 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 prevent 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:

a) Dredging/Excavation of Riverbed
b) Dike
c) River Wall
d) Boundary Bank
e) Bridge Pier Protection

Major structures are described below and layout plan for proposed channel improvement is shown in Figure 4.4.4.

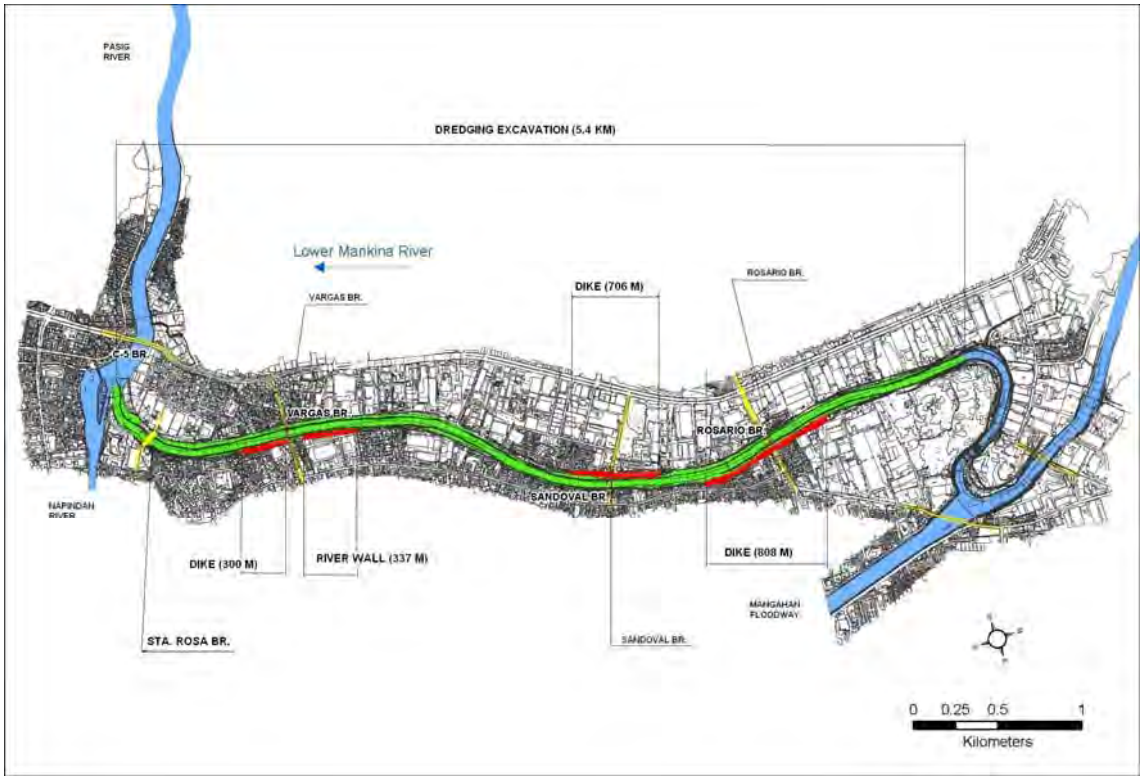


Figure 4.4.4 Layout Plan of Lower Marikina River Channel Improvement

(a) Dredging/Excavation of Riverbed

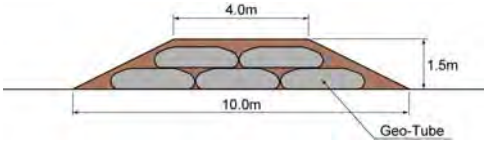
Sampling of riverbed materials of Lower Marikina River conducted in the Detailed Design shows that riverbed consist of sandy and silty clay. Typical cross-section of dredging is designed to have 40 m wide bottom and stable slope with 1 (vertical) to 3 (horizontal). Design dredged riverbed elevation is 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: 1/9000). 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

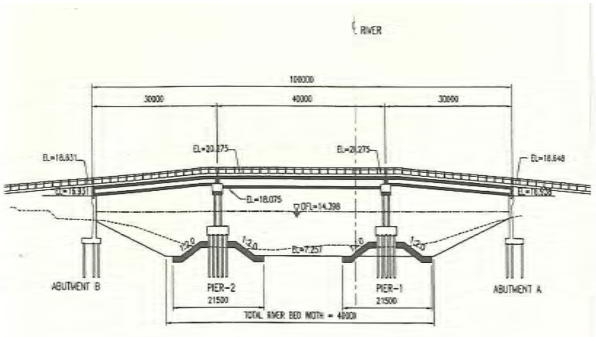
Dikes and River Wall are proposed for protection of four public areas. Dikes with 3-m wide concrete paved top and revetment with steel sheet piles covering riverside slope from erosion are constructed at the existing promenades (3 locations; 1,814 m long in total consisting of 300 m, 706 m and 808 m). Proposed 337 m long concrete River Wall raising 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 the 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 a Boundary Bank as shown in the figure above. Boundary Bank is a low embankment with reused dredged materials, filling the materials in geo-textile tubes which have filtration effect. Geo-tubes should be covered with soil because they are not strong against sunlight. Detailed structure is to be designed in the next stage, the Detailed Design stage.

(d) Bridge Pier Protection



There are four existing bridges within the proposed dredging section (Sta. Rosa, Vargas, Sandoval and Rosario bridges). To ensure the stability of existing bridge piers from dredging (excavation of riverbed), it is proposed to provide reinforcement works of stone riprap around the piers. Since Sta. Rosa Bridge was constructed after the D/D, its protection works will be designed in the next detailed design stage.

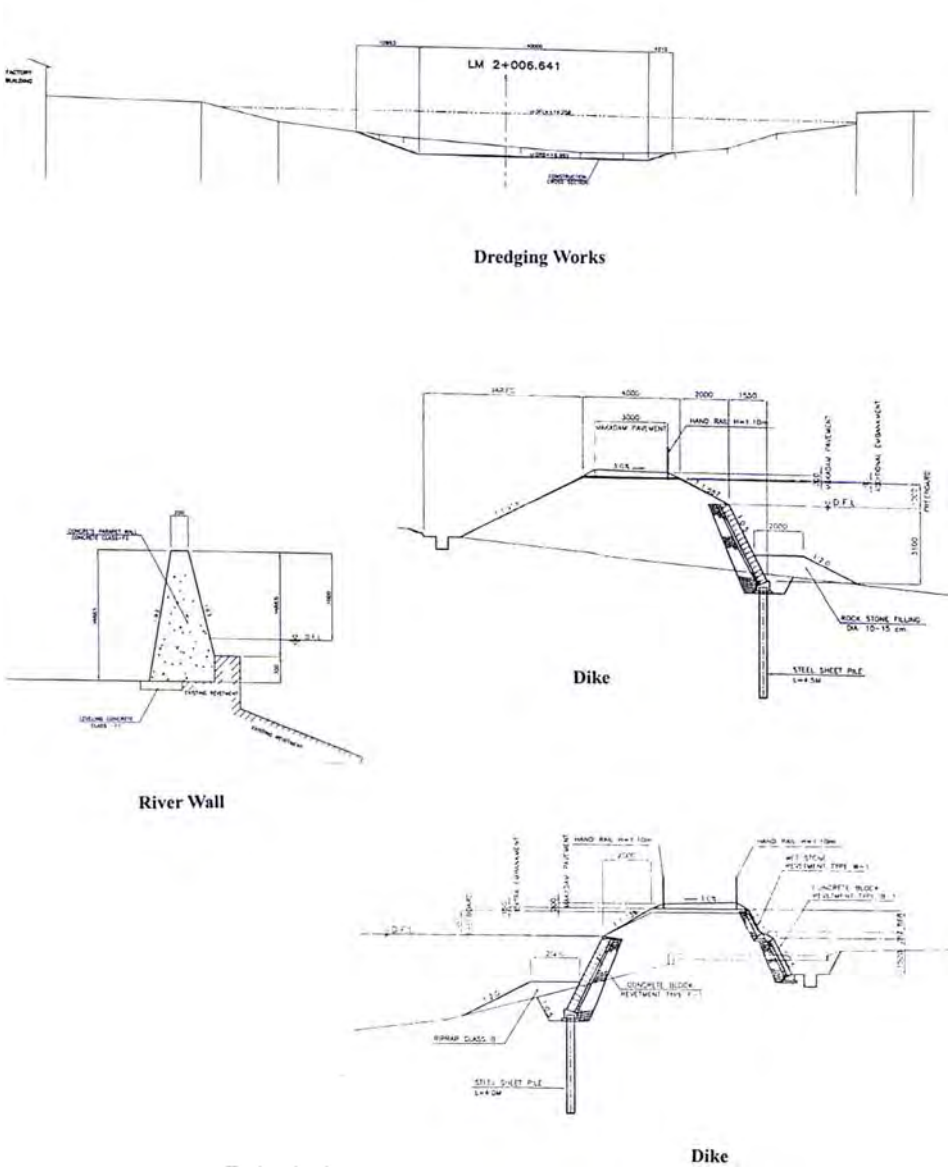


Figure 4.4.5 Typical Section of Proposed Structures

4.5 Strategy of Project Implementation and Operation/Maintenance

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

(1) DPWH for Project Implementation

The DPWH is the implementing agency for the project. As of April 2011, there are broadly five (5) groups of offices in the DPWH:

(a) Technical Services (Bureau of Design, Bureau of Construction, Bureau of Maintenance, Bureau of Research and Standards, Bureau of Equipment, and Bureau of Quality and Safety)
(b) Planning and PPP (Planning Service and Public-Private Partnership Service)

(c) Support Services (Administrative & Manpower Management Service, Controllership and Financial Management Service, Monitoring and Information Service, Legal Service, and Procurement Service)
(d) Regional Operations (Luzon Operation and Visayas/Mindanao Operation)
(e) PMO Operations (27 PMOs).

The DPWH manpower is about 25,000 at present. The following table shows DPWH manpower complement.

Office	Regular	Contractual	Daily/Casual	Total
Proper & Bureau	1,844	10	171	2,025
Regional Office	14,705	43	7,013	21,761
PMO	23	823	468	1,277
Total	16,572	839	7,652	25,063

The DPWH Rationalization Plan (RatPlan) is still being reviewed by the Department of Budget Management (DBM). The RatPlan is primarily archived on the principle of strengthening the functions. Close coordination with the DBM has been undertaken to facilitate the approval and implementation of the RatPlan, to address the staffing problem of the DPWH under its new structure thereby increasing organizational productivity and efficiency (source: DPWH 2010 Annual Report).

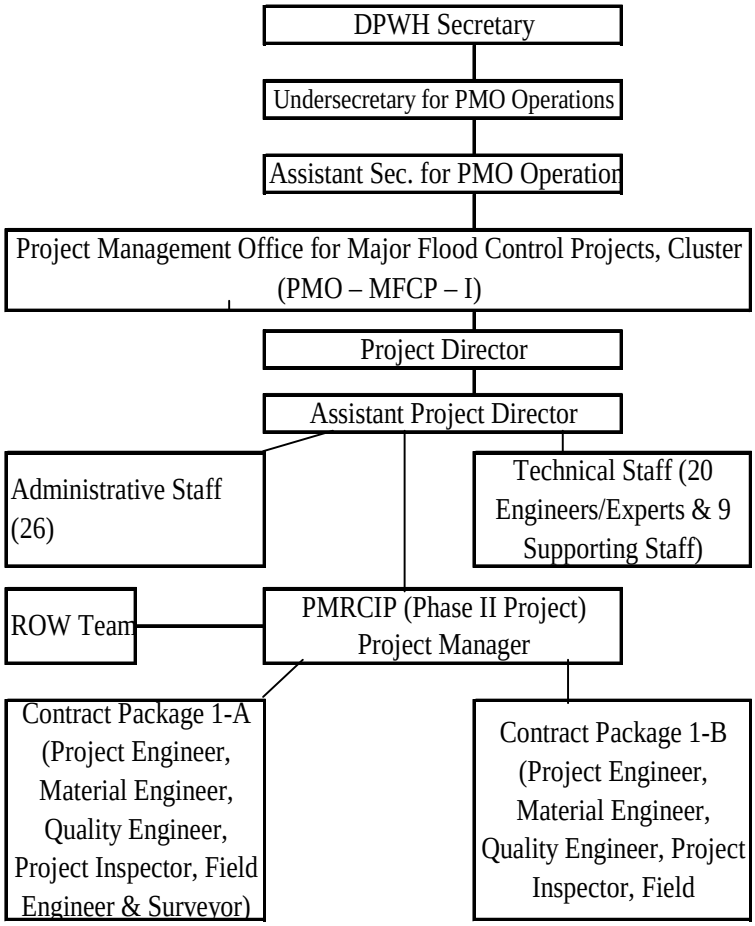
Recent DPWH yearly budgets for flood control projects are as shown in the table below. Budget of 2011 for flood control increased by 52.3% compared to the 2010 budget.

Year	DPWH Total Budget (mil. Peso)	Flood Control	
		Amount (mil. Peso)	% of DPWH Total
2008	94,718	5,485	5.79
2009	129,891	6,098	4.69
2010	126,931	7,436	5.86
2011	100,826	11,322	11.23

Out of the total Php 126,931 million in the 2011 DPWH Budget, the budget for infrastructure is Php 90,900 million broken down as follows:

a) Highways : PHP68,270 million (75%)
b) Flood Control : PHP11,322 million (12%)
c) Feasibility Study/Preliminary Detailed Engineering : PHP580 million (1%)
d) Right-of-Way, Contractual Obligation and VAT : PHP4,208 million (5%)
e) Public-Private Partnership : PHP5,000 million (6%)
f) Water Supply/VIILP/Disaster Related : PHP1,520 million (2%)

The organizational setup of the Project Management Office for Major Flood Control and Drainage Projects, Cluster I (PMO-MFCP I) is as shown below, including the site organization for construction supervision of the ongoing Phase II Project. Under a Project Director, the PMO-MFCP I consists of the Technical Staff (22 positions) and the Administrative Staff (26 positions).



It is proposed that the PMO-MFCP I will manage the Phase III Project as well as the ongoing Phase II Project. Since the ongoing Phase II will be completed in 2012 and the construction of Phase III is expected to start in 2013, the same PMO organization shall manage the Phase III Project. The PMO-MFCP I is generally responsible for the implementation of flood control projects in Metro Manila which are financed by foreign lending institutions.

(2) Project Funds

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

There are advantages in STEP Loan compared with the general untied loan, as follows:

- Low interest rate, grace period and long repayment period, as shown below:

Loan Category	Interest Rate	Grace Period	Repayment Period
General Loan	1.40% p.a.	10 years	25 years
STEP Loan	0.20% p.a.	10 years	40 years

- Review of detailed design can be conducted through the JICA's technical cooperation grant, resulting in substantial reduction/saving of project cost. The detailed design is made by the consultant to be employed by JICA taking the following items into consideration. However, the consultant for the construction supervision is to be selected by the GOP.

  ✓ Latest project site conditions

- ✓ Construction materials in conformity with the conditions of STEP Loan
- ✓ Preparation of Tender Documents in conformity with the conditions of STEP Loan

- After the pledge or loan agreement, the selection of a consultant for construction supervision is to be conducted by the DPWH for about 12 months. During this selection process, the 8-month separate works of the detailed design from the project activities through JICA's technical cooperation grant would result in the shortening of project implementation time by 8 months.

The terms and conditions of the STEP Loan are as described below:

- Prime contractors are tied to Japanese firms. Joint ventures (JV) with recipient countries are also admitted on condition that Japan is a leading partner. Subcontractors are untied and open to all countries.
- Total cost of goods procured from Japan shall be no less than 30% of the total amount of contract(s) (except consulting services) financed by STEP Loan.
- STEP covers up to 100% of the total project cost.

The STEP Loan has conditions to utilize Japanese advance technology and the know-how 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 with 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 the Japanese advanced technology such as Vibro-Hammer with Waterjet for driving method and Eco-Tube Method for Reuse and Pre-mix Method for Solidification for the treatment of dredged materials.

(a) Driving Method for Steel Sheet Pile (Waterjet Technology)

At 65% along the proposed sections, subsoil foundation is formed by volcanic tuff (the Guadalupe tuff), locally called "adobe". This tuff is considered a suitable bedrock foundation. However, it is hard to drive steel piles into this tuff by the common driving method. Therefore, Vibro-Hammer Driving with Waterjet Technology is proposed for utilization as excellent construction method for pile driving into hard strata. This method would facilitate the construction activities and minimize vibration/noise of construction activities. This is also being applied in the ongoing Phase II Project.

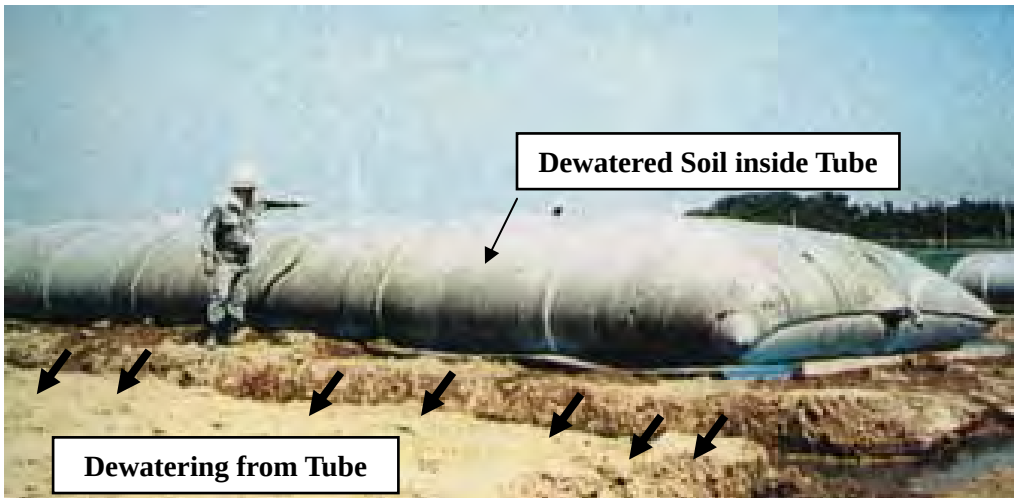
(b) Treatment Method for Dredged Materials

Among the alternative disposal methods of dredged material summarized below, only inland disposal will be applicable at present.

- Manila Bay (20 km one-way hauling distance) => Banned at present.
- Sea outside Manila Bay (100 km one-way hauling distance) => High hauling cost and needed additional construction time.
- Inland Area => Need Solidification => Cement Pre-mix Method for Solidification and disposal to proposed area (Near Laguna Lake in Taguig City) and/or reuse at site for embankment (Eco-tube Method)

Eco-tube Method of Reusing High Water Content Soil: For treatment of dredged material of Lower Marikina River Channel, the Eco-tube Method which was developed by the Public Works Research Institute of the Japanese Government enables dewatering and reinforcement of high water content soil, and to reuse the dredged material for the proposed Boundary Bank(s), filling materials in geo-textile tubes with filtration effect

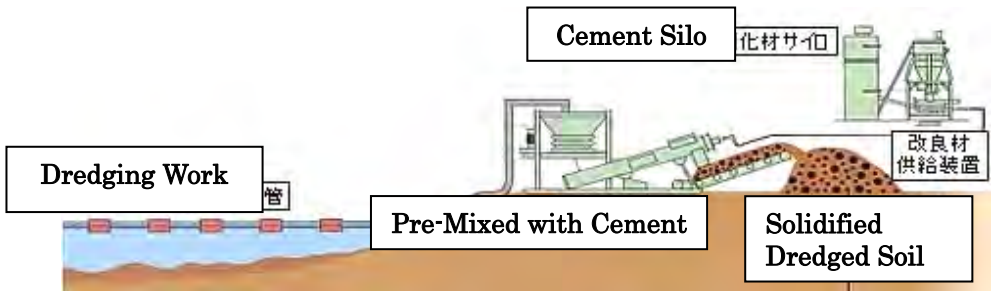
which are made from Japanese technology. This filtration effect ejects clean water from the tube while the soil remains inside it. This method can dewater high water content contaminated soil with keeping contaminants inside the Eco-tube, because of its filtration effect.



On the other hand, Geo-textile Tube has the following characteristics:

a) Since geo-textile tube has weakness against sunlight, tubes should be covered with soil. After the occurrence of floods/earthquake, inspection for maintenance of cover-soil should be conducted. It is essential to repair cover-soil as required.
b) In case of occurrence of large flood, there might be possibility that geo-tube be washed out and damages existing structures such as bridge piers, houses, etc.
c) If contaminated soil is contained in tube, it will be exposed when the tube is damaged.

Pre-Mix Method for Solidification of Dredged Material: Since the dredging works are executed at the river channel flowing in the urban area, loading, hauling and disposal operations for safe high water content soil require sufficient environmental consideration. Therefore, the cement-based Pre-Mix Method for Solidification is proposed for the Project. Cement reacts with water in the dredged material to chemically bind free water and dry the material. Plant equipment for this Method is to be brought to the site from Japan.



(3) MMDA: For Operation and Maintenance

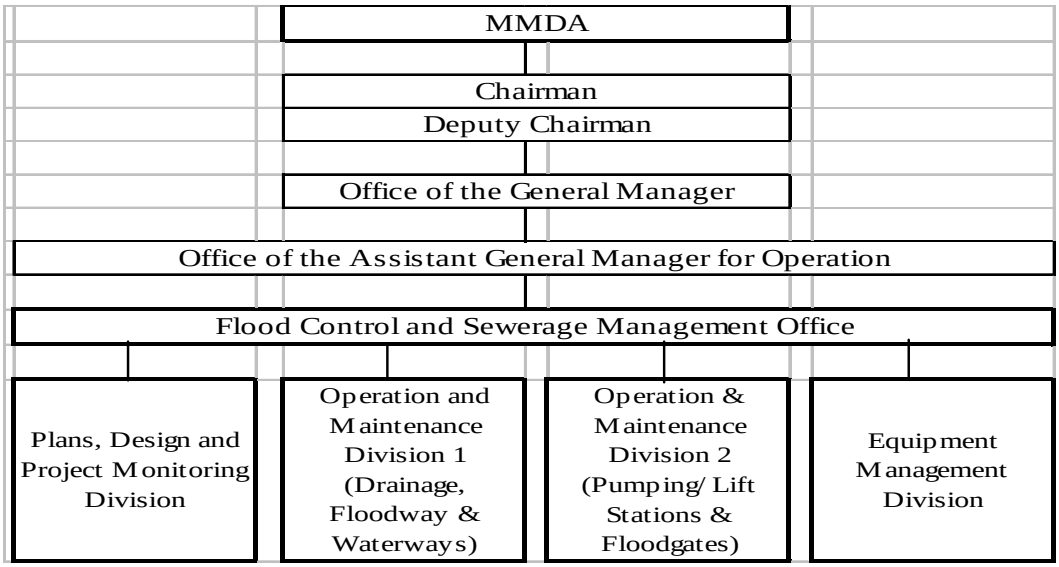
There is the Memorandum of Agreement (MOA) between DPWH and MMDA executed on July 9, 2002 and the Guidelines on the Transfer of Flood Control Responsibilities in Metro Manila from DPWH to MMDA dated August 2002. In addition, the Minutes of Discussion among the DPWH, MMDA and JICA on the implementation of the Phase II project includes

a 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." The number of MMDA personnel is 7,140 in total. Regarding flood control, the Flood Control and Sewerage Management Office is responsible.

(a) Organization for Flood Control

MMDA's organization for flood control is as shown below.



(b) Personnel for Flood Control

The total number of personnel of the Flood Control and Sewerage Management Office is about 1,220, equivalent to 17% of all MMDA personnel, as follows:

Technical	Office	Skilled Workers	Laborers	Total
160	140	320	600	1,220

Personnel are categorized by employment status, as below:

	Permanent	Daily Basis (long period)	Daily Basis (short period)	Total
Total	115	560	545	1,220

(Source: Flood Control & Sewerage Management Office of MMDA, as of January 2011)

(c) MMDA Equipment

All equipment of MMDA are managed by the Equipment Management Division. As of April 2011, the MMDA has the following 150 major equipment. Out of the equipment, 82% is operational and 18% is in the condition requiring repair.

	Equipment	Type	No. of UnitS
1	Dump Truck	2 ton	6

2	Dump Truck	3 ton	11
3	Dump Truck	4 ton	7
4	Dump Truck	10 ton	7
5	Cargo Truck		4
6	Wing Van		4
7	Water Truck		4
8	Vacuum Truck		10
9	Sewer Jet		2
10	Jet Washer		1
11	Sreco Flushing Machine		2
12	Sreco Bucket Machine		2
13	Pumper Truck		4
14	Backhoe/Excavator		27
15	Crane		13
16	Dredger		3
17	Boom Truck/ Wrecker		1
18	Truck Tractor		2
19	Tug Boat		2
20	Generator Set		5
21	Hooklift Truck		4
22	Service Vehicle		22
23	Others (Trailer, etc.)		6

(d) Budget for Flood Control

The annual revenue of MMDA mainly consists of appropriations from the following:

a) The General Appropriations Act, otherwise known as the National Budget;
b) The Internal Revenue Allotment (IRA) from the National Budget;
c) Five percent (5%) of the total annual gross revenue from each Local Government Unit under the jurisdiction of MMDA; and
d) Levies, impositions and charges for various services rendered.

The following shows the budget of MMDA for items a) and b) above in the recent years:

(Unit: million pesos)

Year	2008	2009	2010	2011
a) National Budget	1,772	1,800	2,075	979
b) IRA	262	165	198	211
Total	2,034	1,965	2,273	1,180

Source: DBM Website

The following shows the budgets allotted for the Flood Control and Sewerage Management Office in the recent years:

Year	2008	2009	2010	2011
Budget	568	560	629	559

Source: MMDA Flood Control and Sewerage Management Office

(e) O/M Activities for Completed Projects

During the flood periods, the MMDA, through its Flood Control and Drainage Division, maintains a 24-hour watch for flood height and traffic condition on identified flood prone areas and major thoroughfares. These information are disseminated to the public through radio and television broadcasts. A 24-hour flood control crew/teams with equipment are mobilized to remove debris/garbage that clog inlets of drainage mains/laterals and in open waterways/esteros, to facilitate the flow into the system.

At present, MMDA has responsibility for operation and maintenance on the following major completed flood control protects:

Project	ODA Assistance	Major Facilities
1) Metro Manila Flood Control Project (II)	Japan	Drainage Pumping Stations, Drainage Mains
2) Metro Manila Flood Control Project – West of Mangahan Floodway	Japan	Drainage Pumping Stations, Lakeshore Dike, River Wall along Napindan River
3) EFCOS	Japan	Flood Forecasting and Warning System

Note: Transfer of Kamanava Flood Control and Drainage Improvement Project is presently in progress.

(f) Necessary Maintenance for Structures to be Completed in the Project

After the completion of the Phase II and/or the Phase III Project, 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. Drainage outlets will need frequent maintenance activities, particularly during/after flood.

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 flood should be conducted. For maintenance of dredged channel, cross-sectional/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, tugboats, dredgers, etc., and staff for such required inspection and maintenance works.

CHAPTER 5 CONSTRUCTION PLAN AND COST ESTIMATE

5.1 General

5.1.1 Contract Packages of Phase III

As described in Section 3.2, the construction area for Phase III consists of priority sections selected from potential areas in the Phase II stretch of Pasig River in addition to the Lower Marikina River, as shown below.

Table 5.1.1 Phase III Construction Area

Name of Package	From	To	Distance (km)
Improvement of Pasig River (Selected Sections of Potential Areas)	Del Pan Bridge	Immediate Vicinity of NHCS	16.4*
Improvement of Lower Marikina River	Immediate Vicinity of NHCS	Downstream of Rosario Weir	5.4

* Construction length is partial of Pasig River

5.1.2 Scope of Work

(1) Main Structures to be Constructed

The improvement works aim to mitigate flood damage caused by channel overflow. Main civil works are the construction of new revetments and river walls, improvement and raising of existing revetments, and improvement of drainage works along the Pasig River. Aside from the above works, dredging works for the Lower Marikina River and geo-tube embankment works for Dike and Boundary Bank will be carried out.

(2) Construction Length of Major Works

The construction length for Phase III is divided into the Pasig River and Lower Marikina River improvement stretches. The works in each stretch are as tabulated below.

Table 5.1.2 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 Works	For 4 bridges

The new dike with revetment works and the revetment repair work also include concrete works, reinforcing works, earthworks and other appurtenant works. In addition, drainage improvement works require concrete works with rebar, earthworks and other appurtenant works. Bridge pier protection is riprap works approaching the same procedure as the other repair works.

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

Table 5.1.3 Volume of Main Construction Works 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 by Dredged Soil	m^3	0	472,000
Riprap/Rock-fill	m^3	51,500	6,500
Boundary Bank	m^3	0	50,100

5.2 Construction Planning Method

5.2.1 Construction Conditions

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

5.2.2 Available Working Time

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

- Normal workweek
- Public Holiday
- Rainfall
- Type of Activity

The normal workweek consisting of six (6) working days is adopted for developing all calendars in the Suretrack scheduling program. All construction schedules are based on an 8-hour per working day. The following public holidays are excluded from the working calendars:

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

In addition, an allowance is made for four (4) extra days that may be declared non-working holidays by the Government on account of special events, thus, the total number of non-working days adds up to 15 days.

The time lost due to rainfall is based on the rainfall data and the number of rainy days on record at the Science Garden PAGASA station, Quezon City, for the period 1987-1998. It is recognized that the effect of rain on different types of construction activity will vary.

The schedule of time losses for the key activities due to weather condition is as summarized below.

Table 5.2.1 Average Number of Rainy Days at the Project Site

Month	J	F	M	A	M	J	J	A	S	O	N	D	Total No.
Rainfall Over 10mm	0.42	0.25	0.42	0.92	4.33	8.00	11.92	11.92	11.33	6.25	3.50	2.75	62.00
Rainfall Over 50mm	0.08	0.00	0.00	0.00	0.67	1.50	2.50	2.58	2.17	1.42	0.42	0.33	11.67

Source : Science Garden Station of PAGASA (1987-1998)

The ratio of rainy days per year is :

$62/365 = 0.17$

The number of rainy days on Sundays and Public Holidays are :

$(52+15)\times 0.17 = 11.39$ *days*

Therefore,

Rainy days on weekdays are :

$62 - 11.39 = 50.61$ *days* ≈ 51 *days*

Rainfall of more than 50 *mm will cause a* $1-$ *day suspension for structure excavation, backfilling, slope protection, drainage work and pavement work.*

The suspension days for such works above are :

$11.67 \approx 12$ *days*

The total number of working days available annually for different activities is established by incorporating all assessed time losses into the eleven (11) items shown in the following table:

Table 5.2.2 Workable Days

Work Item	Sundays	Public Holidays	Rainy day on Weekdays	Suspension Days	Available Working days
Structural Excavation	52	15	51	12	235
Dredging	52	15	51		247
Embankment/Backfill	52	15	51	12	235
Concrete Works	52	15	51		247
Revetment Works	52	15	51		247
Repair Works	52	15	51		247
Drainage Works	52	15	51	12	235
Road Works	52	15	51	12	235

Prior to total construction scheduling, each work item is assigned on the defined calendars based on the table above.

In addition, some works are controlled by tidal status in Manila Bay and water stage of Laguna de Bay. Tidal levels at Manila Bay are as follows:

Table 5.2.3 Tidal Levels of Manila Bay

Mean Spring Higher High Water Level (MSHHW)	EL. +11.40 m
Mean Higher High Water Level (MHHW)	EL. +11.10 m
Mean Sea Level	EL. +10.60 m
Datum Line / Mean Lower Low Water Level	EL. +10.00 m

5.2.3 Site Condition

(1) Method of Approach for Each Construction Site

The major civil works of the Pasig River stretch are revetment, excavation (including riverbed excavation) and river wall. Construction can be approached from the riverside and landside depending on the site conditions. In these works, there are some difficulties in approaching from landside due to inadequate width, lack of access and obstruction on approach roads. Based on the ongoing Phase II, most of the works are approached from river side because of the above problem. In the Lower Marikina River, most of the construction sites do not have enough width of access road. Therefore, construction will be approached from river side. Since the depth of Marikina River is shallow, dredging works shall be implemented in advance of the start of the work in order to give allowance for construction boats.

(2) Obstruction at Construction Site

The Pasig River is one of the major navigable rivers flowing through Metro Manila and is therefore utilized for industrial, commercial, agricultural and other private purposes. In this regard, there are many existing river structures and facilities along both riversides, which might become obstructions during construction work. Based on the interview survey regarding the ongoing Phase II, PRRC conducted a metal detector survey of Pasig River during the dredging project, which was limited to only the center area of Pasig River, 15 meters from both river banks, in order to implement the dredging work. Therefore the area from river banks to 15m within the river channel was left for the Phase II Project.

The typical obstructions are boat stations, abandoned barges and mooring facilities. Boat stations will be demolished and reconstructed. Abandoned barges and ships will be towed/hauled by the contractor in coordination with the Philippine Ports Authority (PPA. There are also many types of mooring facilities along the riverside, such as jetty, oil and water pipelines, loading equipment and mooring post, which are either private or government owned. Negotiations must be done by the implementing office (DPWH-PMO-MFCP-I) prior to the commencement of construction work. Moreover, garbage materials will be hauled by MMDA. Cost is included in the project cost based on a ratio of civil works except the cost for garbage hauling.

(3) Spoil Area

During the Detailed Design Stage (D/D), five (5) locations have been evaluated as spoil areas for excess excavated materials and two (2) of them were finally selected and proposed as spoil areas considering hauling distance; namely, the Rizal-Laguna Lakeshore Road and Reclamation Project (RLLRRP) Area and the Calzada Area. At present, only one disposal site has available space to accommodate excavated materials.

Besides, there is an option for dumping the dredged materials offshore to Manila Bay. However, this option is not feasible for the Project due to high cost, unclear factor of sea weather and documentation for the construction plan.

It is, therefore, required to examine the soil test for approval by LLDA or LGUs before the implementation of dumping dredged soil to the approved disposal site.

(4) Compensation of Lots and Structures

Since construction work is approached from the river side, there is no land acquisition involved for the Project. Compensation of structures will be based on the RAP survey as to the number of houses as shown in Section 3.5.

5.3 Resources

5.3.1 General

Most of the construction materials, such as aggregates, cement, form work materials and construction machinery including construction equipment will be procured generally in Metro Manila or the surrounding areas. On the other hand, steel materials for revetment, geo-textile bags/tubes for dredged soil and special driving equipment to penetrate hard-core strata (Guadalupe Formation) shall be imported from Japan under the JICA STEP Loan.

5.3.2 Labor

All classes of labor identified above are available in Metro Manila and surrounding areas.

5.3.3 Materials

(1) Shaped Steel Materials and Sheet Piles

Main steel materials used for the construction of revetment shall be imported from Japan to satisfy the STEP Loan requirement that goods and services procured from Japan shall be at least 30% of the total cost of civil works. However, some shaped steel materials for temporary use are available in the Philippines. Based on the ongoing Phase II Project, Hat Type SSP and H-beam are imported from Japan directly.

(2) Reinforcing Bar

Reinforcing bars are available in the local market.

(3) Ready-Mixed Concrete

Basically, ready-mixed concrete is available within Metro Manila. However, it might not be possible to supply some sites with ready-mixed concrete due to lack of access from the existing main road. In such situations, the simple concrete batching plant barge(s), together with concrete pump with the capacity of $30m^3$/hour, shall be provided. Some supply barges are required to supply concrete aggregates, cement and water to such batching plant barges.

(4) Filling Materials

Filling or backfilling materials are selected from excavated materials or purchased. Most of the filling materials can be purchased from suppliers in Metro Manila.

(5) Rock Materials

Rock materials are used for riprap, wet stone masonry and repair of existing flood dike. Suppliers for small volume works can be found easily in Metro Manila. Big volume of rocks is available/transportable from the Bataan area, which is 50 km from the construction site.

(6) Other Construction Materials

Gabion cages, geo-textile sheets, welded wire fabrics, etc., to be used for the permanent works are available in Metro Manila and surrounding areas.

(7) Imported Materials

Materials of steel sheet piles for revetment, such as corrugated steel sheet piles, pile type steel sheet piles and H-beam, are to be imported from abroad, especially, Japan. In addition, flap gates to be installed at designated drainage outlets will be imported from Japan to insure the quality and durability. The costs of these materials are estimated as imported materials. The list of materials to be imported is given in Table 5.3.1.

Table 5.3.1 List of Materials to be Imported for Phase III

Materials	Purpose
Steel Sheet Pile and H-beam	For revetment foundation
Flap Gate	For drainage outlet
Geo-Textile Bag	For placing dredged backfill soil for the boundary bank

5.3.4 Construction Equipment

The major categories of construction equipment required for the works are classified as follows:

- Earthmoving equipment
- Pile driving/drilling/extracting equipment
- Equipment for on-water works
- Equipment for concrete works
- Lifting equipment

(1) Earthmoving Equipment

For excavation, dredging and hauling, backhoe, dredger, barges or dump trucks will be utilized.

(2) Pile Driving/Drilling/Extracting Equipment

Pile driving works shall utilize crawler crane, vibro-hammer, generator, truck mounted crane and barge for on-water works.

(3) Consideration for On-Water Works

Appropriate number of barges shall be utilized for on-water works. Crawler crane shall be set on a barge when construction is approached from the riverside. Tugboat and flat barge are needed for mobilizing materials and equipment.

(4) Equipment for Concrete Works

Concrete pump, transit mixer and internal vibrator are adopted for concrete works.

(5) Lifting Equipment

Crawler crane or truck mounted crane is used for the loading/unloading of materials.

5.4 Construction Method

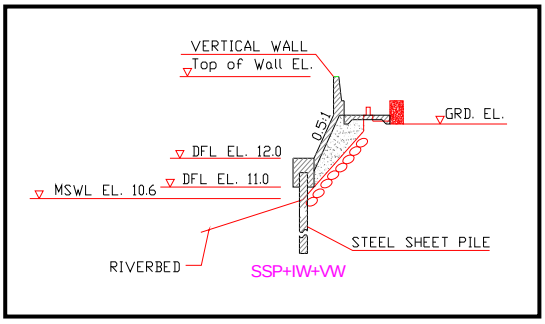
5.4.1 General

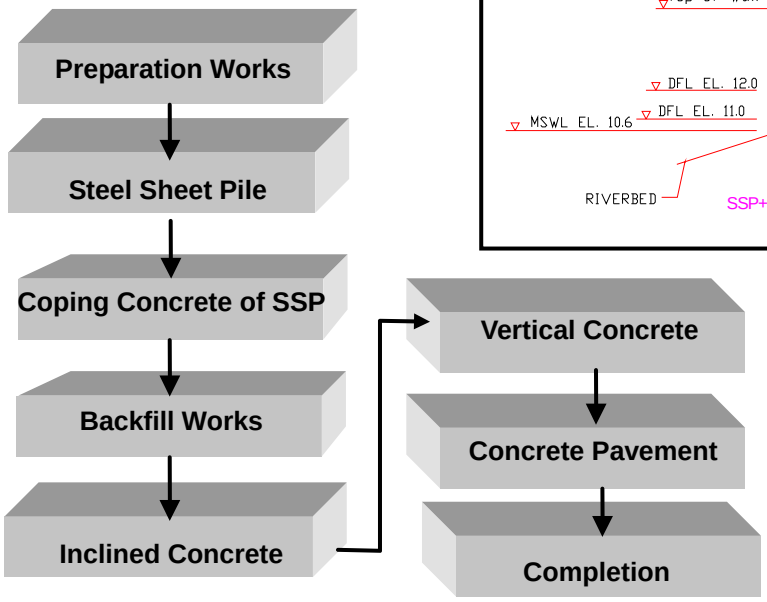
In this Section, the major works are identified for Phase III and the construction procedures are explained. The major civil works along the Pasig River are revetment works and drainage works. On the other hand, Lower Marikina River works contain dredging and dike works.

5.4.2 Revetment Works

Construction work for new revetment installations at the Pasig River can be distinguished into two (2) types based on the type of the materials, such as corrugated steel sheet pile (SSP) and SSP combined with H-beam. Construction procedures of the SSP and the SSP combined type are almost similar. The construction procedure for SSP, concrete inclined wall and concrete vertical wall (SSP+IW+VW) is as diagrammatically shown below.

Revetment Type: SSP+IW+VW





For the SSP and the SSP with H-beam types of revetment, piling works are basically executed from the riverside (see Figure 5.4.1) After piling works, formworks and reinforcing bars for coping concrete of sheet pile are installed. Sequentially, backfilling works and inclined wall concrete works with rebar installation follows piling and coping concrete works.

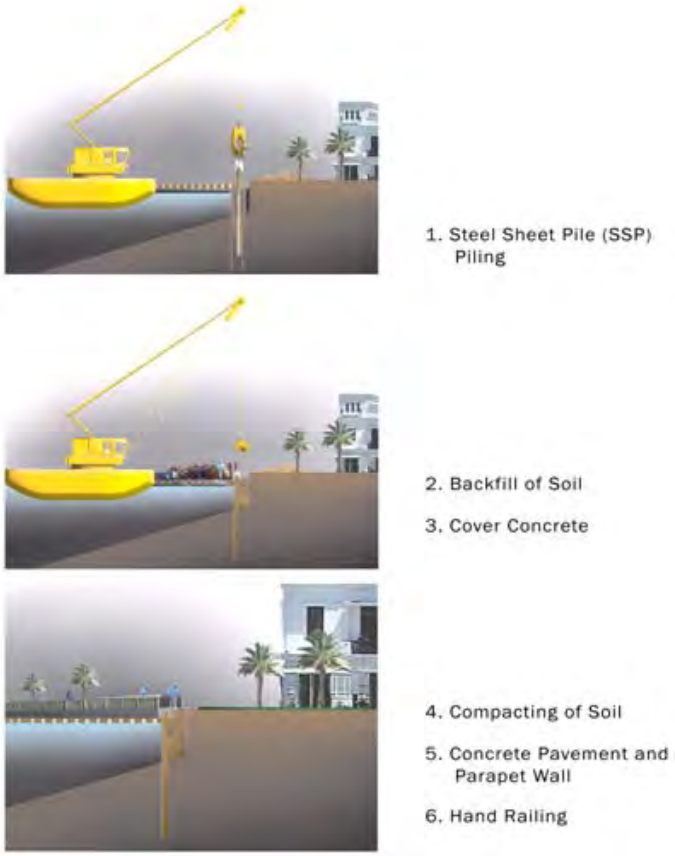


Figure 5.4.1 Construction Procedure of SSP+IW+IP Type Revetment

5.4.3 Repair Works

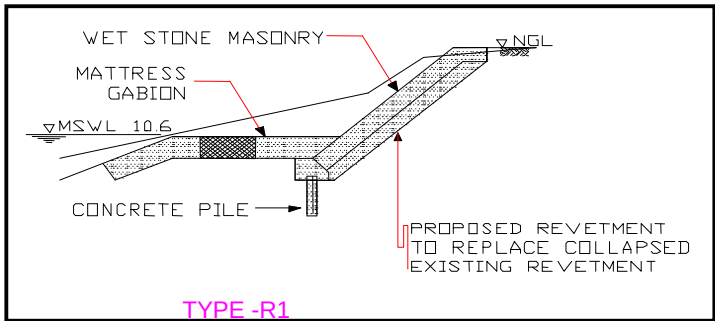
The existing wet stone masonry and bulkhead revetments along the Pasig River are partly damaged at several locations. In this connection, the following repair works shall be undertaken depending on the type of damage and the rehabilitation method, as shown below.

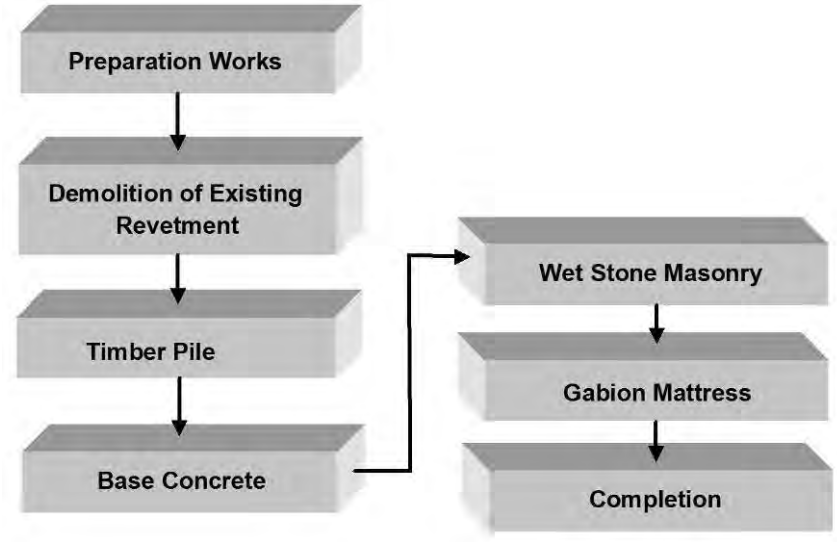
Table 5.4.1 Types of Repair of Damaged Wet Stone Masonry and Revetment

Type	Description
Type R1	Wet Stone Masonry with Gabion Mattress
Type R2	SSP with Coping Concrete

The repair works given above can be distinguished into two (2) types: Type R1 is constructed from the riverside or accessible landside while Type R2 is basically executed from the riverside. The construction procedures for Types R1 and R2, which are representatives of repair works to be done, are as explained below.

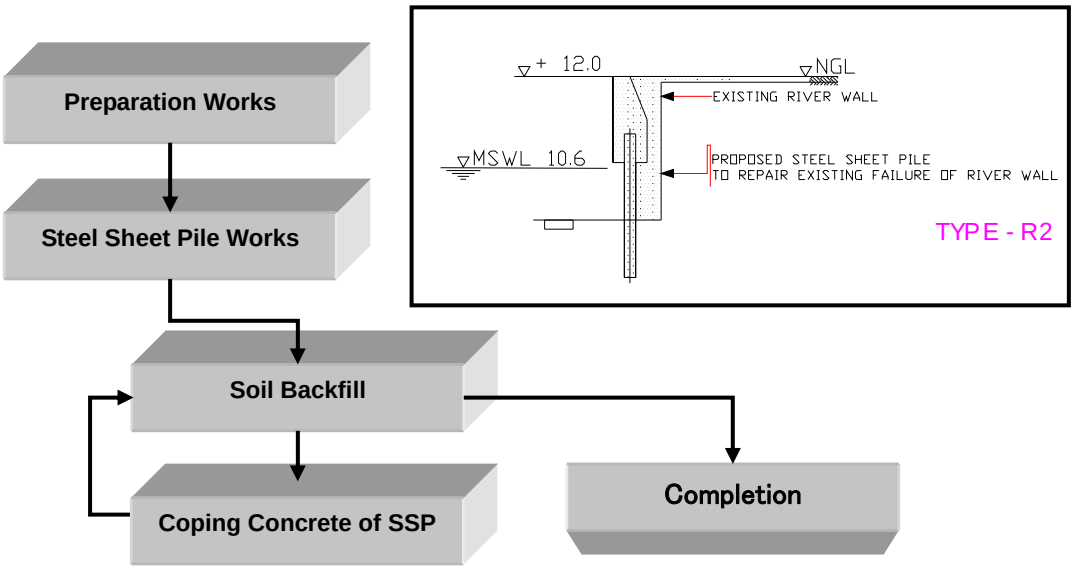
(1) Repair Work: Type R1





Demolition work of existing revetment is executed by backhoe and hydraulic pavement breaker with compressor. Excess disposable material is hauled to the proposed spoil site. Timber pile driving, base concrete and wet stone masonry works are undertaken by using crane and backhoe. Gabion mattress is placed on the riverbed during low tide.

(2) Repair Work: Type R2



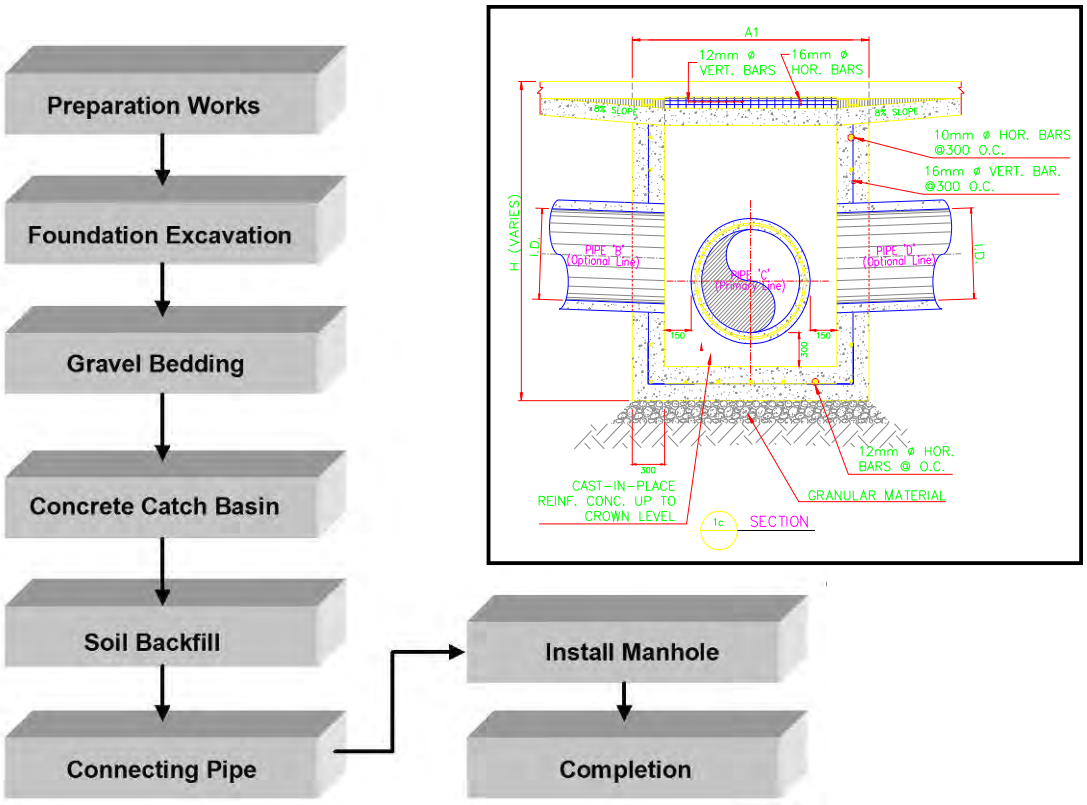
For the Type R2 repair works, SSP driving and coping concrete works are conducted from either the riverside or landside. In case of construction from the riverside, truck crane, pile driver, generator sets on crane barge will be utilized. Soil backfilling shall be done properly, with the compacting works and dewatering works being carried out simultaneously. Bridge Pier Protection is riprap works which adopts common construction methods in the river work.

5.4.4 Drainage Works

Drainage works can be distinguished into three (3) types of structures; namely, drainage outlet, collector pipe and junction manhole. There are a number of structural types and dimensions of existing drainage outlets along the Pasig River. The Project aims to install and provide new pipes and manholes to collect and drain inland water smoothly and promptly. In addition, flap gate will

be provided to prevent inland area from the inundation due to reverse flow at some outfalls where the ground elevation is lower than design high water level. The construction procedure of a junction manhole is shown in the following figure.

(1) Drainage Works: Junction Manhole



Excavation of foundation is executed by backhoe and the concrete catch basin is basically constructed using cast-in-place method. Soil backfill shall be properly done by common compacting equipment.

(2) Temporary Works Assurance

In the construction of the drainage outlets, it is necessary to consider temporary works for dewatering when the bed elevation of the outlet is lower than the water stage of the Pasig River. Basically, the temporary linear cofferdam for dewatering will be constructed in front of the proposed drainage outlet prior to concreting. The material of the cofferdam will be decided in terms of economic aspect and certainty of dewatering. In this connection, corrugated steel sheet pile is selected as material of cofferdam taking into consideration speed of installation and removal and assurance of watertight condition. Dewatering works are estimated for the condition of normal river water condition. At the site, the dewatering is executed 2 hours in advance of working hour until the end of daily working hour. Hence, dewatering activity will be conducted using the following equipment, duration and capacity:

Table 5.4.2 Dewatering Activity for Construction of Drainage Outlet if Necessary

Dimension of Pump	Pump Capacity per Unit	Operation Time	No. of Pump	Daily Capacity
6”	30 m^3/hr	10 hrs/day	1 unit	300 m^3/day

5.4.5 Treatment of Dredged Soil

In the construction works for Lower Marikina River, dredging work is dominant. There are three (3) steps for considering the dredging work, such as dredging method, hauling plan and disposal area, as explained below.

(1) Dredging Method

Based on the sampling results of the D/D, dredging materials abound with silt and loose sand. Besides, there is an approximately 1.0 m of riverbed rise by deposits at the upstream of Marikina River due to Typhoon Ondoy. Newly deposited layers might not be hard for dredging; therefore, it is recommended to use grab-dredging for top layer and pump dredging for bottom layer.

(2) Hauling Plan

Hauling of dredged soil to the disposal area has two ways: by land or by boat. Hauling by land will bring about the mess of transportation in the local area and the operation of dump trucks is allowed only at nighttime which will limit the implementation schedule. Besides, dust and foul smell of water which will come out from the dredged materials during the transportation are expected.

By considering the socio-environmental impacts and workability of the works, transportation of the dredged soil by boat is recommended for the Project. Moreover, it is proposed to conduct improvement of dredged soil in order to reduce the transportation volume and the other issues above. Soil improvement will be applied following Japanese techniques for dewatering and upgrading of the dredged soil.

(3) Soil Improvement

Improvement of dredged soil has two methods: one is the premixing method and the other is the dewatering method. The premixing method consists of transportation of soil, mixing cement or lime to stabilize the soil, transportation of the treated soil and reclamation/land development. With this method, recycling of excavated/dredging soil and development of disposal area can be implemented in a short time. On the other hand, dewatering methods can be applied to high water content soil. Treatment procedure is different in each method but both treated soils are solid. Based on the initial comparison, dewatering works take a longer implementation period and higher cost than the premixing method. In this project, the premixing method is adopted for soil improvement.

(4) Disposal Area

The improved dredged soil will be dumped on the low-land area of the identified disposal site. For the operation and maintenance of the disposal area, coordination with the LLDA or the LGU is essential.

5.4.6 Boundary Bank

In this study, dredging materials will be re-used for Boundary Bank and Dike materials, based on the conditions of soil. Some of the unsuitable materials for embankment can be used through the geo-textile bag method. This method will enable the dewatering and reinforcement of high water-content soil. This method gives easy workability and control the times for self-weight consolidation of the soil.

5.5 Construction Schedule

For planning purposes, the total work has been arranged in such that it can easily be properly divided into major component work units such as earthworks, revetment works and construction works for other structures.

Each of the scheduled activities contains labor to be assigned, equipment resources considered to be the most appropriate method to the particular site conditions and requirement of the work. Major equipment items were selected based on the equipment capacity quoted from the publication of the Association of Carriers and Equipment Lessors (ACEL), Inc. (Equipment Guidebook of 2003, Edition 22). Labor requirement were assessed using a mix of current productivity rates and the rates recorded on similar overseas projects. In the D/D stage, unit construction schedules for each work item has been analyzed and fixed. These fixed unit construction schedules are as tabulated below.

Table 5.5.1 Unit Construction Schedules

Work Item	Unit	Working Days Required	Remarks
Repair Type R1	50 m span	43 days	Wet stone masonry, gabion, timber pile, etc.
Parapet Wall	50 m span	20 days	Reinforced concrete works with pathway
Repair Type R2	50 m span	20 days	SSP, Concrete, etc.
SSP Revetment	50 m span	20 days	SSP, Coping Concrete Works
Inclined Wall	50 m span	24 days	Reinforced concrete works with backfill

The construction schedules for the Pasig River and the Marikina River are as shown in Figure 5.5.1 and Figure 5.5.2. These construction schedules were reviewed based on the previous study results in the D/D stage. Accordingly, the construction could be completed in three (3) years. Construction periods for the main activities estimated in this design review stage are as indicated in the following figure.

Activity Description	Length (m)	Qty.	Unit	No. of Crews
Mobilization				
Survey and Investigation				
Sheet Pile Cofferdams		40	set	1
Demolition and Removal of Existing Structure		1	L.S	1
River Bank Excavation		7,332	m^3	1
Excavation for Manholes and Junction manholes		6,730	m^3	2
Excavation for Pipe Culverts		22,073	m^3	6
Excavation for other structures		783	m^3	1
Free-Draining Backfill		23,726	m^3	4
Random Backfill		399	m^3	1
Zone B Pipe Backfill		11,190	m^3	2
Zone C Pipe Backfill		7,460	m^3	2
Restoration of Road Surfaces		15,717	m^3	2
Restoration of Sidewalks		10,477	m^3	2
Riprap		51,484	m^3	4
Parapet Wall Type3	970		lm	1
Parapet Wall Type4	630		lm	1
SP Revetment	4,660		lm	3
SP+H-Beam Revetment	2,858		lm	3
River Wall	8,215		lm	6
Drainage Works	4,827		lm	6
Demobilization & Documentation				
Site Clean-up				

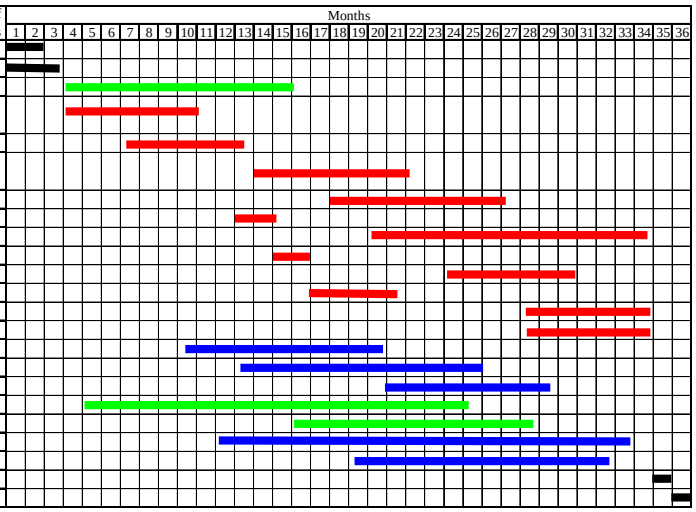


Figure 5.5.1 Construction Schedule for Pasig River

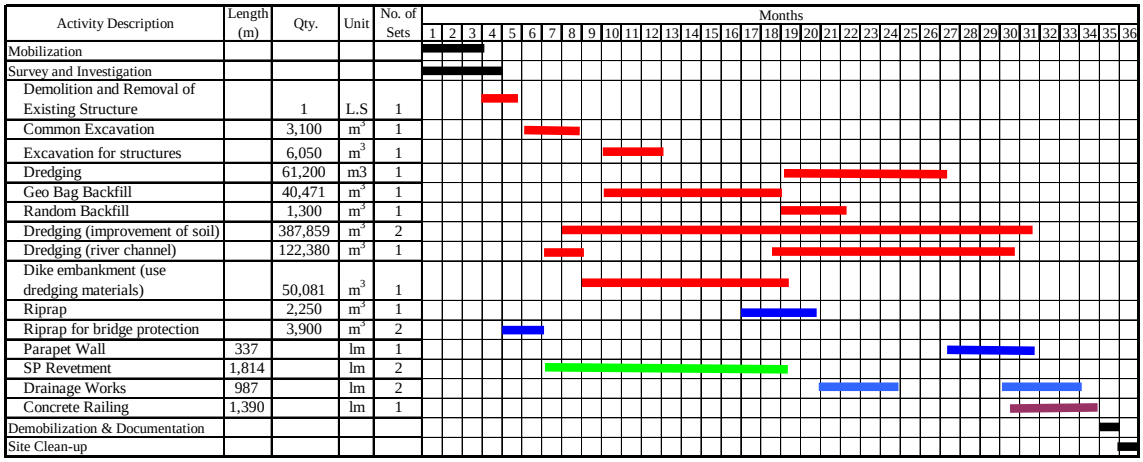


Figure 5.5.2 Construction Schedule for Lower Marikina River

Table 5.5.2 Summary of Construction Schedule

Activities		Period	Remarks
Preliminary and General	Mobilization	2-6 months	
	Survey and Investigation		Incl. reconfirmation of bank and subsoil conditions
Revetment, Floodwall and Dredging Works		30-32 months	
Drainage Works			Depending on River Works
Preliminary and General	Demobilization	2 months	
	Site Clean-up		
Total Construction Period		36 months or 3 years	

5.6 Cost Estimates

5.6.1 General

Cost estimates have been prepared for updating the results of the review on the detailed design of Phase II (ongoing Project) and for accommodating the costs arising from the revised plan under consideration, as follows:

- Fluctuation of labor rates, material unit prices, and equipment rental charges.
- Changes in the Bill of Quantities due to revision of design.
- Labor and Equipment productivity based on the current status of project site.

5.6.2 Basic Conditions for Cost Estimates

The proposed works constitute the construction activities of the potential areas in the Pasig River and the Lower Marikina River. These construction works will be executed through international competitive bidding (ICB) by eligible Japanese construction firms under JICA's STEP Loan, and be implemented by Cluster I of the Project Management Office of the Department of Public Works and Highways (DPWH-PMO-MFCP I).

The contractor will supply the required labor, materials and equipment needed for the execution of the works unless otherwise specified or noted. Prices are estimated to include all works, all supplies, handling and fixing of all materials, equipment and products, together with all obligations corresponding to the complete implementation of the works and services, in accordance with the plans and specifications.

(1) Price Level

The cost estimates have been updated on the price level as of December 2010.

(2) Exchange Rate

Exchange rates are fixed as:

1.0 PHP = 1.905 JPY
1.0 USD = 84.16 JPY = 44.178 PHP

(3) Currency for Cost Estimates

The project cost component consists of foreign currency and local currency portions. Philippine Peso will be used for both the local and foreign currency portions.

(4) Classification of Foreign and Local Portions

The following conditions for the classification of foreign and local currency portions are applied in the cost estimates:

(a) Local Currency Portion

- All Labor Costs
- Part of operation cost of construction equipment
- Part of construction material costs
- Value Added Tax
- Land acquisition and compensation costs
- All costs of administration for the government staff
- Cost of local engineering services

(b) Foreign Currency Portion

- Part of operation costs of equipment
- Part of construction material costs
- Costs of foreign engineering services.

The proportion of foreign and local currency components of major construction materials and other unit price components are presumed as below.

Table 5.6.1 Foreign and Local Currency Portions of Cost

Description	Foreign Currency Portion (%)	Local Currency Portion (%)
1. Labor	0	100
2. Construction Equipment	70	30
3. Construction Materials		
3.1 Oil/Lubricant	80	20
3.2 Woods/Stones/Sand	10	90
3.3 Cement/Concrete	70	30
3.4 Metal Products	90	10
3.5 Chemical Products	90	10

5.6.3 Unit Cost Analysis

(1) Construction Unit Cost

Costs for the construction works are estimated on a unit price basis except for some lump sum and provisional sum items. Unit prices consist of direct cost of equipment, materials and labor, indirect cost including overhead expenses, unforeseen contingencies, miscellaneous expenditures and Contractor's profit and Value Added Tax. Compositions of the unit price are as described below.

(a) Direct Cost

Direct Cost constitute three (3) component items: labor cost, material cost and equipment cost.

(i) Labor Cost

Labor productivity is derived from historical time and motion studies in the field of flood control works conducted by various projects.

The labor rates are estimated based on the minimum labor rate approved by the Department of Labor and Employment (DOLE) of GOP, NCR. The labor wages used in the cost estimates include leave, bonus, social security system (SSS), PhilHealth, Pag-ibig Fund, and all other mandatory benefits, all in accordance with the Labor Code of the Philippines as amended in 2000 (latest).

The updated labor rates based from the prescribed minimum wage are 11.2% higher than the prescribed rates used during the Review of Detailed Design for Phase II in 2008.

(ii) Material Cost

The allowances for waste and inventory loss of materials are estimated in terms of percentage of quantities, as follows:

- Cement 3%
- Processed Material 5%
- Re-Bars 3%
- Others 5%

The costs of construction materials/supplies including the delivery cost to the site were obtained mostly from local suppliers in Metro Manila. Prices of materials that are not available in Metro Manila were canvassed through suppliers or dealers in neighboring provinces.

Construction Materials Price Escalation from the Construction Materials Wholesale Index in the National Capital Region also served as reference.

Based merely from the fluctuation of material unit prices, there is an increase of 10.0% compared with the Review on Detailed Design prices in 2008.

(iii) Equipment Cost

Productivity of equipment was basically derived from the Construction Plan and/or Equipment Performance Handbook.

The hourly-operated rental rates issued by the Association of Carriers and Equipment Lessors, Inc. (ACEL) in 2006, edition 23, were applied for the construction plant and equipment rental rates for the unit price analysis in the detailed engineering stage instead of the rental rates of ACEL in November 1998, edition 21. The rental rates include operating cost of equipment, i.e., operator's wage, spare parts, repair, fuel and lubricants.

Cost for hand tools and small machines with non-mechanized nature as well as miscellaneous costs whose details cannot be quantified are included in the unit prices of construction works.

Cost of minor tools is counted as 5% to 15% of labor cost while 5% to 25% of the major materials are used for miscellaneous cost, if any.

As for special equipment and machinery, such as water-jet machine and drilling equipment for hard soil strata, their operation costs has been estimated in accordance with the "Depreciation Estimate Table of Construction Machinery and Equipment, 2008 Edition, by the Japan Construction Mechanization Association (JCMA).

(b) Indirect Cost

The contractor's indirect expenses are fixed at sixteen (16) percent of the direct cost of works in each unit cost. This percentage is rated within the range instructed in the DPWH's Department Order No. 57, series of 2002.

The indirect cost covers the following:

(i) Overhead expenses are assumed at around 6% of the Estimated Direct Cost (EDC). It includes, supervision, transportation allowances, office expenses, Contractor's all risk insurance, and financing cost.

(ii) Unforeseen contingencies, 3% (usually 3 ~ 5%) of EDC.

(iii) Miscellaneous expenses, 1% (usually 1%) of EDC.

(iv) Contractor's profit, 6% (maximum of 10%) of EDC

(c) Value Added Tax

Value Added Tax (VAT) is computed as 12% of the Estimated Direct Cost (EDC) and Overhead, Profit and Contingencies (OPC), as mandated in DPWH Department Order No. 57, series of 2002.

(2) General and Temporary Works

Mobilization and demobilization, contractor's facilities, experimental equipment and site clearing applied the same ratio between civil works and each item as in the ongoing Project.

5.6.4 Project Cost

Project Cost consists of Construction Cost, Consulting Services Fee (Engineering Services including Contingencies), Land Acquisition and Compensation Cost, Administration Expenses, and Contingencies (Price and Physical Contingencies).

(1) Construction Cost

Construction cost is derived through multiplying the unit cost of each pay item.

As mentioned in Table 5.3.1, imported materials are counted as STEP materials.

(2) Cost for Engineering Services

The Engineering Services Cost was concluded initially in May 2011.

(3) Land Acquisition, Resettlement and Compensation Costs

Land acquisition cost is not occurred in the Project. Resettlement and compensation costs are estimated based on the number of RAP results.

(4) Administration Expenses

Administrative cost includes expenses to be incurred by the Project Management Office of the Philippine Government from conception until completion of construction works of the Pasig-Marikina River Channel Improvement Project, Phase III, and is computed at three-and-a-half percent (3.5%) of the construction cost. All of these expenses are included in the local currency portion.

(5) Physical and Price Contingencies, and Price Escalation

(a) Physical Contingency

The physical contingency for unforeseen conditions is assumed at about five percent (5%) of the sum of construction costs, land acquisition and compensation costs, administration cost, and price contingencies.

(b) Price Contingency and Price Escalation

The annual inflation rates applied for the price contingency are:

- 6.9% for local currency portion
- 1.8% for foreign currency portion

(6) Project Cost

The total project cost of each component and the sum total of Phase III are as shown below on the premise that the Project will be completed at the end of the contract between the DPWH and the Contractor.

Improvement of Pasig River (Remaining Sections)

Objective	Item	Description	Cost (mil. P)
Pasig Phase II (Potental)			
	Construction Base Cost	Civil	**2,531.00**
	Compensation Cost	House/Support	17.40
		Land	-
	Consultancy Services	S/V	327.15
	Administration	3.5% of Civil, ES & Compensation	100.65
	Subtotal		2,976.20
	Contingencies	Physical for Civil, S/V	142.91
		Physical for Compensation	0.87
		Price for Civil, S/V	521.11
		Price for Comp. & Admin.	45.35
	Value Added Tax, etc	12% of Civil & Consultancy	389.14
Grand Total			**4,075.58**

Improvement of Lower Marikina River

Objective	Item	Description	Cost (mil. P)
Phase III			
	Construction Base Cost	Civil	**1,806.00**
	Compensation Cost	House/Support	-
		Land	-
	Consultancy Services	S/V	236.32
	Administration	3.5% of Civil, ES & Compensation	71.48
	Subtotal		2,113.80
	Contingencies	Physical for Civil, S/V	102.10
		Physical for Compensation	-
		Price for Civil, S/V	706.64
		Price for Comp. & Admin.	29.39
	Value Added Tax, etc	12% of Civil & Consultancy	333.92
Grand Total			**3,285.85**

COMBINED

Objective	Item	Description	Cost (mil. P)
Pasig and Lower Marikina River Improvement Project			
	Construction Base Cost	Civil	**4,337.0**
	Compensation Cost	House/Support	17.4
		Land	-
	Consultancy Services	D/D & S/V	563.5
	Administration	3.5% of Civil, ES & Compensation	172.1
	Subtotal		5,090.0
	Contingencies	Physical for Civil, D/D & S/V	245.0
		Physical for Compensation	0.9
		Price for Civil, D/D & S/V	1,227.8
		Price for Comp. & Admin.	74.7
	Value Added Tax, etc	12% of Civil & Consultancy	723.1
Grand Total			**7,361.5**

CHAPTER 6 PROJECT EVALUATION AND IMPLEMENTATION

6.1 Environmental Evaluation of the Project

6.1.1 Assessment of Project Impacts

Overall, the project will generate significant socio-economic benefits by reducing potential flood damages on individual households and business sectors in Metro Manila wherein approximately 33 percent (33%) of the country's GDP is generated. The resettlement for construction of the river structures will be minimized by restricting the extent of river works within the publicly owned land and minimizing interference with existing buildings; however, it remains possible that 58 households are to be relocated to other places depending on the circumstance of the construction site.

Management of dredged material was a concern raised in the scoping session of the project. Contamination of groundwater would take pace if the following two (2) conditions are met: 1) the dredged material contains pollutants at a concentration beyond applicable standards; and 2) appropriate protocol for managing the materials is neglected under the project. Most of the impacts identified in this study are either temporary or short-term and, unless otherwise identified, are deemed mitigable through engineering designs and good construction practices, accompanied by appropriate environmental mitigation measures and management plans.

The assessment matrix developed for the project focuses on negative impacts, as shown in the table below.

Table 6.1.1 Assessment of Negative Impacts

Items			Negative Impact		Explanations
			EIS(98)	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	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 Benefits 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.

			Negative Impact		
	8	Cultural heritage, historical and religious sites	—	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.
	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.

			Negative Impact		
	25	Wastes (including Dredged Material)	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: Unknown, D: Few impact. ― : Not Applicable *EIS1998) 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.					

6.1.2 Mitigation Measures and Monitoring Points in Phase III Construction Stage

The most negative impact by this Phase III project is involuntary resettlement. Therefore, cautious planning and engineering design shall be pursued in the subsequent stage of the project to avoid and minimize incidence of involuntary resettlement resulting from unexpected changes in engineering design.

Other three (3) impacts judged "C" (water pollution, waste and bottom sediment) pertain to the management of dredged materials. Due to uncertainty of the impact occurrence, the project proponent shall undertake soil testing for approval by LLDA or LGU before implementation of disposal of dredged materials to the designated site. Details of the Environmental Management Plan are attached.

Table 6.1.2 Mitigation Measures for Negative Impacts

Items			Impact Evaluation (as Table 5.1)	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

Items			Impact Evaluation (as Table 5.1)	Mitigation Measures
	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	Poor, Indigenous and Ethnic people	D	Not necessary
	7	Misdistribution of Benefit and Damage	D	Not necessary
	8	Cultural heritage, historical and religious sites Recreational area	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.
	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.

Items			Impact Evaluation (as Table 5.1)	Mitigation Measures
	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 impacted, B: Slight impact, C: Unknown, 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.

6.2 Economic Evaluation

The proposed project is part of a series of public sector investment for the protection of assets in flood prone areas in the capital. An economic assessment of the proposed project has been performed in 2002 as part of the Detailed Engineering Design of the Pasig-Marikina River Channel Improvement Project[4]. Therefore the assessment made under the present Preparatory Study was conducted by updating the cost and benefit of the Project.

6.2.1 Economic Cost of the Project

The cost of the Project was updated by using two major sources of information: 1) the record of budget [5] allocated to the Pasig-Marikina River Improvement Project provided by DPWH; and 2) the cost estimate prepared in the Preparatory Study.

[4] The values in the analysis were fixed at the 2001 price level.
[5] Annual Budgetary Allocations, Pasig-Marikina Rover Channel Improvement Project (Phase II)

(1) Financial Cost

The record of DPWH's budget allocation presents the annual values of budget allocated for civil works, consultancy services, ROW acquisition, and construction management in financial term for the period 2007-2012.

Table 6.2.1 DPWH Budget for Phase II Project

Year	Civil Works	Consultancy Services	ROW	Construction Management
2007		84,920		3,080
2008	189,744	160,570		1,656
2009	449,697	50,001	92,512	
2010	800,878	100,000		25,954
2011	1,108,600	18,597		34,863
2012	1,479,289	8,259		

Unit: Thousand Pesos
Source: DPWH

As for the cost estimate prepared in the Preparatory Study, it contains estimates of construction cost, engineering service cost, compensation cost, and administration cost for Phase III and Phase IV of the Project, as presented in subsequent parts of the report.

Table 6.2.2 Financial Cost of Phase III Project

Year	Main Construction Cost			Engineering Services Cost				Compensation Cost		Adminis-tration Cost
	Phase II	Phase III	Physical Cont'ncy.	Detailed Design	Nonstructural Measures	Const. Supervision	Physical Cont'ncy	Base Cost	Physical Cont'ncy	Base Cost
2012					0.0	0.0	0.0	0.0	0.0	0.0
2013	0.0	0.0	0.0	0.0	97.7	80.6	8.9	17.4	0.9	6.5
2014	630.6	451.4	54.1	0.0	65.2	53.7	6.0			37.8
2015	945.3	675.4	81.0	0.0	65.2	53.7	6.0			54.6
2016	945.3	675.4	81.0	0.0	65.2	53.7	6.0			54.6
2017	313.6	220.6	26.7	0.0	32.6	26.9	3.0			18.7

Unit: Million Pesos
Note: Values of price escalation were removed from the table.

Table 6.2.3 Financial Cost of Phase IV Project

	Main Construction Cost			Engineering Services Cost				Compensation Cost		Adminis-tration Cost
	MCGS	Phase IV	Physical Cont'ncy	Detailed Design	Non-Structural Measures	Const. Supervision	Physical Cont'ncy	Base Cost	Physical Cont'ncy	Base Cost
2017					0.0	40.8	2.0	4.0	0.2	1.5
2018	496.2	481.6	48.9	0.0	97.7	131.2	11.5	14.1	0.7	38.6
2019	744.8	720.2	73.3	0.0	65.2	87.5	7.6			50.8
2020	744.8	720.2	73.3	0.0	65.2	87.5	7.6			50.8
2021	744.8	720.2	73.3	0.0	65.2	87.5	7.6			50.8
2022	243.0	235.2	23.9	0.0	32.6	43.7	3.8			17.5

Unit: Million Pesos
Note: Values of price escalation were removed from the table.

In this part of the report, the record of budget for the Pasig-Marikina River Improvement Project is used to present the procedures of converting the financial to the economic values.

(2) Conversion to 2010 Price Level

All values were fixed at the Year 2010 price level by using arithmetic means of price indexes for corresponding years.

Table 6.2.4 Arithmetic Means of Price Indexes

2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1.60	1.56	1.51	1.41	1.27	1.17	1.14	1.06	1.06	1.00

Source: National Statistics Office: Values are the arithmetic means for the corresponding periods of: 1) Consumer Price Index (Metro Manila); 2) General Wholesale Price Index (Luzon); 3) Retail Price Index (Metro Manila); 4) Construction Materials Wholesales Price Index ,NCR; and 5) Construction Materials Retail Price Index, NCR.

The budget of DPWH for the Pasig-Marikina River Improvement Project is converted into the Year 2010 price level, as shown below.

Table 6.2.5 Budget for Pasig-Marikina River Improvement Project in 2010 Price Level (Phase II)

Year	Civil Works	Consultancy Services	ROW	Construction Management
2007	0	94,261	0	3,419
2008	197,334	166,993	0	1,722
2009	458,691	51,001	94,362	0
2010	800,878	100,000	0	25,954
2011	1,108,600	18,597	0	34,863
2012	1,479,289	8,259	0	0

Unit: Thousand Pesos
Source: DPWH

(3) Conversion to Economic Cost

The financial cost of the project was subsequently converted to economic values by using the following conversion factors that were derived in the Detailed Engineering Design Phase. The cost estimates under the Preparatory Study, including those for Phase III and Phase IV, were in the same manner converted to economic values.

Table 6.2.6 Conversion Factors used in the Analysis of Financial Cost

	Cost Category	Financial Cost (Billion Pesos)	Economic Cost (Billion Pesos)	Conversion Factor
1	Direct Construction Cost	6.65	5.28	0.79
	Phase 1: Pasig River Improvement	2.77	2.24	0.81
	Phase 2: MCGS	2.09	1.56	0.75
	Phase 3: Marikina River Improvement	1.81	1.43	0.79
2	Compensation	2.36	1.35	0.57
3	Engineering Services	1.06	1.26	1.19
4	Government Administration	0.29	0.28	0.97
5	Physical Contingency	0.43	0.4	0.93
6	Price Escalation	1.28	0	0.00
	Total	12.07	8.58	0.71

Source: Detailed Engineering Design of Pasig-Marikina River Channel Improvement, Project Evaluation, Volume XV, March 2002

Table 6.2.7 Economic Cost of the Budget for Pasig-Marikina River Improvement Project (Phase II)

Year	Civil Works	Consultancy Services	ROW	Construction Management
2007	0	112,077	0	3,303
2008	159,643	198,554	0	1,664
2009	371,081	60,640	54,070	0
2010	647,910	118,900	0	25,072
2011	896,857	22,112	0	33,678
2012	1,196,745	9,820	0	0

Unit: Thousand Pesos

(4) Other Considerations

The maintenance cost of the project was assumed to be equivalent to 0.3% of the total direct construction cost in consonance with the assessment in 2002. Replacement cost of MCGS includes the costs of items that require periodical replacement. In accordance with the assumption made in the previous assessment in 2002, it was assumed that replacement takes place every 15 years after the completion of MCGS, at 266 million pesos, which is equivalent to 12% of the MCGS construction cost.

6.2.2 Benefit of the Project

The values of potential damage avoided as a result of the project were updated from the previous study in 2001 to the current value in 2010. The major changes made in the analysis are: 1) the growth rate of housing value; 2) the price index; and 3) the flood area. On the basis of the update, the benefit of the project was quantified.

(1) Growth Rate of Housing Value

The growth rate of housing value was computed by comparing the base unit value of house structure in 2001 and in 2010.

Table 6.2.8 Growth Rate of Housing Value

Source	Values (Pesos)	Rate of Increase (%)
Base unit value of house structure in 2001[*1]	130,800	1.35
Base unit value of house structure in the Preparatory Study in 2010	176,919	

[*1] Refer to Page 7-6, Detailed Engineering Design of Pasig-Marikina River Channel Improvement Project prepared in 2002, Project Evaluation, Volume XV, March 2002

(2) Price Index

The arithmetic means of price indexes at 1.6 for the period from 2001 to 2010 was adopted for converting the damage values in 2002 to 2010.

(3) Flood Area

The flood area was also reviewed as part of the study to enable separate estimation of the project benefit of the Pasig River Improvement Project. This is because: 1) prioritization of subproject components was performed for Phase II due to the sharp increase in the steel cost after the detailed engineering design, to stay within the project budget and, therefore, 2) it required the transfer of the unfinished portion of the river protection works in Phase II to the subsequent Phase III project.

Table 6.2.9 Estimated Flood Area

				Return Period				
				2	5	10	20	30
Entire Flood Area				9.7	30.0	35.3	49.4	55.0
	Outside of Project Area	San Juan River		1.8	3.5	3.8	4.7	4.9
		Upper Most Marikina		6.7	7.0	7.5	7.9	8.1
	Pasig Marikina River		Without	1.2	19.5	24.0	36.8	42.0
			With II	1.0	17.9	19.5	30.9	35.4
			With III	0.5	1.4	16.2	29.4	34.6
			With IV	0.0	0.0	0.0	0.0	0.0
		Pasig River (0-7.1 km)	Without	0.0	0.8	2.1	3.0	3.7
			With II	0.0	0.2	0.4	0.7	1.1
			With III	0.0	0.0	0.0	0.0	0.9
			With IV	0.0	0.0	0.0	0.0	0.0
		Pasig River (7.1-17.1km)	Without	0.3	1.3	3.3	4.8	5.8
			With II	0.1	0.3	0.6	1.2	1.8
			Wth III	0.0	0.0	0.0	1.0	1.5
			With IV	0.0	0.0	0.0	0.0	0.0
		Lower and Middle Marikina River	Without	0.9	17.3	18.5	29.0	32.5
			With II	0.9	17.3	18.5	29.0	32.5
			With III	0.5	1.4	16.2	28.4	32.1
			With IV	0.0	0.0	0.0	0.0	0.0
Unit: km^2								

(4) Other Conditions

In undertaking the economic analysis, the following assumptions were further laid down in line with the previous study in 2002:

- The project benefit was fully generated upon completion of the structures of the corresponding project component.
- The damage to infrastructure was equivalent to 35% of the total potential damage to property; and other indirect damages were equivalent to 10% of the total direct damages.
- The damage rate of flood remained unchanged.

(5) Estimation of Potential Flood Damage

On the basis of potential flood damage estimated for the entire project in 2002, potential damages in 2010 were computed according to: 1) the growth rate of housing value; and 2) the price index.

Table 6.2.10 Flood Damage Without Project: Entire Project Area, 2001

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	1.2	19	24	37	42
II Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	1,407	9,288	17,058	30,506	43,960
(1) Facilities	1,019	6,943	12,635	22,596	32,562
a. Housing Units	347	2,233	4,120	7,520	10,576
b. Manufacturing	224	2,130	3,761	6,830	9,473
c. Wholesale & Retail Trade	214	1,338	2,581	4,368	6,918
d. Hotels & Restaurants	27	110	174	319	467
e. Real Estate & Offices	32	170	307	548	792
f. Education	36	203	356	627	899
g. Health	117	630	1,087	1,945	2,798
h. Other Facilities	22	130	248	439	640
(2) Agricultural Production	0	0	0	1	1
a. Irrigated Field	0	0	0	1	1
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	388	2,344	4,422	7,909	11,397
2. Indirect Damage	295	1,883	3,460	6,197	8,826
(1) Household	97	606	1,135	2,074	2,962
(2) Business Losses	48	373	618	1,072	1,469
(3) Other Damages	150	904	1,706	3,051	4,396
3. Total	1,702	11,171	20,517	36,702	52,786

Source: The values in 2001were drawn from the report of the Detailed Engineering Design of Pasig-Marikina River Channel Improvement Project prepared in 2002, Project Evaluation, Volume XV, March 2002.
Unit: Million Pesos

Table 6.2.11 Flood Damages Without Project: Entire Project Area, 2010

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	1.2	19	24	37	42
II Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	2,085	14,253	25,917	46,298	66,804
(1) Property	1,545	10,557	19,197	34,294	49,483
a. Housing Units	470	3,020	5,573	10,172	14,305
b. Manufacturing	358	3,408	6,018	10,928	15,156
c. Wholesale & Retail Trade	343	2,141	4,130	6,989	11,069
d. Hotels & Restaurants	42	176	279	510	747
e. Real Estate & Offices	51	271	491	878	1,267
f. Education	57	325	570	1,003	1,438
g. Health	188	1,008	1,740	3,112	4,476
h. Other Facilities	35	208	397	703	1,025
(2) Agricultural Production	0	1	1	1	1
a. Irrigated Field	0	1	1	1	1
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	541	3,695	6,719	12,003	17,319
2. Indirect Damage	441	2,991	5,398	9,664	13,769
(1) Household	155	970	1,817	3,318	4,739
(2) Business Losses	78	596	990	1,715	2,350
(3) Other Damages	209	1,425	2,592	4,630	6,680
3. Total	2,526	17,244	31,314	55,961	80,573

Unit: Million Pesos

The damages of each section of the water body "with" and "without" the project cases were subsequently computed according to the estimated flood area. The estimated flood damages of the Lower Pasig River "without the Project" and "with the Project Phase III" are as given below.

Table 6.2.12 Flood Damage: Lower Pasig River Without Phase III

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	0.00	0.20	0.36	0.74	1.12
II. Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	0	146	389	930	1,781
(1) Property	0	108	288	689	1,319
a. Housing Units	0	31	84	204	381
b. Manufacturing	0	35	90	220	404
c. Wholesale & Retail Trade	0	22	62	140	295
d. Hotels & Restaurants	0	2	4	10	20
e. Real Estate & Offices	0	3	7	18	34
f. Education	0	3	9	20	38
g. Health	0	10	26	63	119
h. Other Facilities	0	2	6	14	27
(2) Agricultural Production	0	0	0	0	0
a. Irrigated Field	0	0	0	0	0
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	0	38	101	241	462
2. Indirect Damage	0	31	81	194	367
(1) Household	0	10	27	67	126
(2) Business Losses	0	6	15	34	63
(3) Other Damages	0	15	39	93	178
3. Total	0	177	470	1,124	2,148

Unit: Million Pesos

Table 6.2.13 Flood Damage: Lower Pasig River With Phase III

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	0.00	0.00	0.00	0.00	0.94
II. Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	0	0	0	0	1,495
(1) Property	0	0	0	0	1,107
a. Housing Units	0	0	0	0	320
b. Manufacturing	0	0	0	0	339
c. Wholesale & Retail Trade	0	0	0	0	248
d. Hotels & Restaurants	0	0	0	0	17
e. Real Estate & Offices	0	0	0	0	28
f. Education	0	0	0	0	32
g. Health	0	0	0	0	100
h. Other Facilities	0	0	0	0	23
(2) Agricultural Production	0	0	0	0	0
a. Irrigated Field	0	0	0	0	0
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	0	0	0	0	388
2. Indirect Damage	0	0	0	0	308
(1) Household	0	0	0	0	106
(2) Business Losses	0	0	0	0	53
(3) Other Damages	0	0	0	0	150
3. Total	0	0	0	0	1,803

Unit: Million Pesos

(6) Estimation of Benefit

On the basis of the above computation on flood damage, the benefits of the projects were estimated, as shown below.

Table 6.2.14 Benefit Estimation of Pasig River Phase III

River	Return Period	Damages		Avoided Damages	Average Damages Avoided	Average Annual Exeedance Probability	Annual average damage	Sum of the damages
		Without	With					
Pasig Downstream	2	0	0	0	0	-	0	0
	5	177	0	177	89	0.30	27	27
	10	470	0	470	324	0.10	32	59
	20	1,124	0	1,124	797	0.05	40	99
	30	2,148	1,803	345	735	0.02	12	111
Pasig Upstream	1.4	0	0	0	0	-	0	0
	2	104	0	104	52	0.21	11	11
	5	283	0	283	193	0.30	58	69
	10	744	0	744	514	0.10	51	121
	20	1,778	1,520	258	501	0.05	25	146
	30	3,395	2,877	518	388	0.02	6	152
Marikina	1	0	0	0	0	-	0	0
	2	1,904	1,116	788	394	0.50	197	197
	5	15,349	1,201	14,148	7,468	0.30	2,240	2,437
	10	24,222	21,130	3,092	8,620	0.10	862	3,299
	20	44,094	43,182	912	2,002	0.05	100	3,399
	30	62,349	61,601	748	830	0.02	14	3,413
Sum of the above	2	2,008	1,116	892	446	-	208	208
	5	15,809	1,201	14,608	7,750	0.30	2,325	2,533
	10	25,437	21,130	4,307	9,458	0.10	946	3,479
	20	46,996	44,702	2,294	3,301	0.05	165	3,644
	30	67,893	66,282	1,611	1,953	0.02	33	3,676

Unit: Million Pesos

The benefit of Phase II, or the summation of annual average damage, is thus estimated at 3,676 million pesos per year.

The estimated return period of the Upper Pasig River under the non-damage case was at 1.4, so that the corresponding average annual exceedance probability was estimated at 0.21 based on the computation (1/1.4 - 1/2 = 0.21) for the section of river. On the other hand, the estimated return period of Marikina River under the non-damage case was slightly lower than 1.0, so that it was set to 1.0 in this analysis for simplicity.

(7) Summary of Estimated Benefits

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

Table 6.2.15 Benefit Estimation for each of the Project Components in 2010

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

6.2.3 Economic Analysis

The economic internal rate of return (EIRR) of the Project is as presented below. All the projects were judged to be economically viable.

Table 6.2.16 Economic Analysis for each of the Project Components

Project Components	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

The analysis for the project components covered the period until 2067 with the assumption of 50-years of project life after the completion of the Phase III's civil works in 2017.

6.2.4 Sensitivity Analysis

The sensitivity analyses indicate that the project components are less sensitive to the increase in investment cost or decrease in benefit. The cost overrun at 20% and benefit reduction at 20% pushes down the EIRR of all project components. However they are, nonetheless, still well over the threshold of the designated social discount rate.

Table 6.2.17 Sensitivity Analysis: 20% Cost Overrun

Project Components	EIRR	NPV: Million Pesos Discounted at 15%	B/C Ratio (@15%)
Phase II	20%	1,044	1.4
Phase III	34%	3,560	3.1
Phase IV	31%	1,987	2.8
Entire Project	25%	6,591	2.2

Table 6.2.18 Sensitivity Analysis: 20% Reduction in Benefit

Project Components	EIRR	NPV: Million Pesos Discounted at 15%	B/C Ratio (@15%)
Phase II	19%	749	1.3
Phase III	33%	2,791	2.9
Phase IV	30%	1,554	2.7
Entire Project	25%	5,093	2.1

An additional sensitivity analysis was conducted to see the impact of cost overrun on project viability. The result of the analysis indicate that the economic viability is maintained even with the overall cost increase of more than 35%.

Table 6.2.19 Sensitivity Analysis: 35% Cost Overrun

Project Components	EIRR	NPV (Million Pesos Discounted at 15%)	B/C Ratio (at 15%)
Phase II	18%	720	1.2
Phase III	32%	3,347	2.7
Phase IV	29%	1,852	2.5
Entire Project	24%	5,918	2.0

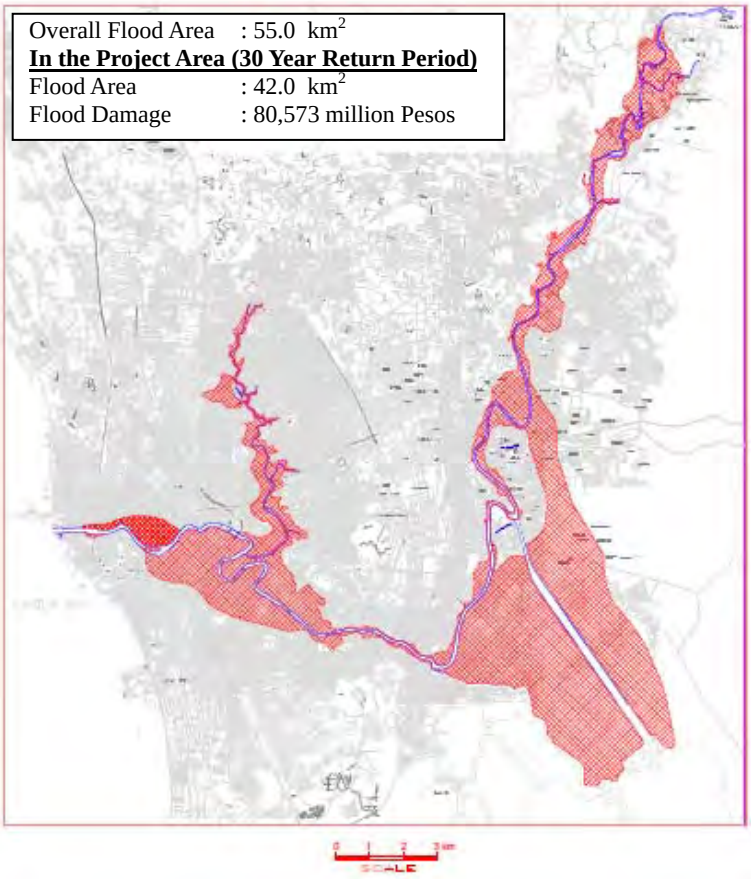


Figure 6.2.1 Inundation Area: Without the Project

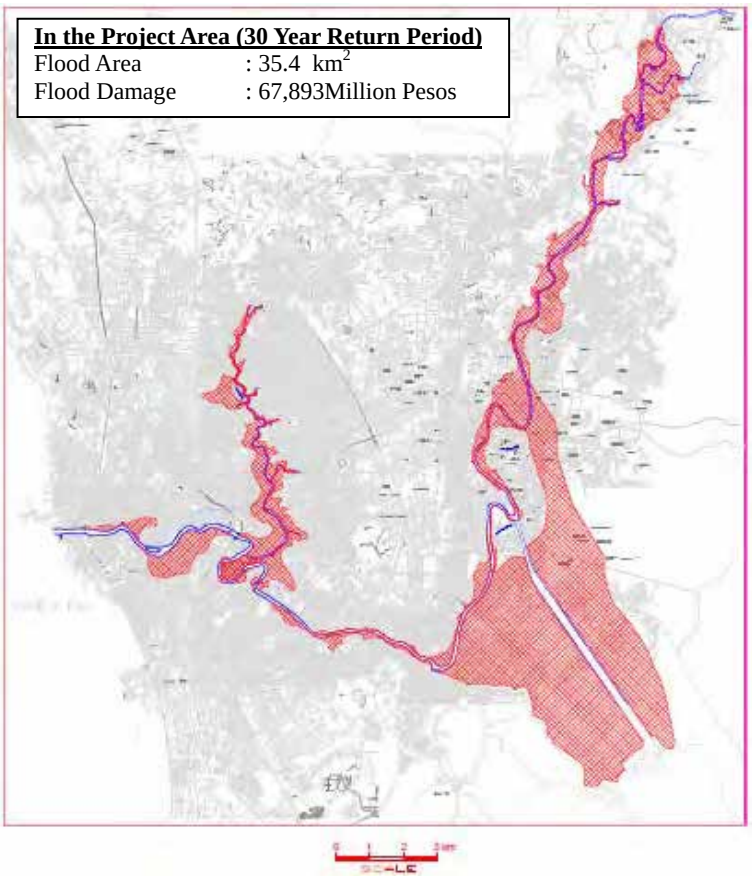


Figure 6.2.2 Inundation Area: With Project Phase II

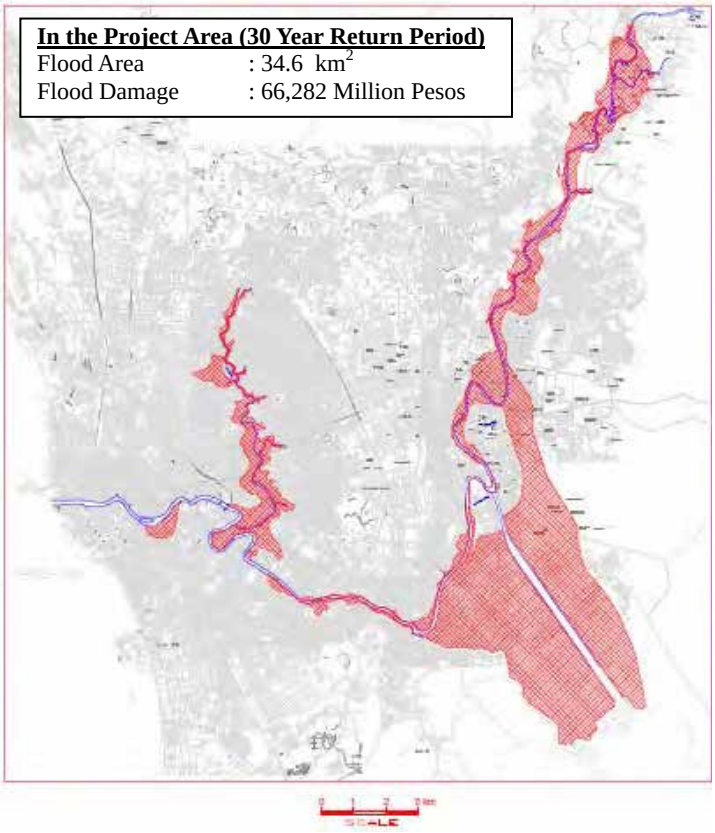


Figure 6.2.3 Inundation Area: With Project Phases II and III

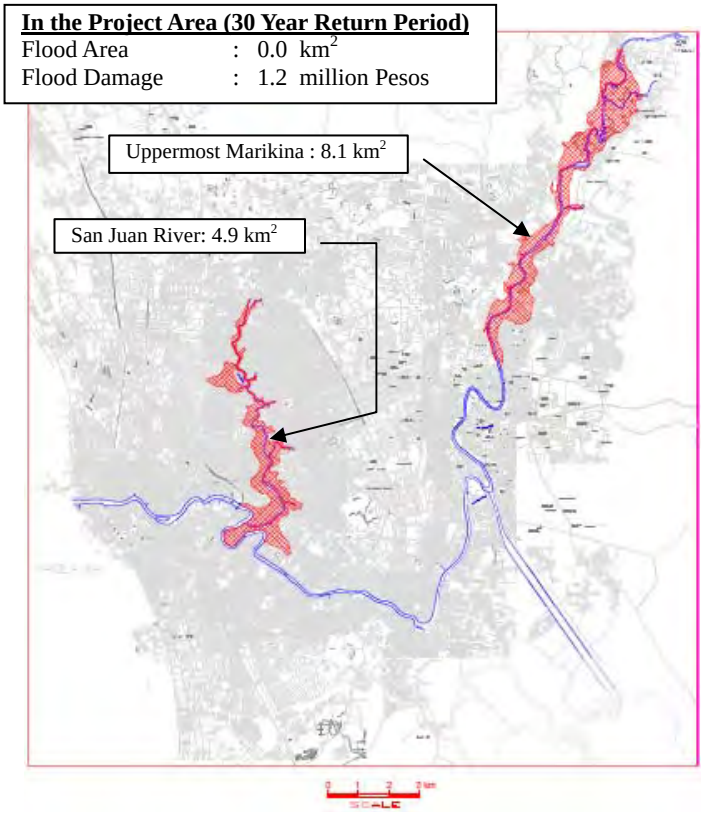


Figure 6.2.4 Inundation Area: With the Entire Project

6.2.5 Effects of the Project and Performance Indicators

(1) Effects of the Project

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

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

Table 6.2.20 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	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 of 30-year return period could not be attained under the "without MCGS" condition. The safety level will remain at about 20-year return period in the lower stretch of the Pasig River after the confluence of San Juan River, and about 10-year and 2-year return periods of the Pasig River before the confluence of San Juan River and the Lower Marikina River.

Judging from the inundation area, the 30-year return period could not be observed as in the case of construction of MCGS. There will still exist inundation areas in the case of "without MCGS."

(2) Performance Indicators

(a) Operation Indicator

According to JICA's "Operation and Effect Indicators Reference (October 2002), it is proposed to set-up an indicator to identify the operation and maintenance conditions of the project through the periodical monitoring activities for the indicator, and also to conduct proper operation and maintenance. In this regard, the application of annual maximum flood discharge as the operational indicator 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 Sto. 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. To detect the annual maximum flood discharge, it is necessary to conduct flood discharge observation at every flooding time using a float or a current meter for water flow velocity, together with a cross sectional survey at the reference point including the arrangement of a table compiling the observed discharge records. As for the flood discharge observation work, it is recognized that FCSEC, among the offices in DPWH, has the capacity to conduct the work.

(b) Effect Indicator

Effect indicators of the Project are as presented below.

Table 6.2.21 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 6.2.22 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 6.2.23 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)	Damage (Million Peso)	Average Damage Avoided (Million Peso)	Average Annual Exeedance Probability	Annual Average Damage (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

* The estimated return period of flood in Upper Pasig River without causing damage is 1/1.4, so that the corresponding annual average damage is estimated at 0.21 based on the computation (1/1.4 - 1/2 = 0.21). On the other hand, the estimated return period in Marikina River without damage is lower than 1.0, so that it is assumed to be 1.0 in this analysis.

Table 6.2.24 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)	Damage (Million Peso)	Average Damage Avoided (Million Peso)	Average Annual Exeedance Probability	Annual Average Damage (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

* The estimated return period of flood in Upper Pasig River without causing damage is 1/1.4, so that the corresponding annual average damage is estimated at 0.21 based on the computation (1/1.4 - 1/2 = 0.21). On the other hand, the estimated return period of Marikina River without damage is lower than 1.0, so that it is assumed to be 1.0 in this analysis.

Table 6.2.25 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

* The estimated return period of flood in Upper Pasig River without causing damage is 1/1.4, so that the corresponding annual average damage is estimated at 0.21 based on the computation (1/1.4 - 1/2 = 0.21). On the other hand, the estimated return period of Marikina River without damage is lower than 1.0, so that it is assumed to be 1.0 in this analysis.

Table 6.2.26 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

* The estimated return period of flood in Upper Pasig River without causing damage is 1/1.4, so that the corresponding annual average damage is estimated at 0.21 based on the computation (1/1.4 - 1/2 = 0.21). On the other hand, the estimated return period of Marikina River without damage is lower than 1.0, so that it is assumed to be 1.0 in this analysis.

6.3 Implementation of the Project

6.3.1 Project Implementation Agency

The implementation office for Phase II is the DPWH-PMO-MFCP-I. After completion of construction of Phase II, operation and maintenance of constructed flood facilities will be turned over to MMDA based on the agreement between DPWH and MMDA. Awareness activities for Flood Risk Management with concerned LGUs and residents were also carried out in the Phase II.

In the Phase III project, the implementing office will be the same as in Phase II. Moreover, it is proposed to strengthen the non-structural measures (NSM) for Flood Risk Management in Phase III, aggressively. For the smooth implementation of NSM, it is important for DPWH to maintain a close coordination with MMDA and the LGUs which already had conducted some activities in advance (refer to Subsection 3.2.2.).

The FMC, which shall be created by the time that the Phase III project is started, will undertake the coordination among the agencies concerned on issues that may arise in each stage of the project, i.e., preparation, implementation and O&M, and also coordination with the local inhabitants as well as PAPs.

DPWH-PMO-MFCP-I is currently undertaking supervision of foreign-assisted river projects and GOP-funded projects and its number of engineers is insufficient. The implementing function of this office is supposed to terminate upon completion of the Project.

Therefore, it is recommended that the DPWH-FCSEC shall take over the responsibilities for NSM of the Project. FCSEC has established an office to conduct development and updating of technical standards, guidelines and manuals, and assessment of efficient countermeasures for flood control and Sabo works. After the completion of construction of the Project, FCSEC shall continuously coordinate with the LGUs and MMDA for updating of the database and technical advisories on Flood Risk Management.

Project implementation agencies for each stage will very, as summarized in below.

Table 6.3.1 Project Implementation Agency

Stage	Activities	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

The MOA among DPWH, MMDA and PRRC, and the Certification between DPWH and the LGUs concerned shall be executed before the start of implementation of construction of the Phase III project. Each agency shall carry out its roles and responsibilities as stipulated in the MOA and/or the Certification.

6.3.2 Implementation Schedule

The Implementation Schedule of Phase III will be as shown in Figure 6.3.1. As reflected in this Figure 6.3.1, the construction period will expire on April 2017 and project completion will coincide with the completion of consultancy services on June 2017.

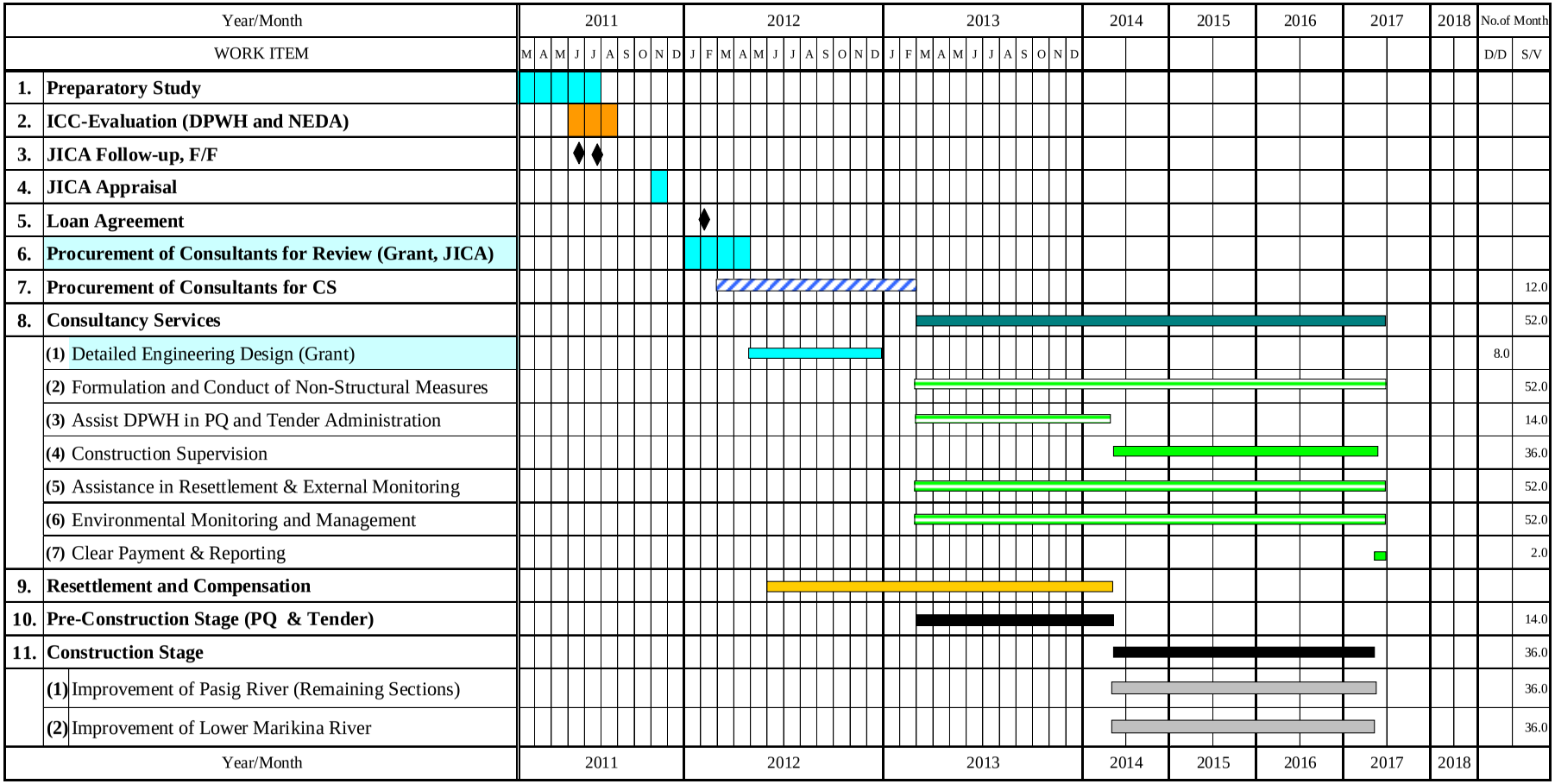


Figure 6.3.1 Implementation Schedule of the Phase III Project in Pasig-Marikina River

6.4 Overall Project Schedule

The main work components of the PMRCIP are the river channel improvement works consisting of dredging, construction of revetment and parapet wall/river wall, and the construction of MCGS, drainage and bridge works.

(1) Original Phasing

For the above project works, the original phasing has been arranged in the Detailed Design Stage, as indicated in the following table.

Table 6.4.1 Phasing in the Detailed Design Stage

Phase	Stretch	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)	7×10^3	0	14.5	9.13	28	-	-	-
	Upper Pasig River: 7.20 km (Lambingan Bridge to Napindan Channel)	8×10^3	0	13.7	8.44	56	2	-	-
Phase III	Lower Marikina River: 6.00 km (Napindan Channel to MCGS)	500×10^3	200×10^3	0.34	1.13	11	1	Vargas Br. Sandoval Br. Rosario Br.	-
	MCGS and Its Vicinity: 1.20 km (MCGS to Mangahan FW)	250×10^3	70×10^3	0	1.08	-	-	-	-
Phase IV	Upper Marikina River: 6.10 km (Mangahan FW to Sto. Niño)	$1,360 \times 10^3$	740×10^3	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) Modified Phasing through the JICA Preparatory Study

For the above phasing of the works, the following issues were, however, pointed out through the JICA Preparatory Study:

- River Channel Improvement of Phase II Potential Area
- Construction of MCGS

(a) River Channel Improvement of Phase II Potential Area

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

In the JICA Preparatory Study, the river channel stretch, which should be covered in the Phase III project, was identified and proposed for improvement as potential areas.

(b) Construction of MCGS

The purpose of construction of MCGS, which was originally scheduled to be implemented together with the river improvement of Phase III, is to assure the design discharge distribution of 500 m^3/s to Lower Marikina River, as well as 2,400 m^3/s to Mangahan Floodway. However, due to the existence informal settlers along Mangahan Floodway, the design flow capacity of 2,400 m^3/s has been lowering to around only 2,000 m^3/s or less. Moreover, there are open portions at the left side bank of Mangahan Floodway to receive the flood discharge from the Cainta, Buli, and Maho rivers, and some amount of diverted discharge of 2,400 m^3/s may spill through the open portions toward the inland areas of the river basins resulting in the increase of flood inundation damage to the inland areas.

Therefore, to assure the safety of diversion of 2,400 m^3/s to Mangahan Floodway, the informal settlers should be first relocated and the open portions have to be closed. The F/S on this matter was conducted by DPWH in 2007 under the title "East Mangahan Project," and it is pointed out that residents along the Upper Marikina River may not easily accept the construction of MCGS without improving the dike and expanding the width of channel in the Phase IV section of the Upper Marikina River.

In this connection, the construction and operation of MCGS could not be initiated until the issues on Mangahan Floodway are resolved and hence the East Mangahan Project should be implemented earlier and then the construction of MCGS as well as the implementation of Phase IV should be put on the last phase of the Project (PMRCIP).

Under the above conditions, the modified phasing is as shown in the following table.

Table 6.4.2 Modified Phasing of the Project

Phase	Stretch	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)	7×10^3	0	14.5	9.13	28	-	-	-
	Upper Pasig River: 7.20 km (Lambingan Bridge to Napindan Channel)	8×10^3	0	13.7	8.44	56	2	-	-
Phase III	Lower Marikina River: 6.00 km (Napindan Channel to MCGS)	618×10^3	51×10^3	0.34	1.81	11	1	Vargas Br.; Sandoval Br.; Rosario Br. Sta. Rosa Br.	-
	Phase II Potential Areas	37×10^3	50×10^3	9.92	7.52	49	-		
Implementation of East Mangahan Project									
Phase IV	Upper Marikina River: 6.10 km (Mangahan FW to Sto. Niño)	$1,360 \times 10^3$	740×10^3	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)	250×10^3	70×10^3	0	1.08	-	-	-	-

CHAPTER 7 CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

In the Study, the currently existing plan of the Pasig-Marikina River Channel Improvement Project (PMRCIP) focusing on the river improvement stretch covered by Phase III was reviewed and updated to support the Yen-Loan Project to be formulated as the Phase III Project. Phase III shall consist of river channel improvement works and monitoring, educational campaign and publicity to local inhabitants and so on.

The Study has concluded that the Phase III project is economically viable, technically feasible, and socially and environmentally acceptable.

7.2 Recommendations

(1) As witnessed from the extent of flood damage caused by typhoons, especially the recent typhoon locally named as "Ondoy" (internationally, "Ketsana") which brought about devastating flood damage in 2009, Metro Manila is very fragile against flood attributable mainly to the poor flood discharge capacity of the Pasig-Marikina River Channel. Since the Pasig-Marikina River Channel Improvement Project (PMRCIP) has been initiated with the implementation of construction of the Phase II Project to alleviate the flood damage, it is strongly recommended that necessary actions to promote the Phase III Project, including preparation of an implementation program (I/P), the resolution of RDC and the application for ICC, should be taken with least lapse of time in accordance with the implementation schedule proposed in the Study.

(2) For the implementation of construction of the Phase III Project, the resettlement of several informal settlers along the river course is anticipated. In the Study, materials for the resettlement action plan (RAP) have been arranged, and DPWH had already formulated the RAP. It is, therefore, recommended that the necessary actions to promote the RAP should be initiated by GOP as early as possible.

(3) To smoothly implement the construction of Phase III Project and for the control of illegal and/or disorderly land development which may further exacerbate the flooding condition in the Pasig-Marikina River Basin, the Study proposes the establishment of a flood mitigation committee (FMC) together with the execution of memorandums of agreement (MOAs) and/or certifications by all agencies or LGUs involved, which shall define the roles and responsibilities of each agency or LGU concerned. In this connection, it is recommended that appropriate actions to set up the FMC, as well as execution of MOA(s) and/or Certification(s) of concerned agencies or LGUs, shall be taken immediately.

(4) The Study proposes the implementation of river channel improvement works targeting the Phase III stretch and the selected priority areas in the Phase II stretch which comprises the PMRCIP Phase III. However, certain areas that were excluded from the priority areas in Phase II will remain without improvement works. For such remaining areas where river channel improvement works seem to be necessary from the environmental point of view, it is recommended that river channel works in the framework of a "PRRC project" shall be implemented as early as possible.

(5) The introduction of nonstructural measures is proposed in parallel with the preparation for the river channel improvement works for the Phase III stretch and the selected priority areas in the Phase II stretch (the Phase III Project). In this connection, preliminary arrangements shall be made regarding the introduction or implementation of the proposed nonstructural measures, particularly, the educational campaign and publicity, which is

essential to facilitate the project's implementation with a deeper understanding of all stakeholders concerned on the significance of the Project.

(6) The Special Terms for Economic Partnership (STEP) Loan is expected to be applied to the implementation of the Phase III Project. In this connection, the application for a STEP Loan shall be arranged with support from the MOA between DPWH and other Government agencies concerned, as well as the certifications signed by the LGUs concerned to be obtained by DPWH.

(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.

ANNEX: FIGURES

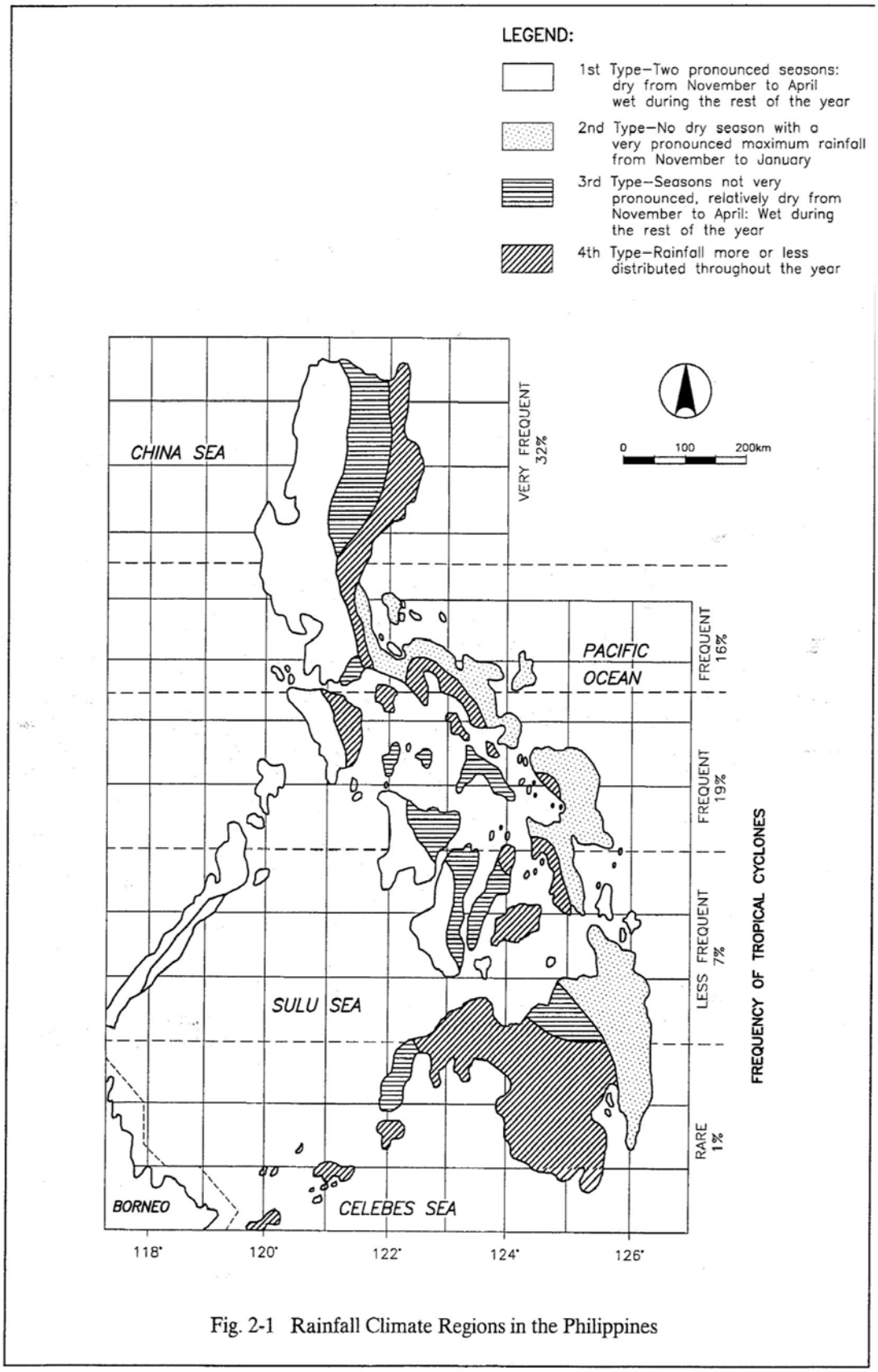


Fig. 2-1 Rainfall Climate Regions in the Philippines

Figure-A2.1.1 Rainfall Climate Regions in the Philippines

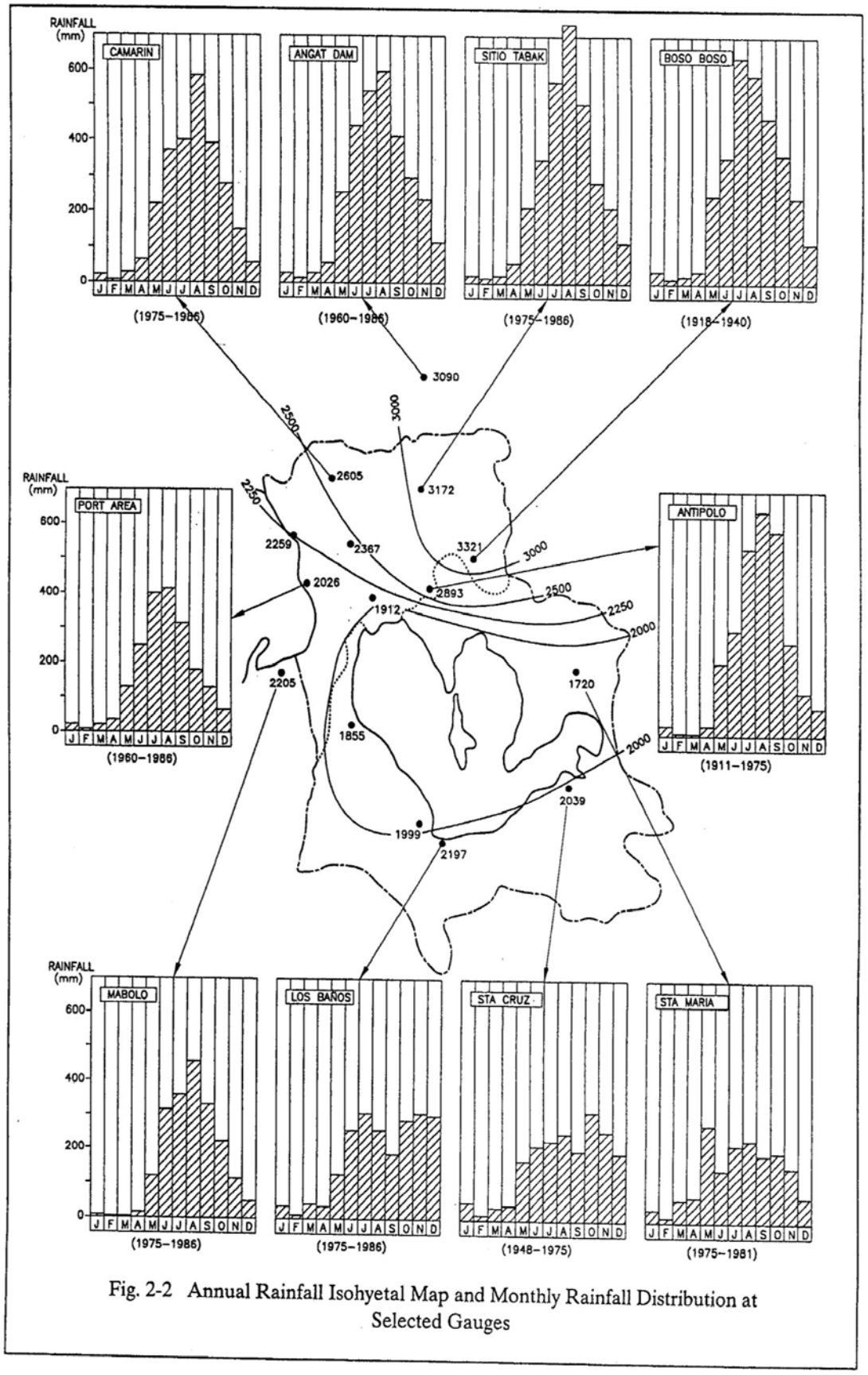


Fig. 2-2 Annual Rainfall Isohyetal Map and Monthly Rainfall Distribution at Selected Gauges

Figure-A 2.1.2 Annual Rainfall Isohyetal Map and Monthly Rainfall Distribution at Selected Gauges

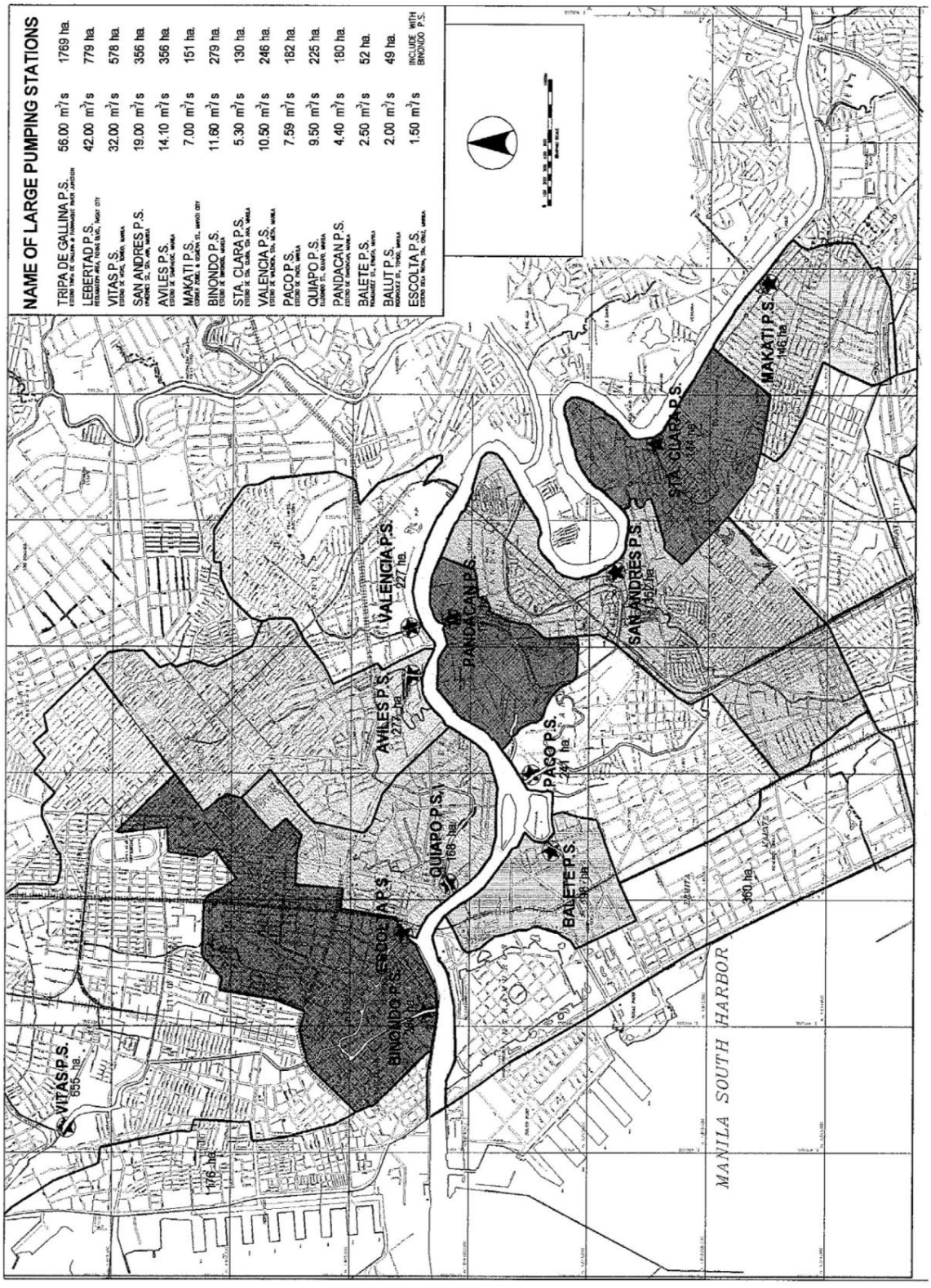


Figure A-2.1.3 Location Map of Pump Stations

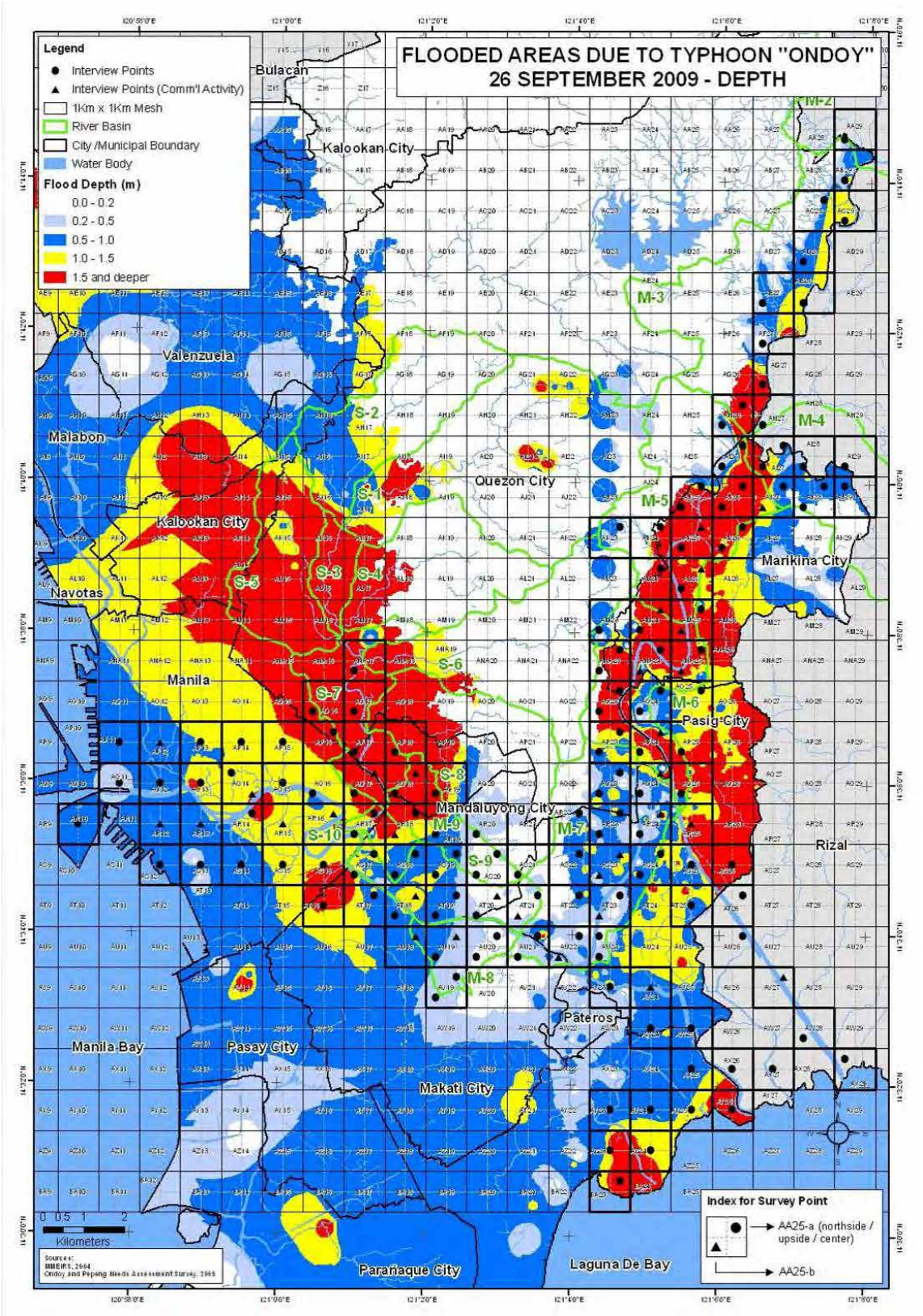


Figure A-2.1.4 Sites of Damage Interview Survey

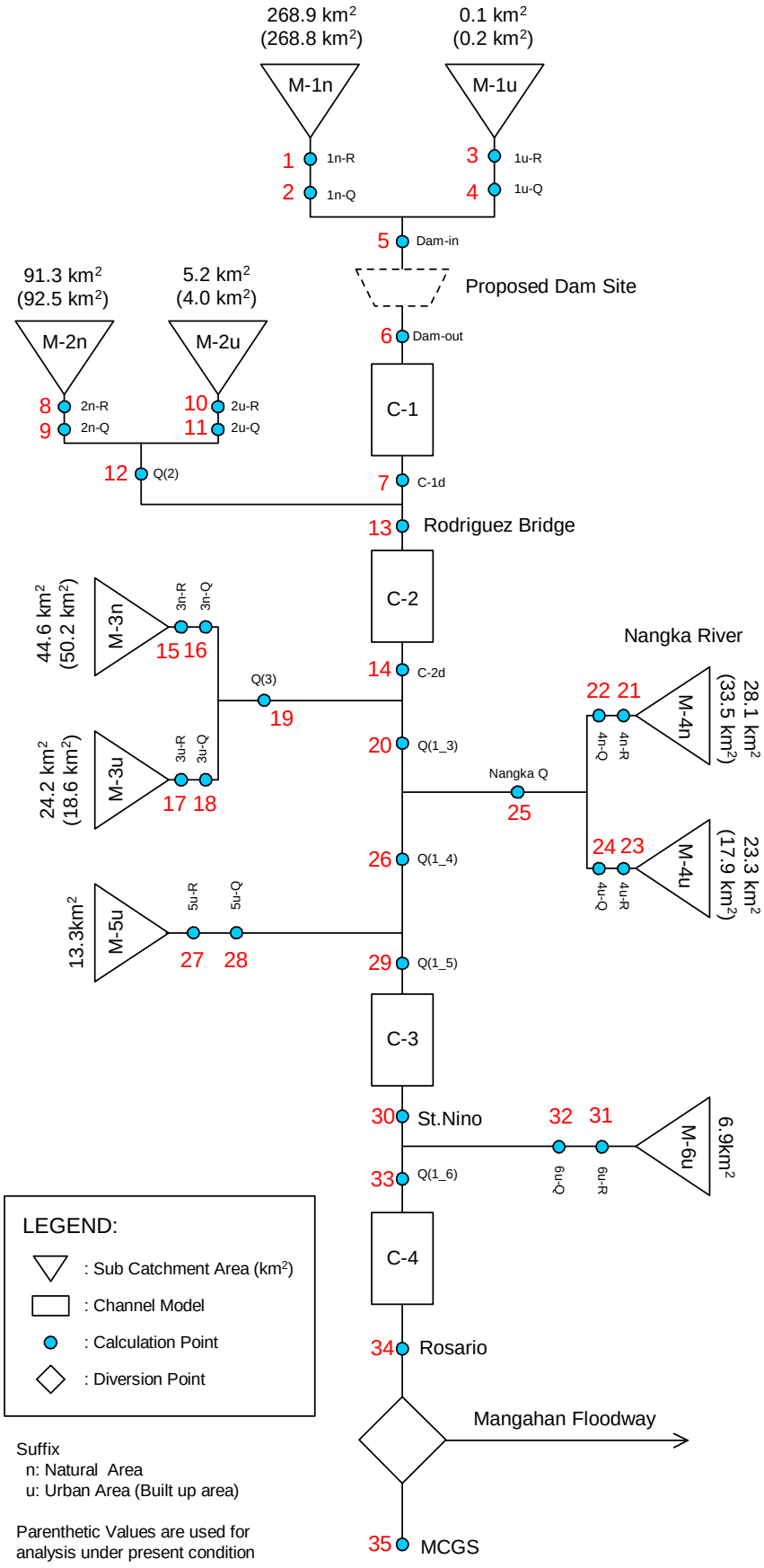


Figure A-3.1.1 Diagram of Runoff Model

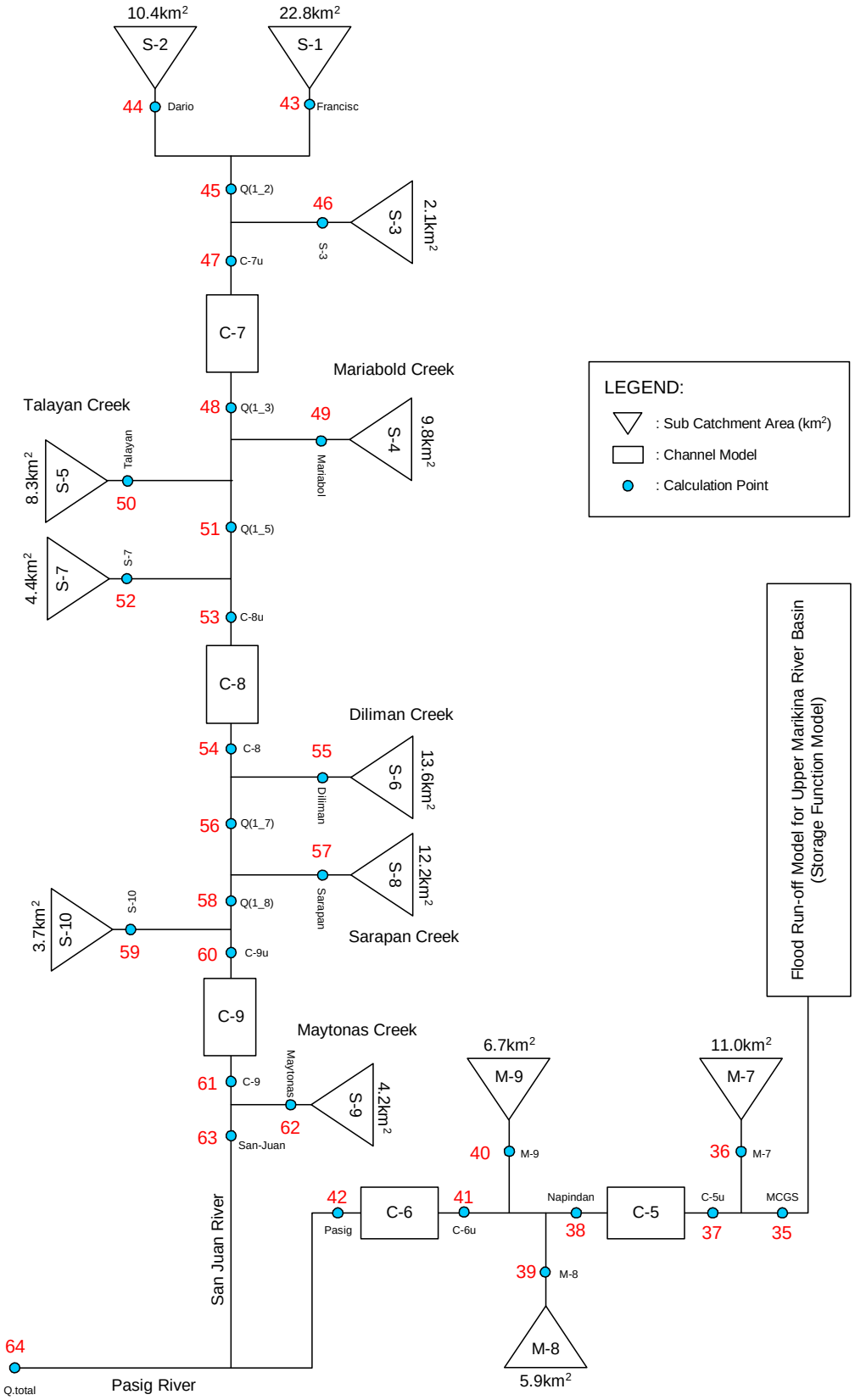


Figure-A 3.1.2 Flood Runoff Model for Lower Basin (Quasi-Linear Model)

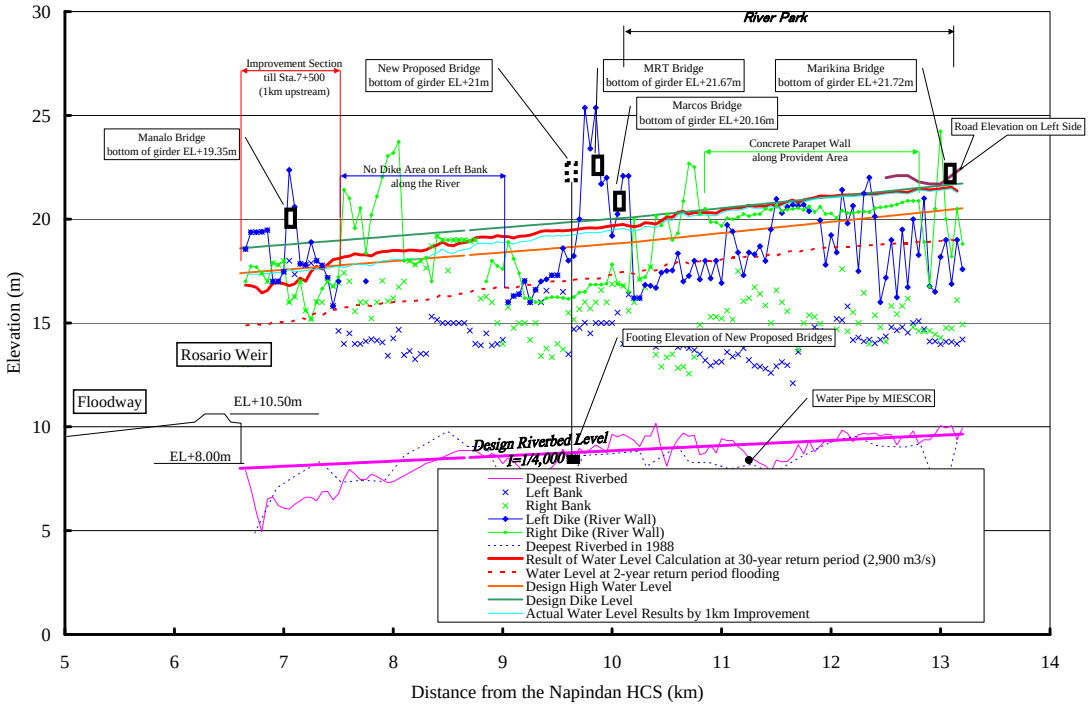


Fig.A 3.2.1 EXPECTED INFLUENCE STRETCH BY MCGS

Figure A3.2.1 Expected Influence Stretch of Backwater by Construction of MCGS

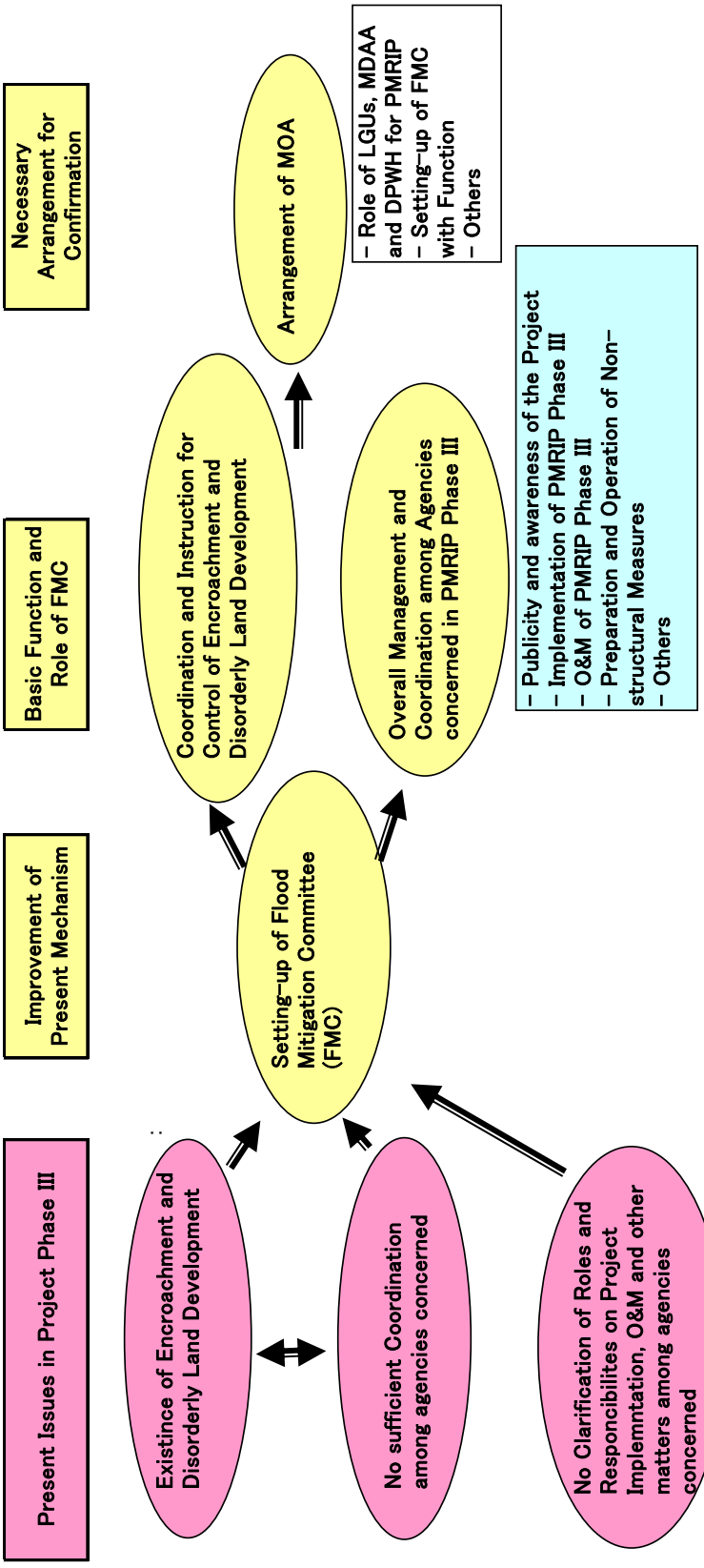


Figure-A 3.7.1 Necessity of FMC

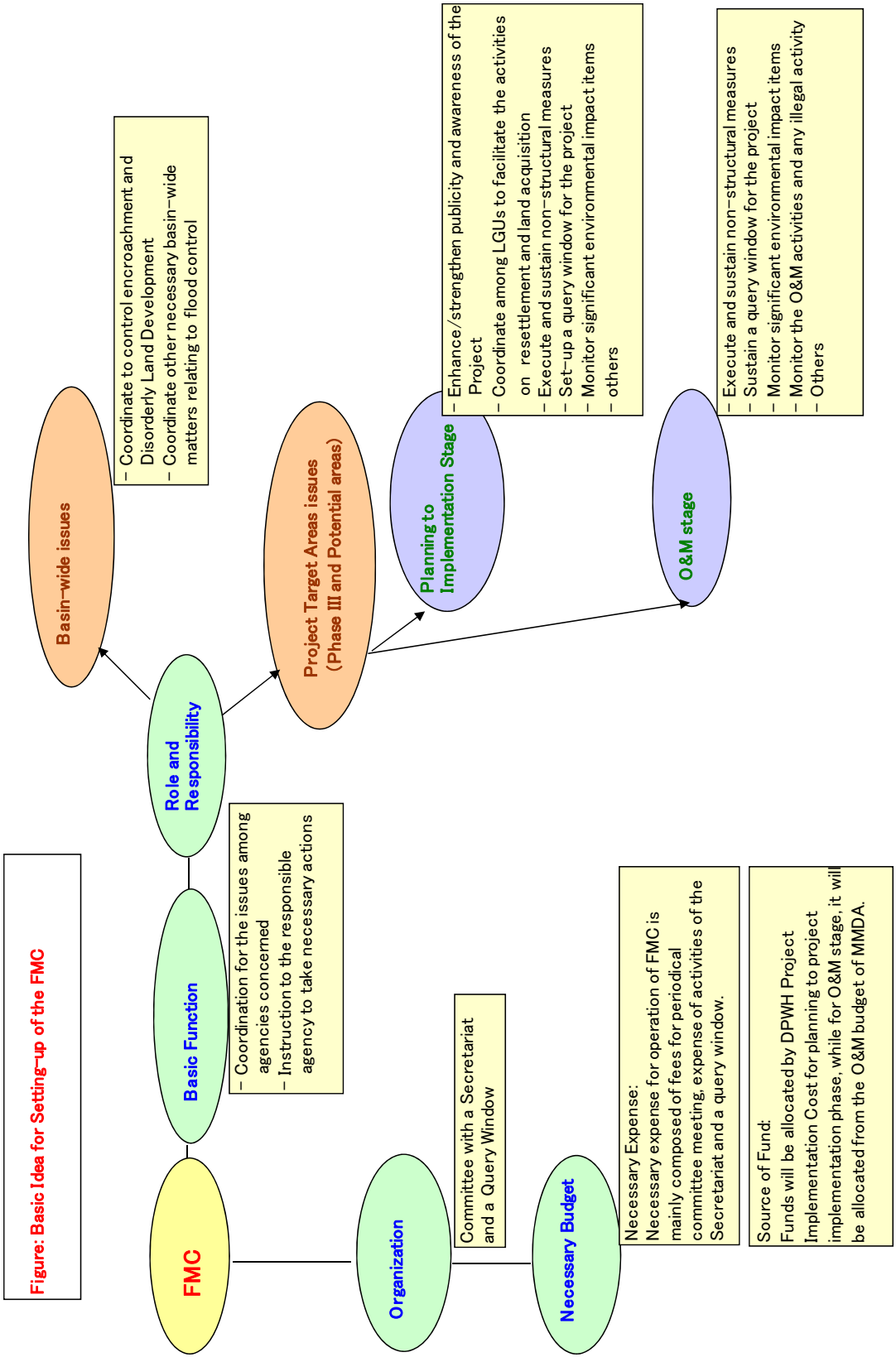


Figure-A 3.7.2 Functions of FMC

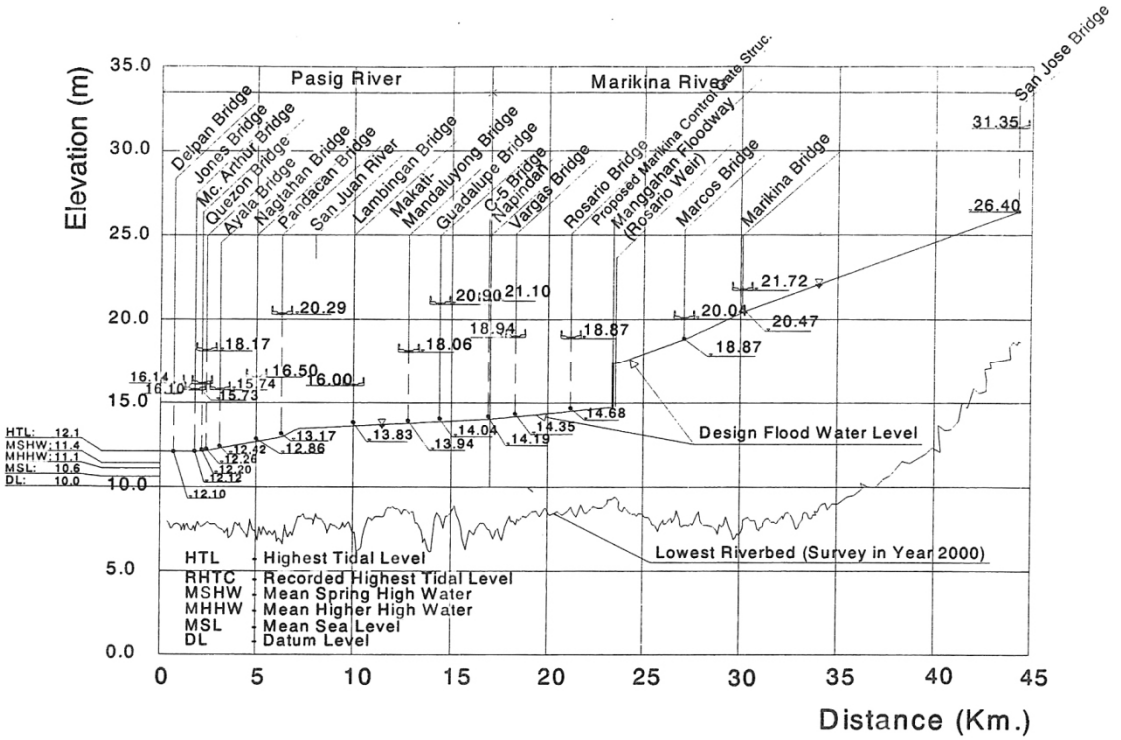


Figure A4.3.1 Location of Bridges on Pasig-Marikina River

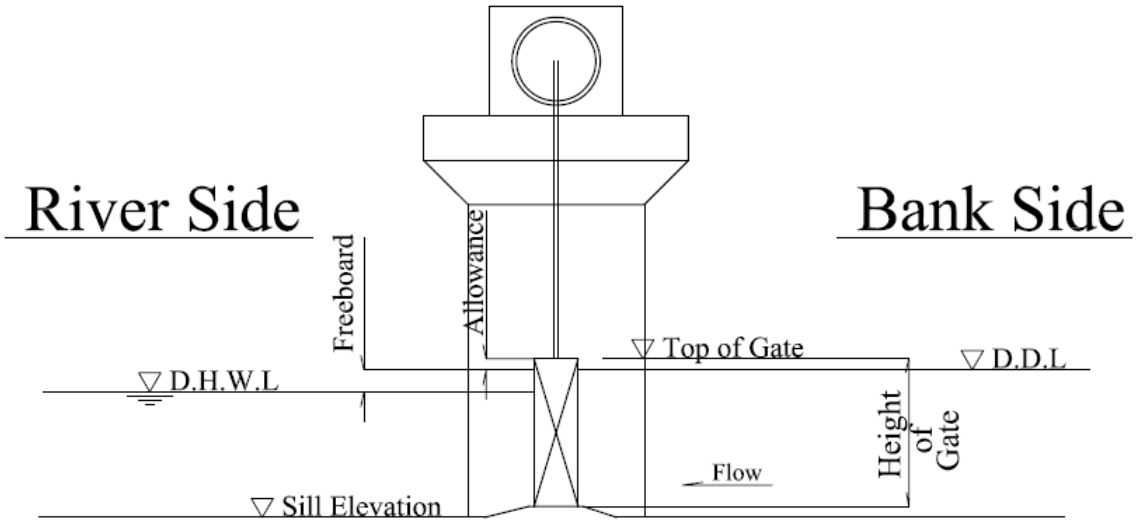


Figure A4.3.2 General Figure of Drainage Facilities

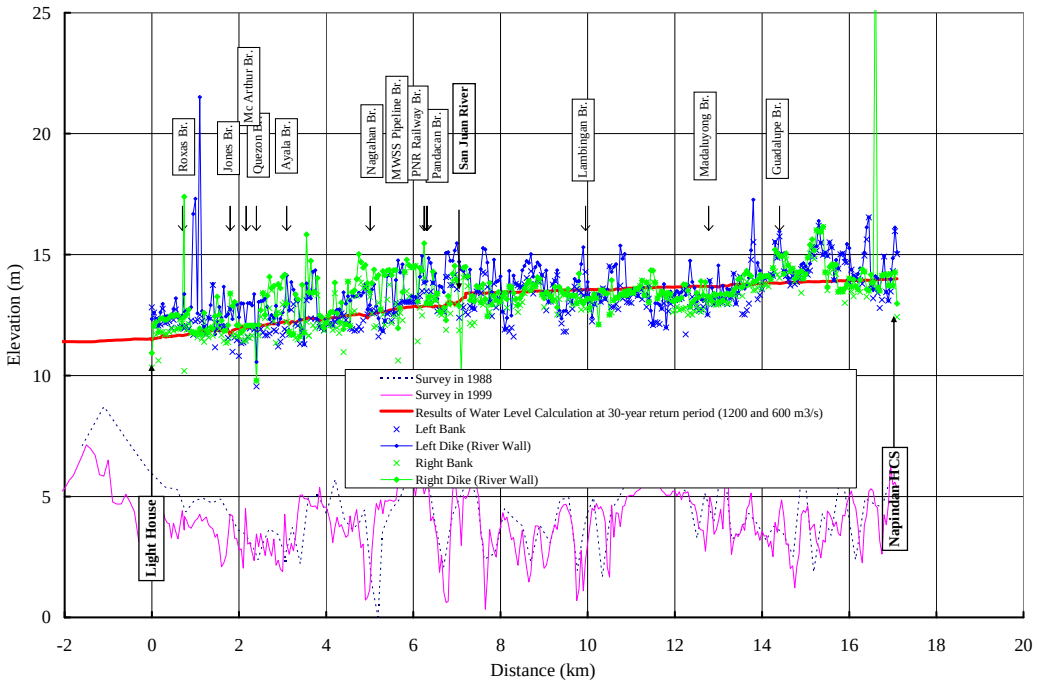
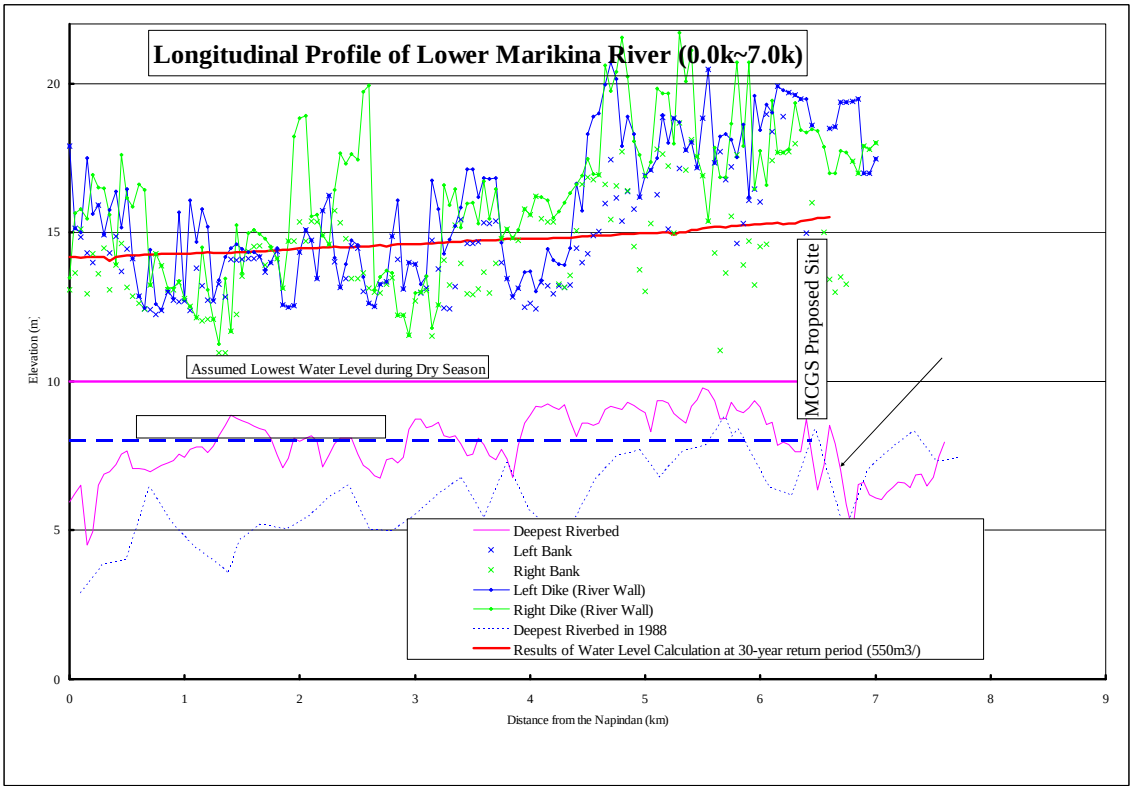


Fig.4.3.2 LONGITUDINAL PROFILE OF PASIG RIVER CHANNEL

FigureA4.3.2 Longitudinal Profile and Ground Height along Pasig River



FigureA4.3.3 Longitudinal Profile and Ground Height along Lower Marikina River

Figure A4.3.5(1/6) Satellite Image of Pasig-Marikina River

Figure A4.3.5(2/6) Satellite Image of Pasig-Marikina River

Figure A4.3.5(3/6) Satellites Image of Pasig-Marikina River

Figure A4.3.5(4/6) Satellite Image of Pasig-Marikina River

Figure A4.3.5(5/6) Satellite Image of Pasig-Marikina River

Figure A4.3.5(6/6) Satellite Image of Pasig-Marikina River

ANNEX: Tables

Table A 2.1.1 Flood Damage (1993-2000)

Name of Typhoon/ Tropical Storm	Occurence Data		Casualties			Affected		Evacuated		Cost of Damage (PhP)
	From	To	Dead	Injured	Missing	Families	Person	Families	Person	Infrastructure
GLORING	7/23/93	7/27/93	-	-	-	2,754	14,067	771	3,914	-
RUBING	8/16/93	8/19/93	-	-	-	2,355	14,130	-	-	-
KADIANG	9/30/93	10/7/93	-	-	-	1,556	6,585	-	-	-
MONANG	12/3/93	12/6/93	1	1	-	4,441	22,418	419	3,596	16,230,000
KATRING	10/18/94	10/21/94	22	40	4	13,919	62,797	-	-	22,762,000
MAMENG	9/27/95	10/2/95	-	-	-	-	-	-	-	-
ROSING	10/30/95	11/4/95	21	253	7	109,254	519,030	-	-	71,370,000
GLORING	7/14/96	7/14/96	3	3	1	2,395	11,482	-	-	-
HUANING	7/27/96	7/31/96	3	-	-	-	-	-	-	-
BINING	5/24/97	5/26/97	20	4	2	40,671	203,045	1,000	50,000	2,850,000
HULING	7/30/97	8/7/97	1	-	-	-	-	-	-	1,100,000
IBIANG & MILING	8/15/97	8/20/97	19	-	-	78,953	449,027	18,368	104,968	6,600,000

Table-A 2.2.2 Results of Flood Damage Interview

Item	Question	Results
General	Experience of flood in 2009	Almost 80% of interviewees experienced flooding
	Flood height on the street	0-1m: 15%, 1-2m: 24%, 2m>: 38%
	Flood height on home	0-1m: 19%, 1-2m: 19%, 2m>: 39%
	Duration of flood	0-1day: 4%, 1-2days: 37%, 2days>: 32%
	Speed of Flood water	Very Fast: 47%, Fast: 34%, Slow: 7%
	Source of Information	Nobody: 3%, Barangay Head: 5%, Media: 91%
	Action taken	None (inc. stay at home) : 43%, Evacuation: 11%
		Went higher place of house: 16%
	Knowledge of evacuation place	Aware 35%, Not aware 51%
	Time to evacuation place	0-15min.:25%, 15-60 min. 2%, 60min>1%
	Damage to property	None:25%, Not incur:14%, Minor: 27%, Collapsed: 24%
Social Service	Interruption to Power Supply	0-1day: 11%, 1-2days: 25%, 2days>: 63%
	Interruption to Water Supply	0-1day: 63%, 1-2days: 10%, 2days>: 27%
	Interruption to Telephone	0-1day: 76%, 1-2days: 5%, 2days>: 18%
	Interruption to Transportation	Zipney: 29%, Walking: 29%, Tricycle: 36%, Public Bus: 1%
	Interruption to Schooling	0-1day: 19%, 1-2days: 1%, 2days>: 79%
	Interruption to Hospital	0-1day: 96%, 1-2days: 0%, 2days>: 4%
	Government Offices	None: 7%, Barangay: 1%, Municipal hall 92%
Commercial Activities	Interruption	0-1day: 32%, 1-2days: 26, 2days>: 42%
	Reason of interruption	Building under water 24%, Materials couldn't be used: 16%
		Employees couldn't come: 5%, Utilities disconnected: 19%
	Compensation for damage from insurance	Received 3%, Not received: 84%

Table A 2.5.1 Members of PRRC

Assignment	Name of Office
Chair	Dept. of Environment and Natural Resources
Co-chair	Metro Manila Development Authority
Member	Office of Executive Secretary
	Dept. of Budget and Management
	Dept. of Finance
	Dept. of Public Works and Highways
	Dept. of National Defense
	Dept. of the Interior and Local Government
	Dept. of Trade
	Dept. of Tourism
	Housing and Urban Development and Coordinating Council
	Metro Manila Mayors League
	GMA Network, Inc. (Private Sector Representative)
	ABS-CBN Foundation, Inc./Bantay Kalikasan
	Unilever Philippine (Private Sector Representative)

Table-A 3.1.1 Annual Maximum Rainfall Intensities Observed at Port Area

Year	Rainfall Intensity (mm/hour)						Rainfall (mm/day)		2days
	5 min.	10 min.	20 min.	30 min.	60 min.	120 min.	1 day	2 days	maximum (mm)
1903	N/A	N/A	N/A	N/A	N/A	N/A	78.7	46.0	92.0
1904	N/A	N/A	N/A	N/A	N/A	N/A	226.2	211.9	423.8
1905	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1906	N/A	N/A	N/A	N/A	N/A	N/A	144.9	81.7	163.4
1907	112.8	91.2	84.6	80.0	57.3	36.2	141.9	100.6	201.2
1908	140.4	100.2	87.0	75.2	57.3	30.8	121.6	82.7	165.4
1909	198.0	172.2	123.6	86.2	46.7	N/A	88.7	76.0	152.0
1910	100.8	79.2	71.7	61.4	40.6	N/A	69.6	44.9	89.8
1911	112.8	91.2	63.3	54.4	43.9	N/A	133.1	89.7	179.4
1912	140.8	121.8	89.1	72.2	45.6	N/A	N/A	N/A	N/A
1913	162.0	138.6	117.9	99.0	60.7	31.0	128.2	117.0	234.0
1914	118.8	107.4	96.9	79.8	46.3	N/A	234.7	202.1	404.2
1915	122.4	91.2	77.7	65.0	41.6	N/A	105.4	72.5	145.0
1916	142.8	97.2	83.7	61.0	40.7	N/A	74.2	45.7	91.4
1917	168.0	140.4	115.2	87.0	44.8	N/A	107.6	70.5	141.0
1918	128.4	117.0	99.0	84.4	55.3	N/A	271.5	185.6	371.2
1919	136.8	120.6	106.8	83.2	49.8	40.0	310.6	255.5	511.0
1920	140.8	109.8	91.3	64.2	41.8	N/A	85.0	N/A	N/A
1921	136.8	103.8	90.0	81.4	58.7	35.7	263.6	200.5	401.0
1922	103.2	81.0	49.2	41.4	N/A	N/A	104.2	N/A	N/A
1923	128.4	99.6	85.5	73.2	54.2	35.0	309.1	278.0	556.0
1924	136.8	101.4	91.8	81.8	68.8	58.2	285.0	162.9	325.8
1925	100.8	79.2	72.3	57.8	32.6	N/A	130.7	112.8	225.6
1926	115.2	99.0	84.6	64.6	35.5	N/A	131.9	81.6	163.2
1927	164.4	117.6	77.7	73.6	63.0	36.8	103.9	71.4	142.8
1928	128.4	96.0	66.3	51.4	36.6	N/A	85.6	73.8	147.6
1929	136.8	126.6	107.4	99.5	65.0	33.8	121.9	83.4	166.8
1930	136.8	103.8	73.2	52.2	N/A	N/A	153.6	121.0	242.0
1931	152.4	144.6	135.0	118.4	65.8	41.3	265.7	264.5	529.0
1932	152.4	126.6	116.1	117.4	100.9	80.2	203.2	117.1	234.2
1933	122.4	90.0	63.3	57.4	32.0	N/A	116.6	93.6	187.2
1934	146.4	117.6	99.9	95.0	76.9	52.9	186.7	N/A	N/A
1935	174.0	125.7	118.8	96.4	65.8	47.6	149.5	N/A	N/A
1936	146.4	135.6	120.3	96.0	59.2	30.6	136.7	N/A	N/A
1937	124.8	115.8	105.0	90.4	63.6	35.3	143.0	N/A	N/A
1938	124.8	100.8	83.1	61.2	50.1	34.9	216.9	149.0	298.0
1939	97.2	85.2	69.2	55.4	N/A	N/A	177.8	N/A	N/A
1940	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1941	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1942	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1943	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1944	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1945	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1946	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1947	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1948	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1949	N/A	N/A	N/A	N/A	N/A	N/A	66.6	45.5	91.0
1950	158.4	135.6	94.5	81.2	50.9	N/A	105.4	60.9	121.8
1951	180.0	141.6	116.7	86.8	45.3	N/A	92.7	61.4	122.8
1952	295.2	205.8	170.7	153.4	92.5	48.8	156.5	123.5	247.0
1953	156.0	137.4	120.3	107.8	76.2	55.5	171.2	97.4	194.8
1954	243.6	225.6	157.8	117.8	82.3	54.4	108.7	73.8	147.6
1955	134.4	105.0	76.2	59.0	35.1	N/A	177.3	89.3	178.6
1956	176.4	158.4	101.4	85.8	74.4	54.0	185.9	126.4	252.8
1957	142.8	134.4	91.5	89.0	58.9	30.4	132.3	89.3	178.6
1958	162.0	144.6	122.7	93.4	63.5	43.7	239.8	207.4	414.8
1959	118.8	84.0	67.2	65.0	52.1	37.1	130.6	78.4	156.8
1960	182.4	158.4	131.1	93.4	51.3	35.6	218.2	135.7	271.4
1961	140.4	108.0	93.6	77.2	54.9	43.8	236.2	165.6	331.2
1962	116.4	75.0	65.4	53.8	35.1	N/A	195.8	138.2	276.4
1963	151.2	91.2	71.4	62.8	59.2	49.6	116.1	96.3	192.6
1964	188.4	161.4	115.8	93.0	55.6	32.3	202.9	113.0	226.0
1965	232.8	202.8	172.8	153.4	90.5	48.6	116.4	83.3	166.6
1966	157.2	130.8	105.0	98.4	74.1	38.1	143.6	142.9	285.8
1967	130.8	111.6	98.4	89.2	72.0	49.3	213.2	125.5	251.0
1968	184.8	138.0	101.4	69.4	55.4	N/A	106.6	71.6	143.2
1969	N/A	N/A	N/A	N/A	N/A	N/A	103.4	77.2	154.4
1970	134.4	134.4	99.9	78.6	58.6	30.3	403.1	254.4	508.8
1971	N/A	N/A	N/A	N/A	N/A	N/A	99.1	49.6	99.2
1972	146.4	112.8	89.4	75.4	58.1	39.7	265.1	244.0	488.0
1973	160.8	133.2	121.2	97.0	59.7	30.0	91.4	62.2	124.4
1974	159.8	148.8	103.5	96.8	50.8	N/A	182.2	146.3	292.6
1975	116.1	83.4	63.9	53.8	36.8	27.1	123.7	64.9	129.8
1976	324.0	250.8	192.3	160.2	105.9	76.9	371.4	191.9	383.8
1977	228.0	177.0	135.9	113.0	74.5	54.1	234.4	147.7	295.4
1978	259.2	198.0	149.7	124.6	82.8	59.7	N/A	N/A	N/A
1979	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1980	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1981	150.0	120.0	82.5	66.0	40.0	27.9	67.2	38.9	77.8
1982	106.8	82.2	63.3	52.8	34.8	25.3	110.2	68.8	137.6
1983	78.0	60.6	45.9	37.6	24.3	17.2	70.0	52.2	104.4
1984	187.2	115.8	82.8	66.8	45.4	27.0	81.2	62.2	124.4
1985	235.2	178.2	136.5	114.4	77.2	56.4	252.8	193.6	387.2
1986	211.2	164.4	125.7	104.2	68.2	49.2	210.5	177.7	355.4
1987	136.8	118.8	82.2	60.2	35.2	26.8	88.7	44.9	89.8
1988	117.6	89.4	68.4	57.2	38.2	27.8	122.7	84.6	169.2
1989	243.6	121.8	68.7	56.6	38.1	27.5	127.5	90.1	180.2
1990	146.4	112.2	81.0	64.2	49.7	38.9	201.1	132.5	265.0
1991	N/A	144.7	109.6	92.3	62.6	42.4	174.8	103.0	206.0
1992	N/A	101.2	76.6	64.5	43.7	29.6	122.2	67.6	135.2
1993	N/A	69.1	52.3	44.0	29.9	20.2	83.4	56.9	113.8
1994	N/A	97.0	73.5	61.9	42.0	28.4	117.2	92.2	184.4
1995	N/A	112.1	84.9	71.5	48.5	32.8	135.4	93.5	187.0
1996	N/A	87.3	66.1	55.7	37.7	25.6	105.4	89.4	178.8
1997	N/A	200.0	151.4	127.5	86.5	58.6	241.5	201.0	402.0
1998	N/A	96.4	73.0	61.5	41.7	28.2	128.8	100.3	200.6
1999	N/A	157.7	119.4	100.5	68.2	46.2	190.4	149.1	298.1
2000	N/A	147.0	111.3	93.7	63.5	43.0	177.5	125.7	251.4
2001	N/A	218.3	127.1	101.2	84.5	64.3	178.0	95.5	191.0
2002	N/A	78.2	62.3	58.8	46.3	36.2	248.2	200.2	400.4
2003	N/A	81.0	79.2	73.3	55.8	39.2	123.6	110.7	221.3
2004	N/A	95.3	62.9	54.4	44.4	40.5	111.4	94.8	189.6
2005	N/A	53.8	48.5	47.7	40.7	24.4	91.0	49.5	98.9
2006	N/A	N/A	N/A	N/A	N/A	N/A	94.0	83.8	167.5
2007	N/A	N/A	N/A	N/A	N/A	N/A	154.0	102.3	204.6
2008	N/A	N/A	N/A	N/A	N/A	N/A	120.9	85.0	169.9
2009	N/A	N/A	N/A	N/A	N/A	N/A	258.5	162.6	325.2
2010	N/A	N/A	N/A	N/A	N/A	N/A	131.4	67.2	134.4
Sample (n)	70	85	85	85	82	62	94	87	87
Maximum	324.0	250.8	192.3	160.2	105.9	80.2	403.1	278.0	556.0
Minimum	78.0	53.8	45.9	37.6	24.3	17.2	66.6	38.9	77.8
Mean	155.0	122.6	96.3	80.4	55.5	40.1	158.7	114.2	228.3
Sd	45.76	38.62	29.46	25.07	17.01	12.85	69.60	57.12	114.24
Skewness	1.52	1.04	0.84	0.96	0.74	0.92	1.10	1.08	1.08

Note: Sd : Standard Deviation

Table-A 3.1.2 Annual Maximum Rainfall Intensities Observed at Port Area

Year	Rainfall Intensity (mm/hour)						Rainfall (mm/day)		2-days
	5 min.	10 min.	20 min.	30 min.	60 min.	120 min.	1 day	2 days	maximum (mm)
1961	N/A	N/A	N/A	N/A	N/A	N/A	128.3	117.0	233.9
1962	N/A	N/A	N/A	N/A	N/A	N/A	191.0	146.8	293.6
1963	N/A	N/A	N/A	N/A	N/A	N/A	114.8	84.8	169.6
1964	N/A	N/A	N/A	N/A	N/A	N/A	193.4	129.8	259.5
1965	N/A	120.6	91.8	76.6	50.8	36.7	159.8	119.7	239.3
1966	N/A	153.6	116.4	95.6	60.0	42.6	169.9	141.2	282.3
1967	N/A	237.0	181.2	151.8	102.4	74.8	334.5	175.0	350.0
1968	N/A	107.4	82.2	68.4	45.6	33.1	145.5	102.5	205.0
1969	N/A	92.4	70.8	59.0	38.9	28.2	102.8	86.4	172.7
1970	N/A	191.4	146.4	123.0	83.7	61.2	276.5	206.3	412.6
1971	N/A	135.0	90.3	67.6	46.2	27.4	84.6	52.0	103.9
1972	N/A	118.8	83.7	83.6	72.5	61.3	218.0	191.4	382.8
1973	N/A	201.6	192.6	173.2	130.3	65.4	131.3	72.7	145.3
1974	N/A	100.8	77.7	65.2	42.2	38.8	214.3	169.7	339.3
1975	N/A	84.0	67.5	52.0	31.7	24.5	209.3	108.0	215.9
1976	N/A	300.0	230.4	192.4	128.0	93.2	28.0	191.9	383.7
1977	N/A	100.2	76.2	61.0	39.3	29.3	135.7	124.3	248.5
1978	N/A	115.2	88.2	74.0	47.2	34.1	174.4	124.5	248.9
1979	N/A	140.4	121.8	103.0	67.1	43.5	223.0	138.7	277.4
1980	N/A	130.2	96.3	76.0	46.0	35.2	133.8	83.1	166.1
1981	N/A	184.2	92.1	61.8	37.5	25.0	161.0	112.5	225.0
1982	N/A	107.4	81.3	66.6	42.2	30.1	121.6	68.1	136.2
1983	N/A	81.6	62.4	52.4	35.2	25.7	114.4	66.5	133.0
1984	N/A	87.0	66.6	55.0	35.4	25.5	106.6	77.9	155.8
1985	N/A	99.6	75.3	63.0	41.8	30.2	131.8	124.0	248.0
1986	N/A	132.6	102.6	87.0	72.2	61.4	217.0	175.2	350.4
1987	N/A	98.4	74.7	62.4	42.4	31.0	137.6	70.1	140.2
1988	N/A	90.6	68.4	57.0	38.5	27.8	123.1	111.1	222.1
1989	N/A	80.4	59.1	48.8	32.4	22.9	96.4	87.1	174.2
1990	N/A	151.8	115.8	96.2	63.7	46.0	199.4	116.7	233.4
1991	N/A	N/A	N/A	N/A	N/A	N/A	209.4	142.0	283.9
1992	N/A	159.1	122.7	110.6	72.0	62.4	119.2	88.8	177.6
1993	N/A	85.4	66.8	56.2	31.5	17.4	145.4	104.2	208.4
1994	N/A	65.4	56.1	43.6	39.0	31.5	131.2	89.9	179.8
1995	N/A	40.6	36.4	36.5	27.4	18.7	143.2	83.6	167.2
1996	N/A	74.1	59.7	52.2	49.5	40.8	104.4	77.0	154.0
1997	N/A	46.8	39.8	33.7	27.1	19.2	156.6	129.7	259.4
1998	N/A	186.5	94.4	62.9	32.6	17.3	137.2	116.0	231.9
1999	N/A	57.6	50.2	42.6	30.4	21.3	204.8	191.1	382.1
2000	N/A	113.2	87.8	79.9	66.6	55.0	267.0	158.1	316.2
2001	N/A	60.0	49.3	41.4	26.4	18.9	110.4	83.8	167.5
2002	N/A	149.9	75.3	52.9	32.4	22.5	246.4	204.5	408.9
2003	N/A	201.7	110.7	73.8	40.9	21.7	137.4	129.1	258.2
2004	N/A	86.4	69.0	61.1	43.9	34.4	135.6	122.6	245.2
2005	N/A	152.8	135.1	109.6	66.9	38.3	104.6	72.3	144.6
2006	N/A	N/A	N/A	N/A	N/A	N/A	159.6	109.9	219.7
2007	N/A	N/A	N/A	N/A	N/A	N/A	147.0	119.6	239.1
2008	N/A	N/A	N/A	N/A	N/A	N/A	125.6	94.1	188.2
2009	N/A	126.0	120.0	118.0	108.0	86.5	455.0	274.4	548.8
2010	N/A	N/A	N/A	N/A	N/A	N/A	122.0	94.1	188.2
Sample (n)	0	41	41	41	41	41	50	50	50
Maximum	0.0	300.0	230.4	192.4	130.3	93.2	455.0	274.4	548.8
Minimum	0.0	40.6	36.4	33.7	26.4	17.3	28.0	52.0	103.9
Mean	N/A	123.1	92.3	76.8	52.9	38.1	162.8	121.2	242.4
Sd	N/A	52.94	39.83	34.72	25.73	18.75	68.53	44.37	88.75
Skewness	N/A	1.13	1.59	1.66	1.63	1.30	1.88	1.12	1.12

Note: Sd : Standard Deviation

Table-A 3.1.3 Parameters of Storage Function Model

Sub-Basin		Land Use	Catchment Area A(km^2)		River Length L(km)	Primary Run-off Ratio(f_1)	Saturation Rainfall Rsa(mm)	Storage Function K	P	TL (hr)	Base Flow Qb (m^3/s)	
			Present	Future							Present	Future
			269.0	269.0	25.0							
M-1	M-1n	Natural	268.8	268.9		0.86	100	40.3	0.5	2.62	10.8	10.8
	M-1u	Urban1	0.2	0.1		0.86	100	12.5	0.5	2.62	0.0	0.0
			96.5	96.5	17.0							
M-2	M-2n	Natural	92.5	91.3		0.86	100	40.3	0.5	2.24	3.7	3.7
	M-2u	Urban1	4.0	5.2		0.86	100	12.5	0.5	2.24	0.0	0.0
			68.8	68.8	13.0							
M-3	M-3n	Natural	50.2	44.6		0.86	100	40.3	0.5	2.05	2.0	1.8
	M-3u	Urban1	18.6	24.2		0.86	100	12.5	0.5	2.05	0.0	0.0
			51.4	51.4	16.0							
M-4	M-4n	Natural	33.5	28.1		0.86	100	40.3	0.5	2.19	1.3	1.1
	M-4u	Urban1	17.9	23.3		0.86	100	12.5	0.5	2.19	0.0	0.0
			13.3	13.3	3.0							
M-5	M-5n	Natural	0.0	0.0							0.0	0.0
	M-5u	Urban2	13.3	13.3		0.86	100	10.1	0.5	2.00	0.0	0.0
			6.9	6.9	1.0							
M-6	M-6n	Natural	0.0	0.0							0.0	0.0
	M-6u	Urban2	6.9	6.9		0.86	100	10.1	0.5	2.00	0.0	0.0
Total			505.9								17.8	17.4

Note : K, P, F1, Rsa for natural area are standard values by Synthetic Storage Function Model (by Dr. Kimura)
TL = 0.047 * L - 0.56 (if L>11.9km), TL = 0 (if L<11.9km)
Qb = 0.04 m3/s/km2, Roughness N=0.7 for natural area
Urban1 = Low Density Area (N=0.1), Urban2 = Middle Density Area (N=0.07)
K(urban1) = K(natural) * (Nu/Nn)^0.6 = 40.3 * (0.1/0.7)^0.6 = 12.5
K(urban2) = K(natural) * (Nu/Nn)^0.6 = 40.3 * (0.07/0.7)^0.6 = 10.1

Revised Parameters

Table-A 3.1.4 Parameters of Storage Function Model for River Channel

Channel	Length L(km)	Width B(m)	Roughness n	Bed Slope I = 1/x	Storage Function K	P	TL (hr)	TLz (hr)
C-1	7.5	200	0.040	1,000	20.0	0.6	0.17	0.17
C-2	8.6	200	0.040	1,100	23.6	0.6	0.21	0.21
C-3	5.6	100	0.030	1,800	11.3	0.6	0.17	0.17
C-4	6.4	100	0.030	2,700	14.6	0.6	0.24	0.24

Table-A 3.1.5 Parameters of Quasi-Linear Model for Lower Part of River Basin

Area Classified by Land Use	Equivalent Roughness N	Land Gradient S	Coefficient C	Primary Runoff Rate f1
Urban Area				
Low Density	0.10	1 / 250	237	0.50
Middle Density	0.07	1 / 250	191	0.65
High Density	0.05	1 / 250	156	0.80
Factory Area	0.10	1 / 250	237	0.50
Open Space	0.30	1 / 250	458	0.35

Note : $C = (N/0.7)^{0.6} * (S/(1/10))^{-0.3} * 290$

Table-A 3.1.6 Area Percentage of Future Land Use for Quasi-Linear Model

Sub-Basin	Catchment Area (km^2)	Percentage of Land Use (%) Urban Area (Density) Low	Middle	High	Factory Area	Open Space	Paddy or Fish Pond	Farm Land	Mountainous Area	Total
Pasig-Marikina River										
M-7	11.0	73.1	7.3	8.7	10.8	0.0	0.0	0.0	0.0	100.0
M-8	5.9	50.2	16.7	24.3	0.0	8.7	0.0	0.0	0.0	100.0
M-9	6.7	53.4	17.6	19.9	7.9	1.3	0.0	0.0	0.0	100.0
San Juan River										
S-1	22.8	76.1	16.9	2.7	0.9	3.5	0.0	0.0	0.0	100.0
S-2	10.4	31.3	47.2	0.0	21.5	0.1	0.0	0.0	0.0	100.0
S-3	2.1	8.3	61.3	0.0	30.4	0.0	0.0	0.0	0.0	100.0
S-4	9.8	44.9	40.5	8.7	2.2	3.7	0.0	0.0	0.0	100.0
S-5	8.3	41.5	15.3	0.0	41.6	1.6	0.0	0.0	0.0	100.0
S-6	13.6	48.1	48.2	3.7	0.0	0.0	0.0	0.0	0.0	100.0
S-7	4.4	63.5	33.1	3.3	0.0	0.0	0.0	0.0	0.0	100.0
S-8	12.2	65.9	13.0	11.4	0.0	9.7	0.0	0.0	0.0	100.0
S-9	4.2	77.5	1.9	19.8	0.0	0.7	0.0	0.0	0.0	100.0
S-10	3.7	67.5	5.3	6.4	20.3	0.6	0.0	0.0	0.0	100.0
Total	115.1	57.6	24.4	7.2	8.0	2.7	0.0	0.0	0.0	100.0

Note : Low Density Urban Area : Low density residential, Middle density residential, Institutional, Utility zone
Middle Density Urban Area High density residential, Low density commercial zone
High Density Urban Area Medium density commercial, High density commercial zone
Factory Area = Industrial 1 and 2 zone
Open Space Area = Park, Recreational, Cemetery zone

Table-A 3.1.7 Parameters of Quasi-Linear Model for River Channel

Channel	Length L (km)	Width B(m)	Roughness n	Bed Slope I = 1/x	Storage Function K	P	TL (hr)	TLz (hr)
Pasig-Marikina River								
C-5	6.6	120	0.03	10,000	24.1	0.6	0.49	0.49
C-6	9.8	120	0.03	16,000	41.1	0.6	0.91	0.91
San Juan River								
C-7	3.0	50	0.03	1,200	4.1	0.6	0.08	0.08
C-8	3.6	50	0.03	1,700	5.4	0.6	0.11	0.11
C-9	4.1	50	0.03	2,800	7.2	0.6	0.16	0.16

Note : $K = L * B^{0.4} * n^{0.6} * I^{-0.3} / 3.6$, $TL = 0.000736 * L * I^{-0.5}$, TLz = TLz

Table-A 3.7.1 Comparative Chart of Present Disaster Management Agency

		Name of Organization								
		Nation-wide			Pasig-Marikina River				Other Local	Other Proposal
Organization Involved		River Basin Control Office	National Disaster Risk Reduction and Management Council	Flood Mitigation Committee	Metro Manila Development Authority	Regional Disaster Risk Reduction and Management Council in NCR	Pasig River Rehabilitation Commission	Flood Mitigation Committee	Flood Mitigation Committee	Flood Mitigation Committee
		RBCO	NDRRMC (NDCC)	FMC	MMDA	RDRRMC (RDCC)	PRRC	FMC	FMC	FMC
Target Area		Whole River Basin (for 20 river basins in principle)	Whole country (and every disaster)	Flood Plain in the River Basin	Manila Metropolitan Area	Metro Manila Area (and every disaster)	Pasig River line Area	Pasig-Marikina River line Area	Anilao and Malbasag River Basins	Cagayan and Tagoloan River Basin
Major Purpose		Integrated river basin management and development including flood control	Disaster Risk Reduction and Management including flood disaster (Policy making, coordination, integration, supervision, monitoring and evaluation	Management of flood plain in terms of flood control	Development and Management of Manila Metropolitan area including flood control	Disaster Risk Reduction and Management including flood disaster (Policy making, coordination, integration, supervision, monitoring and evaluation)	Rehabilitation of Pasig river environment including flood protection	Coordination to implement flood control project and O&M and restriction of encroachment	Coordination for O&M of the implemented flood control project	Coordination for O&M of the implemented flood control project
Major Members of Committee or Council	DPWH	○	○	Chair	○	○	○	○	○	○
	DENR	Chair	○	○		○	○			
	OCD/DND	○	Chair	○		Chair				
	PHILVOLCS	○	○	○		○				
	PAGASA	○	○	○		○				
	NWRB	○	○	○		○				
	NEDA	○	○	○		○				
	DILG/LGU	○	○	○	○	○	○	○		○
	Other	○ (DA, DOST, DOE, DOH, DAR, NGOs, Private Sector, etc)	○ (DSWD, DOST, DOH, DA, DepED, DOE, DOF, DTI, DOTC, DBM, DFA, etc)		○ (DOTC, DOT, DBM, HUDCC, etc)	○ (DSWD, DOST, DOH, DA, DepED, DOE, DOF, DTI, DOTC, DBM, DFA, etc)	○ (MMDA,OES,DOF, DOT, DTC,DND, HUDCC, etc)	○ (MMDA)	○ Ormoc City	
Legal Arrangement		Executive Order 510 (of 2006)	Republic Act No. 10121(PDRRM Act of 2010)	Water code of Philippines (PD 1067) and IRR of 2005	Republic Act No. 7924in 1995, replacement of MMA Executive Order No. 392 of 1990	Republic Act No. 10121(PDRRM Act of 2010)	Executive Order 54 and 65 of 1999	-	Ormoc city ordinance	DPWH Guideline
Major Role and Responsibility		Currently only 20 river basins are covered	The council covers every kind of disasters including flood disaster	The target areas are confined in the flood plain.	MMDA has the function to conduct O&M for the flood control structures.	The council covers every kind of disasters including flood disaster	The major purpose of the Council is to rehabilitate the river environment	Coordination among MMDA and LGUs for restriction of encroachment and project implementation and O&M	Coordination among agencies concerned of O&M of the flood control project	Coordination among agencies concerned of O&M of the flood control project
Relation to the flood control of Pasig-Marikina River		Implementation of flood control projects including O&M is undertaken by DPWH	Implementation and O&M of flood control project are not included in the task	DPWH has no example applied this PD to Pasig-Marikina River basin	Some of the area in Pasig-Marikina River Basin is out of the covering area of MMDA	Implementation and O&M of flood control project are not included in the task	the major target area is the river course along the Pasig River.	Exclusively set-up for Pasig-Marikina River Basin	-	-
Issue on Flood Control Management in the Pasig River Basin		For the flood control management of Pasig-Marikina river basin, substantial activities of RBCO is not clarified yet.	For the flood control management of Pasig-Marikina River basin, PDRRMC will not take the works for restriction of encroachment and O&M.	For the flood control management of Pasig-Marikina River, organization needs to be newly created.	Coordination with DPWH and LGUs is necessary for restriction of encroachment and implementation and O&M for the Project	For the flood control management of Pasig-Marikina River basin, MMDRRMC will not take the works for restriction of encroachment and O&M.	PRRC does not cover the Project area of Phase III	-	-	-
Previous Experience for Coordination on Flood Control Activities related to Pasig-Marikina River Basin	Project Implementation	-	-	-	○	-	△*	-**	-	-
	O&M	-	-	-	○	-	△*	-**	-	-
	Control of Illegal Activities	-	-	-	○	-	△*	-**	-	-
					(Chair person is the chief executive officer of the Authority)		(Chaired by Private Sector)			(LGUs involved in FRIMP Project)

*: Marikina River is not included
**: FMC is to be set up with such functions

Table-A 3.7.2 Evaluation of Coordinating Organizations for Disaster

Table-A 3.7.2 Value Engineering for Set-up FMC

Evaluation Items			MMDA	PRRC	Creation of FMC
Process of Creation	Readiness of Organization	Description	Creation of Sub-committee in MMDA	Creation of Sub-committee in PRRC	Creation of New-organization
		Evaluation	◎	◎	○
	Legal Arrangement or Documentation	Description	Not necessary	Modification of Executive Order	Department Order by DPWH & arrangement of MOA
		Evaluation	◎	△	◎
Capacity	Human Resources	Description	Needs expertise for project planning, D/D and implementation	Needs expertise for project planning, D/D, implementation and O&M	Available from the organization of committee members (DPWH & MMDA)
		Evaluation	△	△	○
	Budget Allocation	Description	Budget arrangement is necessary (at present, no budget available, especially for project planning, D/D and implementation stage.)	Budget arrangement is necessary (at present, no budget available for the activities)	Available through allocation from the budget for project implementation and O&M.
		Evaluation	△	△	○
Sustainability		Description	Organization can be sustained as long as issues concerned exist.	Organization can be sustained as long as issues concerned exist.	Organization can be sustained as long as issues concerned exist.*
		Evaluation	○	○	○
Overall Evaluation		Description	In general, it may be possible to handle the necessary coordination roles. However, issues on experts and budgets are expected for project planning, D/D and implementing stage.	At first, PRRC has to extend the covering area from only Pasig river to Pasig-Marikina river by modification of E.O. Even though, the issues for expertise and budget allocation are remained.	In principle, creation of FMC seems to be suitable , since most of the issues raised for the other cases can be resolved through cooperation among DPWH, MMDA and LGUs.
		Evaluation	○	△	◎
◎: No Serious issues encountered			○: Some issues may exist but can be settled down.	△: There may be Some issues encountered, which may take a long time to settle down.	* As one of the experiences, FMC created in the Ormoc is well maintained.

Table A 3.7.3 Major Court Order (Related to this Study)

Agencies	Major Court Order (Abstraction for Agencies related this PMRCIP III)
DENR	Submit to the Court on or before June 30, 2011 the updated Operational Plan for the Manila Bay Coastal Strategy
	Submit the names and addresses of persons and companies in Metro Manila, Rizal, Laguna, Cavite, Bulakan, Pampanga and Bataan that generate toxic and hazardous waste on or before Sep. 30 , 2011
DILG	DILG shall order the Mayors of all cities in Metro Manila, the Governors of Rizal, Laguna,・・・and the Mayors of all the cities and towns in said provinces to inspect all factories, commercial establishment and private home along the banks of the major rivers such as Pasig-Marikina river that eventually discharge water into the Manila Bay and thelandsabutting it, to determine if they have wastewater treatment facilities and/or hygienic septic tanks. Said LGU officials are given up to Sep. 30, 2011 to finish the inspection of said establishment and houses.
	DILG is required to submit a five-year plan of action that will contain measures intended to ensure compliance of all non-compliance factories, commercial establishment, and private homes.
	On or before June 30, 2011, the DILG and the mayors of all cities in Metro Manila shall consider providing land for the wastewater facilities of the MWSS.
MWSS	Submit to the Court on or before June 30, 2011the list of areas in Metro Manila, Rizal and Cavite that do not have the necessary wastewater treatment facilities.
MMDA	Submit the Court on or before June 30, 2011 the names and address of the Iss in Metro Manila.
	On or before June 30, 2011, the MMDA shall submit its plan for the removal of said informal settlers and the demolition of the aforesaid houses, structures, constructions and encroachment, as well as the completion dates for said activities , which shall be fully implemented not later than December 31, 2015.

Table-A 3.8.1 Candidate Items for MOA

Agency	Item	Cagayan (Tuguegarao City and Enrile Municipality)	Item	Sample MOA (LGUs)	Item	MOA for Phase II (MMDA)
LGU/MMDA	1.	Purchase and develop the resettlement area	1.	Commit to generate and allocate more local resources in support of the implementation of the project	1.	take all the necessary measures to ensure proper and efficient O&M of the project
	2.	Construct secondary drainage system	(a)	Purchase and develop the resettlement area	2.	Establish the joint working group with DPWH
	3.	Implement the Resettlement Action Plan (RAP)	(b)	construct secondary drainage system	3.	
	4.	Undertake the Operation and Maintenance (O&M) of the Project	(c)	Provide local technical and administrative personnel		
	5.	Issue Certificate of Availability of Fund for items 1-4	(d)	Commit to appropriate necessary local fund		
	6.	Provide the local technical and administrative personnel	(e)	Commit to appropriate fund for implementation of the drainage program		
	7.	Maintain/preserve the current situation of the ROW and other areas	(f)	Commit to shoulder O&M of the Project		
	8.	Create a Flood Mitigation Committee (FMC) with the following responsibilities	2.	Create a Flood Mitigation Committee (FMC) to enhance/strengthen the publicity and awareness of the project		
	(a)	Enhance/strengthen the publicity and awareness of the Project	(a)	Coordinate, facilitate and assist the activities on the resettlement and acquisition of the ROW		
	(b)	Coordinate, facilitate and assist the activities on the resettlement and acquisition of the ROW	(b)	Set-up a "query window" for the Project		
	(c)	Execute and sustain non-structural measures	(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				
DPWH	1.	Provide funds and undertake the D/D and preparation of RAP and construction	1.	Undertake D/D and prepare RAP and complete construction	1.	take all the necessary measures to ensure proper and efficient implementation of the Project
	2.	Conduct information dissemination	2.	Conduct information dissemination	2.	Overall management and coordination of the Project during its implementation
	3.	Provide quarterly updates on the status of the Project	3.	Coordinate with DENR on the establishment of IWRM	3.	make a close coordination with PRRC and LGUs concerned for the smooth implementation of the Project
	4.	Identify the specific area for the ROW acquisition	4.	Provide quarterly updates on the status of the Project	4.	Secure the budget of the Project
	5.	Conduct trainings on O&M for the LGU	5.	Identify the specific area for the ROW acquisition	5.	Establish the joint working group with MMDA
	6.	Turn over to the municipality the completed project for the O&M	6.	Shoulder the remaining cost of the land acquisition on ly for the ROW and full construction cost of the Project	6.	Comply with all the conditions stipulated in the ECC
	7.	Provide technical assistance to the Municipal government in the rehabilitation				
Joint Technical working group					1.	oversee and monitor progress of the Project
					2.	vc
					3.	Formulate operation and maintenance framework for the Project
					4.	Undertake other relative activities
					5.	

Table A 4.3.1 Clearance of Bridges on Pasig-Marikina River

	No.	Bridge Name	Clearance (m)		Evidence of Collision	Existing Counter-measures
			Horizontal	Vertical		
Pasig River	1	Delpan Bridge	46.5	4.0 - 6.0	No	No
	2	Jones Bridge	**40.8**	**3.6** - 4.8	Ruptured Exterior Girders at Center Span	Pier Protection (Expanded Footing)
	3	McArthur Bridge	**36.6**	4.0	No	No
	4	Quezon Bridge	81.9	6.1	No	No
	5	Ayala Bridge	60.2	**3.50**	Ruptured/Broken Bracing	No
	6	Nagtahan Bridge	54.1	4.4	No	Pier Protection (Expanded Footing)
	7	Pandacan Bridge	**44.5**	8.2	No	No
	8	Lambingan Bridge	58.9	3.8	Cracks at the center span exterior girder of upstream sidge	Pier Protection (Expanded Footing)
	9	Makati-Mandaluyong Bridge	48.6	5.6	No	No
	10	Estrella-Pantaleon Bridge	48.6	5.51	No	No
	11	Guadalupe Bridge	**34.2**	8.3	Broken Existing Pier Protection	Pier Protection (RC Fender Type Connected with Footing)
	12	C-5 Bridge	**42.5**	8.2	Broken Existing Pier Protection	Pier Protection (Independent RC Fender Type)
	13	Bambang Bridge	**38.7**	4.6	No	Pier Protection (Expanded Footing and Wooden Fender Type)
Marikina River	14	Vargas Bridge	**40.4**	5.7	Exposed Rebars at Pier & (Downstream Side)	Pier Protection for Downstream side (Expanded Footing) No Protection for Downstream side pier
	15	Rosario Bridge	**28.7**	5.2	No	Pier Protection (Expanded Footing)
	16	Marcos Bridge	25.6	4.9	No	No
	17	Marikina Bridge	26.3	5.7	No	No
	18	San Jose Bridge	24.0	5.7	No	No

Note: Values in bold and underline are are insufficient for regulatory clearances

Table A4.3.2 Ideal and Minimum Vertical Clearance

Stretch	Ideal Clearance	Preferable Clearance (Minimum Requirement)
Pasig River (Manila Bay to Laguna Lake) and Lower Marikina River (Napindan Weir to Rosario Weir)	5.0 m	3.75 (Regulatory Clearance)
Marikina River (Rosario Weir to Marikina Bridge)	3.0 m	3.0 m * *
Marikina River (Marikina Bridge to San Jose Bridge)	1.5 m	1.5 m * *

* : Recorded highest tide level or the water level at a run off discharge of 500 m3, the water level of which is the highest water level for safe navigation.

* * : Actually required vertical clearance considering the possible scale of boats passing the river.

Table A4.3.3 Design Features of Existing Drainage Facilities

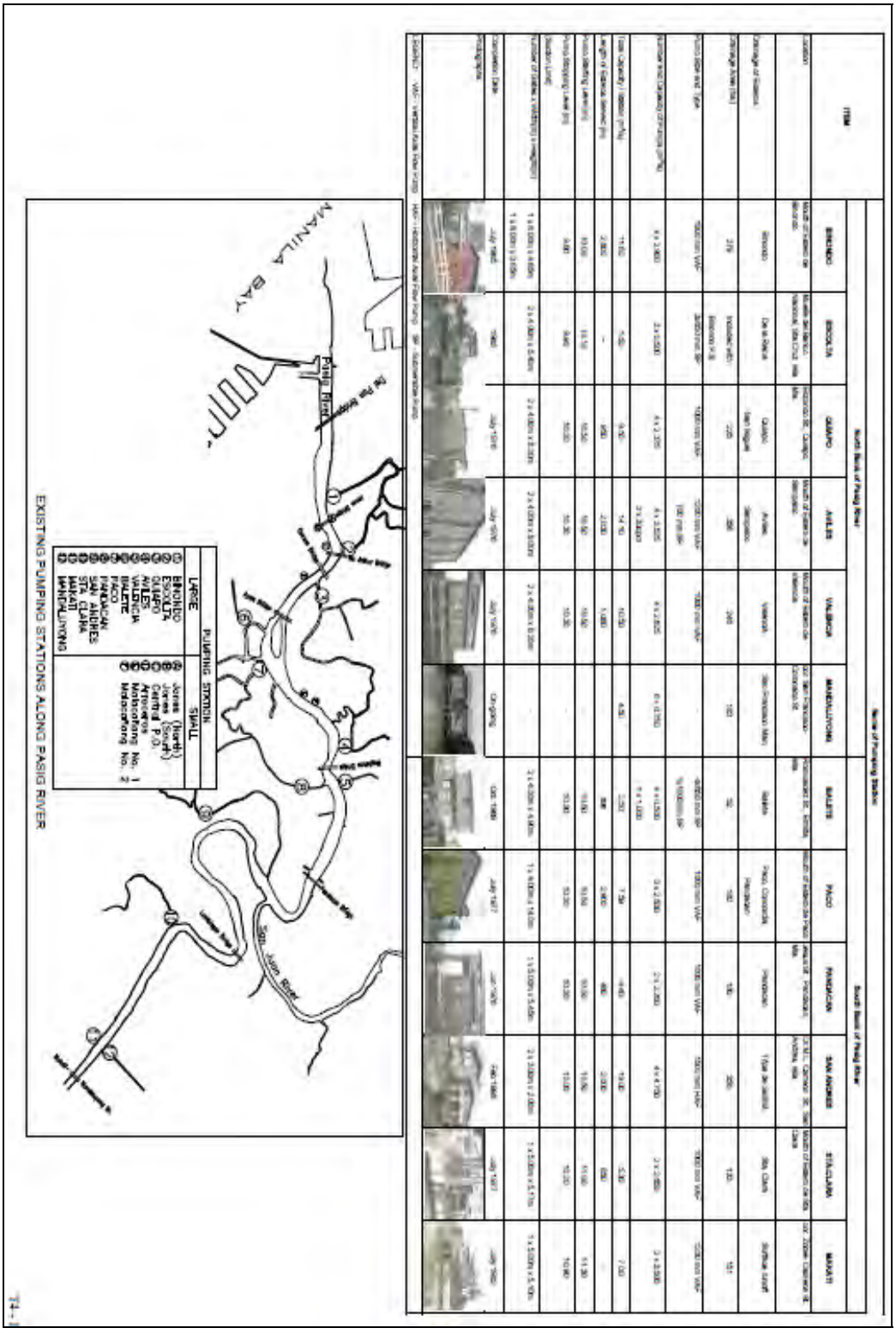


Table A4.3.5 Design Features of Existing Drainage Facilities

	Name of Gate	Name of Pumping Station	Location	Peak Discharge (m3/s)	Bottom Elevation (EL+ m)	Top of Revetment (EL+ m)	DFL	DFL+1.0m	Allowance (m)	Width (m)	Gate Dimension B x H x Nos.	
Ancillary Floodgates	Valencia	Valencia	Sta.5+250R (Pasig River)	38.30	8.00	14.40	12.744	13.744	0.656	10.0	4.0 x 6.2 x 2	OK
	Quiapo	Quiapo	Sta.0+050 (Quiapo Creek)	33.50	7.40	13.60	12.171	13.171	0.429	21.0	4.0 x 6.3 x 2	OK
	Pandacan	Pandacan	Sta.5+150L (Pasig River)	22.10	8.75	14.40	12.723	13.723	0.677	12.0	5.0 x 5.45 x 1	OK
	Aviles-Sampaloc	Aviles	Sta.4+750R (Pasig River)	47.90	8.00	14.20	12.640	13.640	0.560	17.0	4.0 x 6.0 x 2	OK
	Paco	Paco	Sta.3+600L (Pasig River)	23.60	7.20	13.90	12.400	13.400	0.500	22.0	14.0 x 6.5 x 1	OK
	Sta. Clara	Sta. Clara	Sta.10+800L (Pasig River)	20.10	9.85	15.20	13.665	14.665	0.535	7.0	5.0 x 5.17 x 1	OK
	Balete	-	Sta.0+200 (Estero de Provisor)	8.40	8.70	13.80	12.420	13.420	0.380	14.0	4.0 x 4.9 x 2	OK
	Makati	Makati	Sta.12+350L (Pasig River)	24.10	10.10	15.40	13.756	14.756	0.644	-	5.0 x 5.1 x 1	OK
	Binondo	Binondo	Sta.1+500R (Pasig River)	30.50	8.35	13.20	12.100	13.100	0.100	26.0	6.0 x 4.65 x 1	OK
	Escolta	-	Sta.2+100R (Pasig River)		7.72	13.32	12.100	13.100	0.220	17.0	4.0 x 5.4 x 2	OK
Indipendent	Beata	-	Sta.7+300L (Pasig River)	8.10	9.85	14.80	13.459	14.459	0.341	7.0	4.0 x 4.75 x 1	OK
	Santebanez	-	Sta.3+800L (Pasig River)	-	8.30	14.00	12.442	13.442	0.558	31.0	10.0 x 5.5 x 1	OK
	Uliuli	-										

Note : 1. Elevations at the top of gate sill are 20 cm above the bottom elevation of waterway.
2. All gates are steel roller type except Pandacan-Tripa de Gallina Control Gate, which is iron sluice gate.

Table A 6.2.1 Unit Price of Houses and Number of Houses in 2010

	Unit price of houses			Number of Houses in 2010			
	Type A	Type B	Type C	Type A	Type B	Type C	Total
Manila	272,498	146,486	58,187	237,290	83,837	12,402	333,529
Mandaluyong	287,832	178,642	70,960	49,071	12,846	1,896	63,812
Makati	209,332	142,913	56,768	98,340	18,762	6,035	123,137
Taguig	196,772	141,409	66,702	105,836	23,038	5,156	134,030
Pateros	209,070	150,247	66,702	9,255	2,895	569	12,719
Pasig	235,760	169,428	75,218	97,553	29,895	4,921	132,369
Quezon	139,467	100,227	52,732	450,235	93,243	30,416	573,894
Marikina	377,059	196,506	78,056	69,172	12,518	3,329	85,019
San Juan	236,283	153,632	61,026	18,713	5,877	953	25,544
Rodoriguez	175,839	126,366	63,864	38,697	8,527	1,950	49,175
San Mateo	160,139	115,083	63,332	32,534	5,801	1,797	40,133
Antipolo	132,402	95,150	55,083	93,490	33,675	10,057	137,222
Cainta	115,133	82,739	50,736	47,394	16,251	4,050	67,695
Taytay	129,524	93,082	53,885	37,745	17,270	2,571	57,586

Source 1: 2007 Census of Population, Population by Province, City/Municipality and Barangay, National Capital Region, Report No.1-N

Source 2: 2007 Census of Population, Population by Province, City/Municipality and Barangay, Calabarzon-Region IVA, Report No.1-D

Table A 6.2.2 Unit Cost of Houses in 2010

	Unit price of houses			Weighted Average Value
	Type A	Type B	Type C	
Manila	35,221	6,689	393	176,919
Mandaluyong	7,693	1,250	73	
Makati	11,213	1,461	187	
Taguig	11,344	1,775	187	
Pateros	1,054	237	21	
Pasig	12,528	2,759	202	
Quezon	34,204	5,091	874	
Marikina	14,207	1,340	142	
San Juan	2,408	492	32	
Rodoriguez	3,706	587	68	
San Mateo	2,838	364	62	
Antipolo	6,742	1,745	302	
Cainta	2,972	732	112	
Taytay	2,663	876	75	

Source 1: 2007 Census of Population, Population by Province, City/Municipality and Barangay, National Capital Region, Report No.1-N

Source 2: 2007 Census of Population, Population by Province, City/Municipality and Barangay, Calabarzon-Region IVA, Report No.1-D

Table A 6.2.3 Economic Value of Damageable Assets in 2001

Asset	Building (Pesos)	Durable Assets	H. Effects/ Inv. Stock (Pesos)	Value Added*1 (Pesos/day)	Damageable Value (Pesos/ha)	Daily Amount*2 (Pesos)
1.Residence						
a. Residential Unit	134,000		66,000			770
2.Industrial, Educational and Medical Facilities						
a. Manufacturing	1,197,000	4,108,000	5,002,000	23,800		
b. Wholesale & Retail Trade	57,000	139,000	1,697,000	4,610		
c. Hotels & Restaurants	1,337,000	810	103,000	3,560		
d. Real Estate & Business Activities	1,632,000	1,110	869,000	17,600		
e. Education	12,300,000	1,230,000	369,000	0		
f. Health & Social Work	7,626,000	1,968,000	1,148,000	0		
3.Crop Production						
a. Irrigated Farm Land (ha)					27,700	
b. Rainfed Paddy Field (ha)					9,500	
c. Rainfed Corn Field (ha)					2,000	

Note: *1 VA is calculated based on not actual business days of 250 days but 365 calendar days.
*2 In residence, the daily amount for cleaning damaged house is equivalent to daily income of an average family.
Source: Detailed Engineering Design of Pasig-Marikina River Channel Improvement Project

Table A 6.2.4 Rate of Flood Damage

Item	Inundation Depth					
	Below Floor Level	Over Floor Level				
		Less than 0.5 m	0.5-0.99 m	1.0-1.99 m	2.0-2.99 m	More than 3.0 m
1.Building						
a. Building*1	0.000	0.092	0.119	0.266	0.380	0.834
2.Residence						
a. Household Effects	0.000	0.145	0.326	0.508	0.928	0.991
3.Industrial, Educational and Medical Facilities						
a. Depreciable Assets	-	0.232	0.453	0.789	0.966	0.995
b. Inventory Stock	-	0.128	0.267	0.586	0.897	0.982
4.Crop Production *2						
a. Lowland Crop	-	0.210	0.240	0.370	0.370	0.370
b. Upland Crop	-	0.200	0.310	0.440	0.440	0.440

Note: *1 In case of residence, a floor level is 15cm higher than the ground level.
However, a floor level of business establishments is the same as the ground level.
*2 An inundation duration is less than 2 days.
Source: Detailed Engineering Design of Pasig-Marikina River Channel Improvement Project

Table A 6.2.5 Indirect Loss Rate

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

Note: *1 In Japanese case, stagnant days are set as the same number of days.
Source: Detailed Engineering Design of Pasig-Marikina River Channel Improvement Project

Table A 6.2.6 Damageable Value of Existing Properties in Areas Inundated by Flood of Respective Return Periods: 2001

Item		Return Period (Year)				
		2	5	10	20	30
1	Buildings	5.40	41.50	59.60	98.50	119.80
	a. Housing Units	2.60	17.70	27.90	46.80	56.90
	b. Manufacturing	1.00	8.30	11.60	19.40	22.90
	c. Wholesale & Retail Trade	0.80	8.00	9.80	15.50	18.70
	d. Hotels & Restaurants	0.20	0.90	1.20	2.10	2.70
	e. Real Estate & Offices	0.20	1.20	1.80	2.90	3.70
	f. Education	0.20	1.30	1.90	3.00	3.80
	g. Health	0.50	4.10	5.40	8.90	11.10
2	Agricultural	0.00	0.00	0.00	0.00	0.00
	a. Irrigated Field	0.00	0.00	0.00	0.00	0.00
	b. Rainfed Field	0.00	0.00	0.00	0.00	0.00
Total		5.40	41.50	59.60	98.50	119.80

Source: Detailed Engineering Design of Pasig-Marikina River Channel Improvement Project
Unit: Billion Pesos in Economic Term

Table A6.2.7 Damageable Value of Existing Properties in Areas Inundated by Flood of Respective Return Periods: 2010

Item		Return Period (Year)				
		2	5	10	20	30
1	Buildings	8.16	62.02	88.46	146.18	177.60
	a. Housing Units	3.52	23.94	37.74	63.30	76.96
	b. Manufacturing	1.60	13.28	18.56	31.04	36.64
	c. Wholesale & Retail Trade	1.28	12.80	15.68	24.80	29.92
	d. Hotels & Restaurants	0.32	1.44	1.92	3.36	4.32
	e. Real Estate & Offices	0.32	1.92	2.88	4.64	5.92
	f. Education	0.32	2.08	3.04	4.80	6.08
	g. Health	0.80	6.56	8.64	14.24	17.76
2	Agricultural	0.00	0.00	0.00	0.00	0.00
	a. Irrigated Field	0.00	0.00	0.00	0.00	0.00
	b. Rainfed Field	0.00	0.00	0.00	0.00	0.00
	Total	8.16	62.02	88.46	146.18	177.60

Unit: Billion Pesos in Economic Term

Table A 6.2.8 Flood Damage - Lower Pasig River Without Phase II

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	0.00	0.83	2.10	3.02	3.67
II. Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	0	607	2,270	3,797	5,837
(1) Property	0	450	1,681	2,812	4,324
a. Housing Units	0	129	488	834	1,250
b. Manufacturing	0	145	527	896	1,324
c. Wholesale & Retail Trade	0	91	362	573	967
d. Hotels & Restaurants	0	8	24	42	65
e. Real Estate & Offices	0	12	43	72	111
f. Education	0	14	50	82	126
g. Health	0	43	152	255	391
h. Other Facilities	0	9	35	58	90
(2) Agricultural Production	0	0	0	0	0
a. Irrigated Field	0	0	0	0	0
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	0	157	589	984	1,513
2. Indirect Damage	0	127	473	792	1,203
(1) Household	0	41	159	272	414
(2) Business Losses	0	25	87	141	205
(3) Other Damages	0	61	227	380	584
3. Total	0	735	2,743	4,589	7,040

Unit: Million Pesos

Table A 6.2.9 Flood Damages - Upper Pasig River Without Phase II

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	0.30	1.31	3.33	4.79	5.83
II Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	513	959	3,600	6,022	9,272
(1) Property	380	710	2,666	4,460	6,868
a. Housing Units	116	203	774	1,323	1,986
b. Manufacturing	88	229	836	1,421	2,104
c. Wholesale & Retail Trade	84	144	574	909	1,536
d. Hotels & Restaurants	10	12	39	66	104
e. Real Estate & Offices	13	18	68	114	176
f. Education	14	22	79	130	200
g. Health	46	68	242	405	621
h. Other Facilities	9	14	55	91	142
(2) Agricultural Production	0	0	0	0	0
a. Irrigated Field	0	0	0	0	0
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	133	249	933	1,561	2,404
2. Indirect Damage	109	201	750	1,257	1,911
(1) Household	38	65	252	432	658
(2) Business Losses	19	40	137	223	326
(3) Other Damages	51	96	360	602	927
3. Total	622	1,160	4,349	7,278	11,184

Unit: Million Pesos

Table A 6.2.10 Flood Damage - Marikina River Without Phase II

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	0.92	17.34	18.55	29.02	32.50
II Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	1,572	12,687	20,047	36,480	51,694
(1) Property	1,164	9,397	14,849	27,021	38,291
a. Housing Units	354	2,688	4,311	8,015	11,070
b. Manufacturing	270	3,034	4,655	8,611	11,728
c. Wholesale & Retail Trade	258	1,906	3,194	5,507	8,565
d. Hotels & Restaurants	32	157	216	402	578
e. Real Estate & Offices	39	241	380	691	980
f. Education	43	289	441	790	1,113
g. Health	141	897	1,346	2,452	3,464
h. Other Facilities	27	185	307	554	793
(2) Agricultural Production	0	1	1	1	1
a. Irrigated Field	0	0	0	1	1
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	408	3,289	5,197	9,457	13,402
2. Indirect Damage	332	2,662	4,175	7,614	10,655
(1) Household	117	863	1,405	2,615	3,667
(2) Business Losses	58	531	765	1,352	1,818
(3) Other Damages	157	1,269	2,005	3,648	5,169
3. Total	1,904	15,349	24,222	44,094	62,349

Unit: Million Pesos

Table A 6.2.11 Flood Damage - Lower Pasig River With Phase II

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	0.00	0.20	0.36	0.74	1.12
II. Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	0	146	389	930	1,781
(1) Property	0	108	288	689	1,319
a. Housing Units	0	31	84	204	381
b. Manufacturing	0	35	90	220	404
c. Wholesale & Retail Trade	0	22	62	140	295
d. Hotels & Restaurants	0	2	4	10	20
e. Real Estate & Offices	0	3	7	18	34
f. Education	0	3	9	20	38
g. Health	0	10	26	63	119
h. Other Facilities	0	2	6	14	27
(2) Agricultural Production	0	0	0	0	0
a. Irrigated Field	0	0	0	0	0
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	0	38	101	241	462
2. Indirect Damage	0	31	81	194	367
(1) Household	0	10	27	67	126
(2) Business Losses	0	6	15	34	63
(3) Other Damages	0	15	39	93	178
3. Total	0	177	470	1,124	2,148

Unit: Million Pesos

Table A 6.2.12 Flood Damage - Upper Pasig River With Phase II

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	0.05	0.32	0.57	1.17	1.77
II. Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	86	234	616	1,471	2,815
(1) Property	63	173	456	1,089	2,085
a. Housing Units	19	50	132	323	603
b. Manufacturing	15	56	143	347	639
c. Wholesale & Retail Trade	14	35	98	222	466
d. Hotels & Restaurants	2	3	7	16	31
e. Real Estate & Offices	2	4	12	28	53
f. Education	2	5	14	32	61
g. Health	8	17	41	99	189
h. Other Facilities	1	3	9	22	43
(2) Agricultural Production	0	0	0	0	0
a. Irrigated Field	0	0	0	0	0
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	22	61	160	381	730
2. Indirect Damage	18	49	128	307	580
(1) Household	6	16	43	105	200
(2) Business Losses	3	10	24	54	99
(3) Other Damages	9	23	62	147	282
3. Total	104	283	744	1,778	3,395

Unit: Million Pesos

Table A 6.2.13 Flood Damage - Marikina River With Phase II

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	0.92	17.34	18.55	29.02	32.50
II. Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	1,572	12,687	20,047	36,480	51,694
(1) Property	1,164	9,397	14,849	27,021	38,291
a. Housing Units	354	2,688	4,311	8,015	11,070
b. Manufacturing	270	3,034	4,655	8,611	11,728
c. Wholesale & Retail Trade	258	1,906	3,194	5,507	8,565
d. Hotels & Restaurants	32	157	216	402	578
e. Real Estate & Offices	39	241	380	691	980
f. Education	43	289	441	790	1,113
g. Health	141	897	1,346	2,452	3,464
h. Other Facilities	27	185	307	554	793
(2) Agricultural Production	0	1	1	1	1
a. Irrigated Field	0	0	0	1	1
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	408	3,289	5,197	9,457	13,402
2. Indirect Damage	332	2,662	4,175	7,614	10,655
(1) Household	117	863	1,405	2,615	3,667
(2) Business Losses	58	531	765	1,352	1,818
(3) Other Damages	157	1,269	2,005	3,648	5,169
3. Total	1,904	15,349	24,222	44,094	62,349

Unit: Million Pesos

Table A 6.2.14 Flood Damage - Lower Pasig River Without Phase III

Item			Return Period (Year)				
			2	5	10	20	30
I.	**Area Inundated (km^2)**		0.00	0.20	0.36	0.74	1.12
II.	**Estimated Value of Damaged Property (Million Pesos in Economic Terms)**						
1.	Direct Damage		0	146	389	930	1,781
	(1)	Property	0	108	288	689	1,319
		a. Housing Units	0	31	84	204	381
		b. Manufacturing	0	35	90	220	404
		c. Wholesale & Retail Trade	0	22	62	140	295
		d. Hotels & Restaurants	0	2	4	10	20
		e. Real Estate & Offices	0	3	7	18	34
		f. Education	0	3	9	20	38
		g. Health	0	10	26	63	119
		h. Other Facilities	0	2	6	14	27
	(2)	Agricultural Production	0	0	0	0	0
		a. Irrigated Field	0	0	0	0	0
		b. Rainfed Field	0	0	0	0	0
	(3)	Infrastructure	0	38	101	241	462
2.	Indirect Damage		0	31	81	194	367
	(1)	Household	0	10	27	67	126
	(2)	Business Losses	0	6	15	34	63
	(3)	Other Damages	0	15	39	93	178
3.	Total		0	177	470	1,124	2,148

Unit: Million Pesos

Table A 6.2.15 Flood Damage - Upper Pasig River Without Phase III

Item			Return Period (Year)				
			2	5	10	20	30
I.	**Area Inundated (km^2)**		0.05	0.32	0.57	1.17	1.77
II.	**Estimated Value of Damaged Property (Million Pesos in Economic Terms)**						
1.	Direct Damage		86	234	616	1,471	2,815
	(1)	Property	63	173	456	1,089	2,085
		a. Housing Units	19	50	132	323	603
		b. Manufacturing	15	56	143	347	639
		c. Wholesale & Retail Trade	14	35	98	222	466
		d. Hotels & Restaurants	2	3	7	16	31
		e. Real Estate & Offices	2	4	12	28	53
		f. Education	2	5	14	32	61
		g. Health	8	17	41	99	189
		h. Other Facilities	1	3	9	22	43
	(2)	Agricultural Production	0	0	0	0	0
		a. Irrigated Field	0	0	0	0	0
		b. Rainfed Field	0	0	0	0	0
	(3)	Infrastructure	22	61	160	381	730
2.	Indirect Damage		18	49	128	307	580
	(1)	Household	6	16	43	105	200
	(2)	Business Losses	3	10	24	54	99
	(3)	Other Damages	9	23	62	147	282
3.	Total		104	283	744	1,778	3,395

Unit: Million Pesos

Table A 6.2.16 Flood Damage - Marikina River Without Phase III

Item		Return Period (Year)				
		2	5	10	20	30
I.	**Area Inundated (km^2)**	0.9184	17.34	18.55	29.02	32.50
III.	**Estimated Value of Damaged Property (Million Pesos in Economic Terms)**					
1.	Direct Damage	1,572	12,687	20,047	36,480	51,694
(1)	Property	1,164	9,397	14,849	27,021	38,291
a.	Housing Units	354	2,688	4,311	8,015	11,070
b.	Manufacturing	270	3,034	4,655	8,611	11,728
c.	Wholesale & Retail Trade	258	1,906	3,194	5,507	8,565
d.	Hotels & Restaurants	32	157	216	402	578
e.	Real Estate & Offices	39	241	380	691	980
f.	Education	43	289	441	790	1,113
g.	Health	141	897	1,346	2,452	3,464
h.	Other Facilities	27	185	307	554	793
(2)	Agricultural Production	0	1	1	1	1
a.	Irrigated Field	0	0	0	1	1
b.	Rainfed Field	0	0	0	0	0
(3)	Infrastructure	408	3,289	5,197	9,457	13,402
2.	Indirect Damage	332	2,662	4,175	7,614	10,655
(1)	Household	117	863	1,405	2,615	3,667
(2)	Business Losses	58	531	765	1,352	1,818
(3)	Other Damages	157	1,269	2,005	3,648	5,169
3.	Total	1,904	15,349	24,222	44,094	62,349

Unit: Million Pesos

Table A 6.2.17 Flood Damage - Lower Pasig River With Phase III

Item		Return Period (Year)				
		2	5	10	20	30
I.	**Area Inundated (km^2)**	0.00	0.00	0.00	0.00	0.94
II.	**Estimated Value of Damaged Property (Million Pesos in Economic Terms)**					
1.	Direct Damage	0	0	0	0	1,495
(1)	Property	0	0	0	0	1,107
a.	Housing Units	0	0	0	0	320
b.	Manufacturing	0	0	0	0	339
c.	Wholesale & Retail Trade	0	0	0	0	248
d.	Hotels & Restaurants	0	0	0	0	17
e.	Real Estate & Offices	0	0	0	0	28
f.	Education	0	0	0	0	32
g.	Health	0	0	0	0	100
h.	Other Facilities	0	0	0	0	23
(2)	Agricultural Production	0	0	0	0	0
a.	Irrigated Field	0	0	0	0	0
b.	Rainfed Field	0	0	0	0	0
(3)	Infrastructure	0	0	0	0	388
2.	Indirect Damage	0	0	0	0	308
(1)	Household	0	0	0	0	106
(2)	Business Losses	0	0	0	0	53
(3)	Other Damages	0	0	0	0	150
3.	Total	0	0	0	0	1,803

Unit: Million Pesos

Table A 6.2.18 Flood Damage - Upper Pasig River With Phase III

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	0.00	0.00	0.00	1.00	1.50
II. Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	0	0	0	1,257	2,386
(1) Property	0	0	0	931	1,767
a. Housing Units	0	0	0	276	511
b. Manufacturing	0	0	0	297	541
c. Wholesale & Retail Trade	0	0	0	190	395
d. Hotels & Restaurants	0	0	0	14	27
e. Real Estate & Offices	0	0	0	24	45
f. Education	0	0	0	27	51
g. Health	0	0	0	84	160
h. Other Facilities	0	0	0	19	37
(2) Agricultural Production	0	0	0	0	0
a. Irrigated Field	0	0	0	0	0
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	0	0	0	326	618
2. Indirect Damage	0	0	0	262	492
(1) Household	0	0	0	90	169
(2) Business Losses	0	0	0	47	84
(3) Other Damages	0	0	0	126	239
3. Total	0	0	0	1,520	2,877

Unit: Million Pesos

Table A 6.2.19 Flood Damage - Marikina River with Phase III

Item	Return Period (Year)				
	2	5	10	20	30
I. Area Inundated (km^2)	0.54	1.36	16.18	28.42	32.11
II. Estimated Value of Damaged Property (Million Pesos in Economic Terms)					
1. Direct Damage	921	993	17,487	35,725	51,074
(1) Property	683	735	12,953	26,462	37,832
a. Housing Units	207	210	3,760	7,849	10,937
b. Manufacturing	158	237	4,061	8,432	11,587
c. Wholesale & Retail Trade	151	149	2,786	5,393	8,463
d. Hotels & Restaurants	19	12	188	394	571
e. Real Estate & Offices	23	19	331	677	969
f. Education	25	23	385	774	1,099
g. Health	83	70	1,174	2,401	3,422
h. Other Facilities	16	14	268	542	783
(2) Agricultural Production	0	0	0	1	1
a. Irrigated Field	0	0	0	1	1
b. Rainfed Field	0	0	0	0	0
(3) Infrastructure	239	257	4,534	9,262	13,241
2. Indirect Damage	195	208	3,642	7,457	10,527
(1) Household	68	68	1,226	2,561	3,623
(2) Business Losses	34	42	668	1,324	1,797
(3) Other Damages	92	99	1,749	3,573	5,107
3. Total	1,116	1,201	21,130	43,182	61,601

Unit: Million Pesos

Table A 6.2.20 Estimation of Project Benefit (Phase II)

River	Return Period	Damages		Avoided Damages	Average Damages Avoided	Average Annual Exeedance Probability	Annual average damage	Sum of the damages
		Without	With					
Pasig Downstream	2	0	0	0	0	-	0	0
	5	735	177	558	279	0.30	84	84
	10	2,743	470	2,273	1,415	0.10	142	225
	20	4,589	1,124	3,464	2,869	0.05	143	369
	30	7,040	2,148	4,892	4,178	0.02	70	438
Pasig Upstream	1.4	0	0	0	0	-	0	0
	2	622	104	518	259	0.21	56	56
	5	1,160	283	877	697	0.30	209	265
	10	4,349	744	3,605	2,241	0.10	224	489
	20	7,278	1,778	5,501	4,553	0.05	228	716
	30	11,184	3,395	7,788	6,644	0.02	111	827
Marikina River	1	0	0	0	0	-	0	0
	2	1,904	1,904	0	0	0.50	0	0
	5	15,349	15,349	0	0	0.30	0	0
	10	24,222	24,222	0	0	0.10	0	0
	20	44,094	44,094	0	0	0.05	0	0
	30	62,349	62,349	0	0	0.02	0	0
Sum of the above	2	2,526	2,008	518	259	-	56	56
	5	17,244	15,809	1,434	976	0.30	293	348
	10	31,314	25,437	5,878	3,656	0.10	366	714
	20	55,961	46,996	8,965	7,421	0.05	371	1,085
	30	80,573	67,893	12,680	10,822	0.02	180	1,265

Unit: Million Pesos

Note: The estimated return period of Upper Pasig River for the non-damage case was at 1/1.4 so that the corresponding annual average damage was estimated at 0.21 based on the computation as follows: 1/1.4-1/2=0.21. On the other hand, the estimated return period of Marikina River for the non-damage case was lower than 1.0 so that it was assumed to be at 1.0 in this analysis.

Table A 6.2.21 Estimation of Project Benefit (Phase III)

River	Return Period	Damages		Avoided Damages	Average Damages Avoided	Average Annual Exeedance Probability	Annual average damage	Sum of the damages
		Without	With					
Pasig Downstream	2	0	0	0	0	-	0	0
	5	177	0	177	89	0.30	27	27
	10	470	0	470	324	0.10	32	59
	20	1,124	0	1,124	797	0.05	40	99
	30	2,148	1,803	345	735	0.02	12	111
Pasig Upstream	1.4	0	0	0	0	-	0	0
	2	104	0	104	52	0.21	11	11
	5	283	0	283	193	0.30	58	69
	10	744	0	744	514	0.10	51	121
	20	1,778	1,520	258	501	0.05	25	146
	30	3,395	2,877	518	388	0.02	6	152
Marikina	1	0	0	0	0	-	0	0
	2	1,904	1,116	788	394	0.50	197	197
	5	15,349	1,201	14,148	7,468	0.30	2,240	2,437
	10	24,222	21,130	3,092	8,620	0.10	862	3,299
	20	44,094	43,182	912	2,002	0.05	100	3,399
	30	62,349	61,601	748	830	0.02	14	3,413
Sum of the above	2	2,008	1,116	892	446	-	208	208
	5	15,809	1,201	14,608	7,750	0.30	2,325	2,533
	10	25,437	21,130	4,307	9,458	0.10	946	3,479
	20	46,996	44,702	2,294	3,301	0.05	165	3,644
	30	67,893	66,282	1,611	1,953	0.02	33	3,676

Unit: Million Pesos

Note: The estimated return period of Upper Pasig River for the non-damage case was at 1/1.4 so that the corresponding annual average damage was estimated at 0.21 based on the computation as follows: 1/1.4-1/2=0.21. On the other hand, the estimated return period of Marikina River for the non-damage case was lower than 1.0 so that it was assumed to be at 1.0 in this analysis.

Table A 6.2.22 Estimation of Project Benefit (Phase IV)

River	Return Period	Damages		Avoided Damages	Average Damages Avoided	Average Annual Exeedance Probability	Annual average damage	Sum of the damages
		Without	With					
Lower Pasig	2	0	0	0	0	-	0	0
	5	0	0	0	0	0.300	0	0
	10	0	0	0	0	0.100	0	0
	20	0	0	0	0	0.050	0	0
	30	1,803	0	1,803	902	0.017	15	15
Upper Pasig	1.4	0	0	0	0	-	0	0
	2	0	0	0	0	0.21	0	0
	5	0	0	0	0	0.300	0	0
	10	0	0	0	0	0.100	0	0
	20	1,520	0	1,520	760	0.050	38	38
	30	2,877	0	2,877	2,198	0.017	37	75
Marikina	1	0	0	0	0	-	0	0
	2	1,116	0	1,116	558	0.500	279	279
	5	1,201	0	1,201	1,159	0.300	348	627
	10	21,130	0	21,130	11,165	0.100	1,117	1,743
	20	43,182	0	43,182	32,156	0.050	1,608	3,351
	30	61,601	1	61,600	52,391	0.017	873	4,224
Sum of the above	2	1,116	0	1,116	558	-	279	279
	5	1,201	0	1,201	1,159	0.300	348	627
	10	21,130	0	21,130	11,165	0.100	1,117	1,743
	20	44,702	0	44,702	32,916	0.050	1,646	3,389
	30	66,282	1	66,280	55,491	0.017	925	4,314

Unit: Million Pesos

Note: The estimated return period of Upper Pasig River for the non-damage case was at 1/1.4 so that the corresponding annual average damage was estimated at 0.21 based on the computation as follows: 1/1.4-1/2=0.21. On the other hand, the estimated return period of Marikina River for the non-damage case was lower than 1.0 so that it was assumed to be at 1.0 in this analysis.

Table A 6.2.23 Summary of Project Benefit

Phase of Project	Benefit
Phase II	1,265
Phase III	3,676
Phase IV	4,314
Entire Project	9,256

Unit: Million Pesos

Table A 6.2.24 Cost Benefit Analysis (Phase II)

Year	Cost						Benefit	Net Benefit
	Civil work	Consultancy service	ROW	Construction MNG	Maintenance Cost	Total		
2007	0	112	0	3	0	115	0	-115
2008	160	199	0	2	0	360	0	-359
2009	371	61	54	0	0	486	0	-485
2010	648	119	0	25	0	792	0	-791
2011	897	22	0	34	0	953	0	-952
2012	1,197	10	0	0	0	1,207	0	-1,206
2013					10	10	1,265	1,255
2014					10	10	1,265	1,255
2015					10	10	1,265	1,255
2016					10	10	1,265	1,255
2017					10	10	1,265	1,255
2018					10	10	1,265	1,255
2019					10	10	1,265	1,255
2020					10	10	1,265	1,255
2021					10	10	1,265	1,255
2022					10	10	1,265	1,255
2023					10	10	1,265	1,255
2024					10	10	1,265	1,255
2025					10	10	1,265	1,255
2026					10	10	1,265	1,255
2027					10	10	1,265	1,255
2028					10	10	1,265	1,255
2029					10	10	1,265	1,255
2030					10	10	1,265	1,255
2031					10	10	1,265	1,255
2032					10	10	1,265	1,255
2033					10	10	1,265	1,255
2034					10	10	1,265	1,255
2035					10	10	1,265	1,255
2036					10	10	1,265	1,255
2037					10	10	1,265	1,255
2038					10	10	1,265	1,255
2039					10	10	1,265	1,255
2040					10	10	1,265	1,255
2041					10	10	1,265	1,255
2042					10	10	1,265	1,255
2043					10	10	1,265	1,255
2044					10	10	1,265	1,255
2045					10	10	1,265	1,255
2046					10	10	1,265	1,255
2047					10	10	1,265	1,255
2048					10	10	1,265	1,255
2049					10	10	1,265	1,255
2050					10	10	1,265	1,255
2051					10	10	1,265	1,255
2052					10	10	1,265	1,255
2053					10	10	1,265	1,255
2054					10	10	1,265	1,255
2055					10	10	1,265	1,255
2056					10	10	1,265	1,255
2057					10	10	1,265	1,255
2058					10	10	1,265	1,255
2059					10	10	1,265	1,255
2060					10	10	1,265	1,255
2061					10	10	1,265	1,255
2062					10	10	1,265	1,255
2063					10	10	1,265	1,255
2064					10	10	1,265	1,255
2065					10	10	1,265	1,255
2066					10	10	1,265	1,255
2067					10	10	1,265	1,255

Unit: Million Pesos

EIRR	NPV	B/C
23%	1,478	1.7

Table A6.2.25 Cost Benefit Analysis (Phase III)

Year	Cost												Benefit	Net Benefit
	Main Construction Cost			Engineering Services Cost				Compensation Cost		Admin Cost	Maintenance Cost	Total Cost		
	Potentail Area	Lower Marikina	Physical Contingency	Detailed Design	Non-Structural	Construction Supervision	Physical Contingency	Base Cost	Physical Contingency	Base Cost				
2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
2008	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
2009	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
2010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
2011	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
2012	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0
2013	0.0	0.0	0.0	0.0	116.2	95.8	8.3	10.0	0.8	6.3	0.0	237.4	0	-237
2014	510.1	357.0	50.4	0.0	77.5	63.9	5.5	0.0	0.0	36.5	0.0	1,100.9	0	-1,101
2015	764.7	534.2	75.4	0.0	77.5	63.9	5.5	0.0	0.0	52.7	0.0	1,574.0	0	-1,574
2016	764.7	534.2	75.4	0.0	77.5	63.9	5.5	0.0	0.0	52.7	0.0	1,574.0	0	-1,574
2017	253.7	174.5	24.9	0.0	38.7	31.9	2.8	0.0	0.0	18.0	0.0	544.6	0	-545
2018											11.7	11.7	3,676	3,665
2019											11.7	11.7	3,676	3,665
2020											11.7	11.7	3,676	3,665
2021											11.7	11.7	3,676	3,665
2022											11.7	11.7	3,676	3,665
2023											11.7	11.7	3,676	3,665
2024											11.7	11.7	3,676	3,665
2025											11.7	11.7	3,676	3,665
2026											11.7	11.7	3,676	3,665
2027											11.7	11.7	3,676	3,665
2028											11.7	11.7	3,676	3,665
2029											11.7	11.7	3,676	3,665
2030											11.7	11.7	3,676	3,665
2031											11.7	11.7	3,676	3,665
2032											11.7	11.7	3,676	3,665
2033											11.7	11.7	3,676	3,665
2034											11.7	11.7	3,676	3,665
2035											11.7	11.7	3,676	3,665
2036											11.7	11.7	3,676	3,665
2037											11.7	11.7	3,676	3,665
2038											11.7	11.7	3,676	3,665
2039											11.7	11.7	3,676	3,665
2040											11.7	11.7	3,676	3,665
2041											11.7	11.7	3,676	3,665
2042											11.7	11.7	3,676	3,665
2043											11.7	11.7	3,676	3,665
2044											11.7	11.7	3,676	3,665
2045											11.7	11.7	3,676	3,665
2046											11.7	11.7	3,676	3,665
2047											11.7	11.7	3,676	3,665
2048											11.7	11.7	3,676	3,665
2049											11.7	11.7	3,676	3,665
2050											11.7	11.7	3,676	3,665
2051											11.7	11.7	3,676	3,665
2052											11.7	11.7	3,676	3,665
2053											11.7	11.7	3,676	3,665
2054											11.7	11.7	3,676	3,665
2055											11.7	11.7	3,676	3,665
2056											11.7	11.7	3,676	3,665
2057											11.7	11.7	3,676	3,665
2058											11.7	11.7	3,676	3,665
2059											11.7	11.7	3,676	3,665
2060											11.7	11.7	3,676	3,665
2061											11.7	11.7	3,676	3,665
2062											11.7	11.7	3,676	3,665
2063											11.7	11.7	3,676	3,665
2064											11.7	11.7	3,676	3,665
2065											11.7	11.7	3,676	3,665
2066											11.7	11.7	3,676	3,665
2067											11.7	11.7	3,676	3,665

Unit: Million Pesos

EIRR	NPV	B/C
38%	3,844	3.7

Table A6.2.26 Cost Benefit Analysis (Phase IV)

Year	Phase IV													Benefit	Net Benefit
	Civil Work			Engineering Service				Compensation Cost		Admin Cos	Maitenanc e Cost	Replaceme nt Cost	Total Cost		
	MCGS	Phase IV	Physical Contingency	Detailed Design	Nonstructural Measures	Construction Supervision	Physical Contingency	Base Cost	Physical Contingency	Base Cost					
2007													0.0	0	0
2008													0.0	0	0
2009													0.0	0	0
2010													0.0	0	0
2011													0.0	0	0
2012													0.0	0	0
2013													0.0	0	0
2014													0.0	0	0
2015													0.0	0	0
2016													0.0	0	0
2017	0.0	0.0	0.0	0.0	0.0	48.5	1.9	2.3	0.2	1.5			54.4	0	-54
2018	370.6	380.9	45.5	0.0	116.2	156.0	10.7	8.1	0.7	37.3			1,126.0	0	-1,126
2019	556.4	569.6	68.2	0.0	77.5	104.0	7.1	0.0	0.0	49.1			1,431.9	0	-1,432
2020	556.4	569.6	68.2	0.0	77.5	104.0	7.1	0.0	0.0	49.1			1,431.9	0	-1,432
2021	556.4	569.6	68.2	0.0	77.5	104.0	7.1	0.0	0.0	49.1			1,431.9	0	-1,432
2022	181.6	186.0	22.3	0.0	38.7	52.0	3.5	0.0	0.0	16.9			501.0	0	-501
2023											13.5		13.5	4,314	4,300
2024											13.5		13.5	4,314	4,300
2025											13.5		13.5	4,314	4,300
2026											13.5		13.5	4,314	4,300
2027											13.5		13.5	4,314	4,300
2028											13.5		13.5	4,314	4,300
2029											13.5		13.5	4,314	4,300
2030											13.5		13.5	4,314	4,300
2031											13.5		13.5	4,314	4,300
2032											13.5		13.5	4,314	4,300
2033											13.5		13.5	4,314	4,300
2034											13.5		13.5	4,314	4,300
2035											13.5		13.5	4,314	4,300
2036											13.5		13.5	4,314	4,300
2037											13.5	266.6	280.0	4,314	4,034
2038											13.5		13.5	4,314	4,300
2039											13.5		13.5	4,314	4,300
2040											13.5		13.5	4,314	4,300
2041											13.5		13.5	4,314	4,300
2042											13.5		13.5	4,314	4,300
2043											13.5		13.5	4,314	4,300
2044											13.5		13.5	4,314	4,300
2045											13.5		13.5	4,314	4,300
2046											13.5		13.5	4,314	4,300
2047											13.5		13.5	4,314	4,300
2048											13.5		13.5	4,314	4,300
2049											13.5		13.5	4,314	4,300
2050											13.5		13.5	4,314	4,300
2051											13.5		13.5	4,314	4,300
2052											13.5	266.6	280.0	4,314	4,034
2053											13.5		13.5	4,314	4,300
2054											13.5		13.5	4,314	4,300
2055											13.5		13.5	4,314	4,300
2056											13.5		13.5	4,314	4,300
2057											13.5		13.5	4,314	4,300
2058											13.5		13.5	4,314	4,300
2059											13.5		13.5	4,314	4,300
2060											13.5		13.5	4,314	4,300
2061											13.5		13.5	4,314	4,300
2062											13.5		13.5	4,314	4,300
2063											13.5		13.5	4,314	4,300
2064											13.5		13.5	4,314	4,300
2065											13.5		13.5	4,314	4,300
2066											13.5		13.5	4,314	4,300
2067											13.5		13.5	4,314	4,300

Unit: Million Pesos

EIRR	NPV	B/C
35%	2,167	3.4

Table A6.2.27 Cost Benefit Analysis (Entire Project)

Year	Cost				Benefit	Net Benefit
	Phase II	Phase III	Phase IV	Total Cost		
2007	115	0		115	0	-115
2008	360	0		360	0	-360
2009	486	0		486	0	-486
2010	792	0		792	0	-792
2011	953	0		953	0	-953
2012	1,207	0		1,207	0	-1,207
2013	10	237		247	1,265	1,018
2014	10	1,101		1,111	1,265	155
2015	10	1,574		1,584	1,265	-318
2016	10	1,574		1,584	1,265	-318
2017	10	545	54	609	1,265	657
2018	10	12	1,126	1,148	4,942	3,794
2019	10	12	1,432	1,453	4,942	3,489
2020	10	12	1,432	1,453	4,942	3,489
2021	10	12	1,432	1,453	4,942	3,489
2022	10	12	501	523	4,942	4,419
2023	10	12	13	35	9,256	9,221
2024	10	12	13	35	9,256	9,221
2025	10	12	13	35	9,256	9,221
2026	10	12	13	35	9,256	9,221
2027	10	12	13	35	9,256	9,221
2028	10	12	13	35	9,256	9,221
2029	10	12	13	35	9,256	9,221
2030	10	12	13	35	9,256	9,221
2031	10	12	13	35	9,256	9,221
2032	10	12	13	35	9,256	9,221
2033	10	12	13	35	9,256	9,221
2034	10	12	13	35	9,256	9,221
2035	10	12	13	35	9,256	9,221
2036	10	12	13	35	9,256	9,221
2037	10	12	280	302	9,256	8,954
2038	10	12	13	35	9,256	9,221
2039	10	12	13	35	9,256	9,221
2040	10	12	13	35	9,256	9,221
2041	10	12	13	35	9,256	9,221
2042	10	12	13	35	9,256	9,221
2043	10	12	13	35	9,256	9,221
2044	10	12	13	35	9,256	9,221
2045	10	12	13	35	9,256	9,221
2046	10	12	13	35	9,256	9,221
2047	10	12	13	35	9,256	9,221
2048	10	12	13	35	9,256	9,221
2049	10	12	13	35	9,256	9,221
2050	10	12	13	35	9,256	9,221
2051	10	12	13	35	9,256	9,221
2052	10	12	280	302	9,256	8,954
2053	10	12	13	35	9,256	9,221
2054	10	12	13	35	9,256	9,221
2055	10	12	13	35	9,256	9,221
2056	10	12	13	35	9,256	9,221
2057	10	12	13	35	9,256	9,221
2058	10	12	13	35	9,256	9,221
2059	10	12	13	35	9,256	9,221
2060	10	12	13	35	9,256	9,221
2061	10	12	13	35	9,256	9,221
2062	10	12	13	35	9,256	9,221
2063	10	12	13	35	9,256	9,221
2064	10	12	13	35	9,256	9,221
2065	10	12	13	35	9,256	9,221
2066	10	12	13	35	9,256	9,221
2067	10	12	13	35	9,256	9,221

Unit: Million Pesos

EIRR	NPV	B/C
28%	7,489	2.7

ANNEX: Water Quality Survey

Water Quality Survey

Parameter		Unit	Analysis method	Environmental Standard (Class C)
1)	Color	PCU	Visual Comparison	(c)
2)	Temperature	°C	Ion Electrode Method	3°C max rise
3)	pH	--	Ion Electrode Method	6.5 - 8.5
4)	Dissolved Oxygen (DO)	mg/L	Ion Electrode Method	5.0
5)	Biochemical oxygen demand (BOD)	mg/L	Azide Modification (Dilution Technique)	<10 mg/L
6)	Total suspended solids (TSS)	mg/L	Gravimetric (Dried at 103 - 105 °C)	(g)
7)	Total Dissolved Solids (TDS)	mg/L	Ion Electrode Method	(g)
8)	Surfactants (MBAS)	mg/L	Cold Vapor-AAS	0.5
9)	Oil & Grease (Petroleum Ether Extracts)	mg/L	Nephelometric	2
10)	Nitrate as Nitrogen	mg/L	Brucine Sulfate	10
11)	Phosphate as Phosphorus	mg/L	Stannous Chloride	0.4
12)	Phenolic Substances as Phenols	mg/L	Carbazide	0.02
13)	Total Coliform	MPN/100 ml	Gravimetric (Petroleum Ether Extraction)	5,000
14)	Chloride as Cl^-	mg/L	Argentometric	350
15)	Copper (Cu)	mg/L	Flame AAS	0.05
16)	Arsenic (As)	mg/L	Multiple Tube Fermentation	0.05
17)	Cadmium (Cd)	mg/L	Hydride Generation -AAS	0.05
18)	Hexavalent Chromium (Cr^{6+})	mg/L	Diphenyl	0.05
19)	Cyanide (CN)	mg/L	Chloroform Extraction	0.05
20)	Lead (Pb)	mg/L	Flame AAS	0.05
21)	Total Mercury (T-Hg)	mg/L	Flame AAS	0.002
22)	Organophosphate	mg/L	Methylene Blue Gas Chromatography – FID	nil
23)	Turbidity	NTU	Specific ION Electrode	-
24)	Salinity	‰	Ion Electrode Method	-
25)	Electric Conductivity (EC)	µs/cm	Ion Electrode Method	-

http://www.prrc.com.ph/index.php?page=timeline-of-deterioration

According to Pasig River Rehabilitation Commission (PRRC), water quality state of the Pasig Rivers is as follows:
In 1850, Spanish dwellers noticed the waters of Pasig River slowly losing its pristine quality. They resorted to the method of using sand and charcoal to maintain its potable quality.

(Antonio Cordorniu, Manila, 27 ng Marzo de 1850)

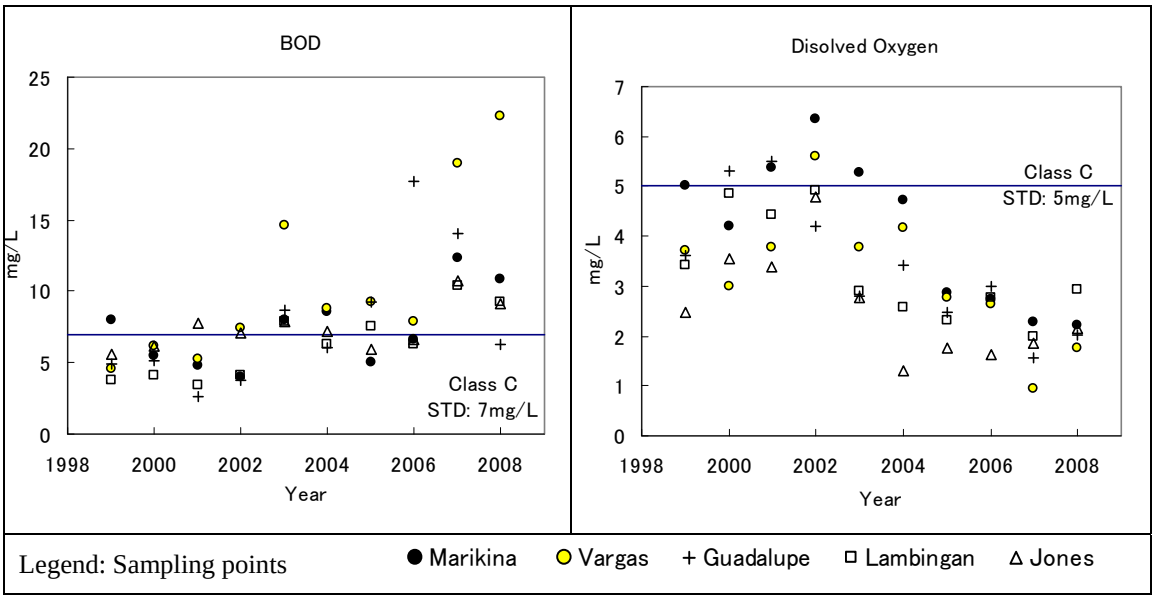
1930: Decrease in fish migration
1950: Noticeable drop in people's bathing activities
1960: Obvious drop in both bathing and washing activities
1970: River began to smell bad and water quality fell below Class "C" category
1980: All fishing activities stopped
1990: Declared biologically dead; about 60% of total BOD (est. 250,000 ton-BOD/year) inputs to Manila Bay are estimated to be from the Pasig River[6]

[6] Manila Bay Area Environmental Atlas (2007), UNDP/GEF, IMO, DENR

Water Quality of Manila Bay (2006)

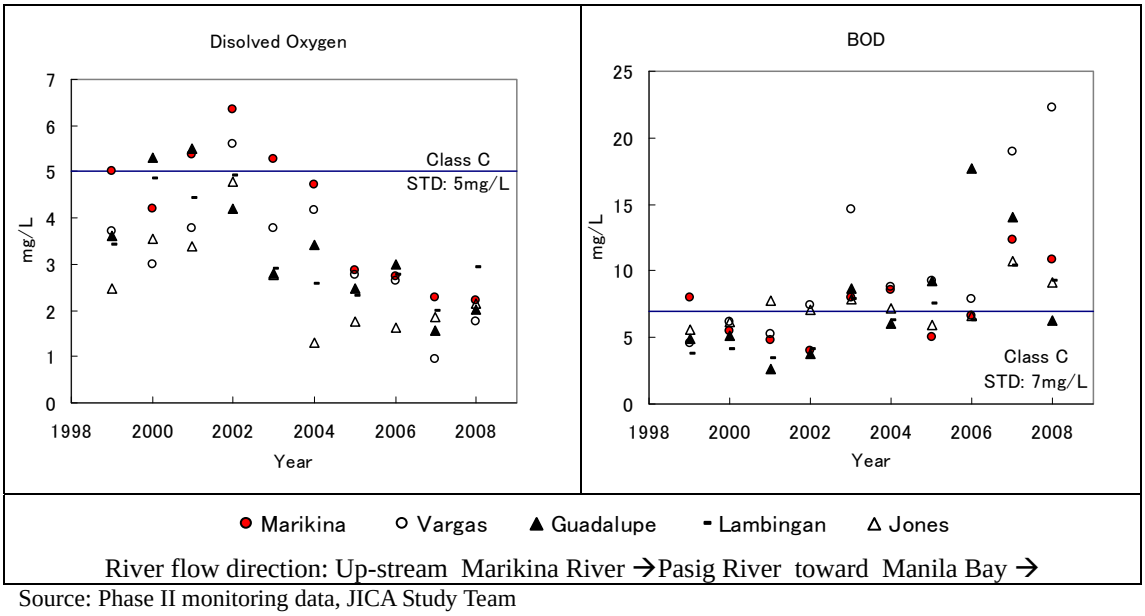
Parameters	Concentration (mg/L)	ASEAN Standard value (mg/L)
Dissolved Oxygen	0.05-6.6	5
pH	7.03-8.06	6.0-8.5
Oil and Grease	Nil-0	5
Ammonia	Nil-0.064	0.07
Nitrate	Nil-0.107	0.06
Orthophosphate	0.002-0.032	0.015

Source: PEMSEA and MBEMP IEMP-TWG, 2006 IN Manila Bay Area Environmental Atlas



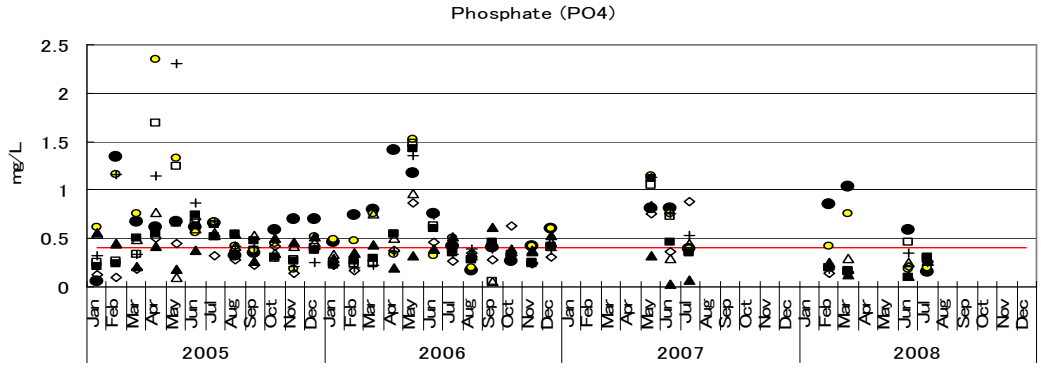
Source: Phase II monitoring data, JICA Study Team

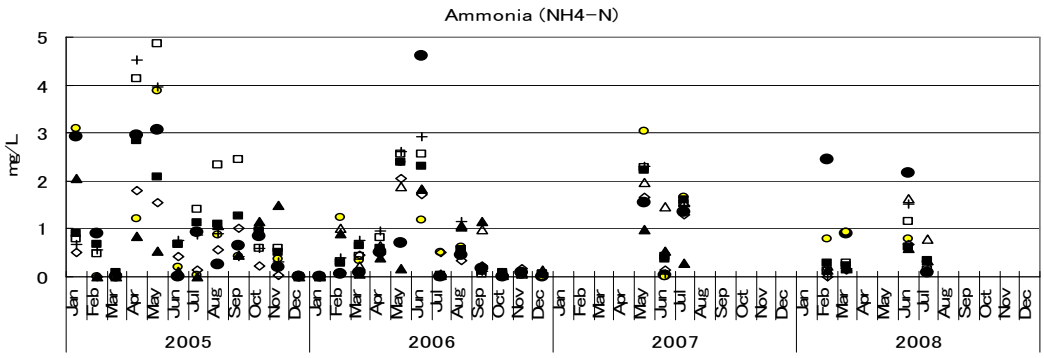
Figure 1 Pasig River Water Quality Monitoring (1999-2008)

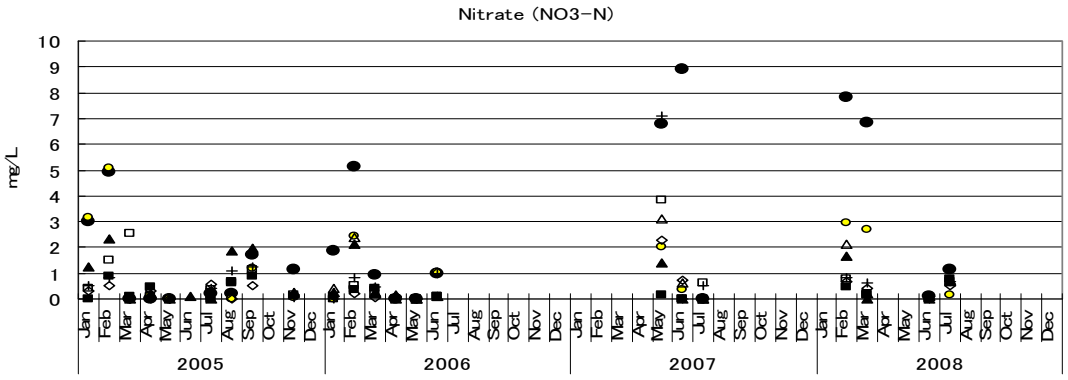


Source: Phase II monitoring data, JICA Study Team

Figure 2 Pasig River Water Quality: BOD and DO (1999-2008)







(s) means a sample taken at surface, and (b) means a sample taken at bottom of the rivers

Figure 3 Pasig River Water Quality Monitoring Results (1999-2008)


JICA