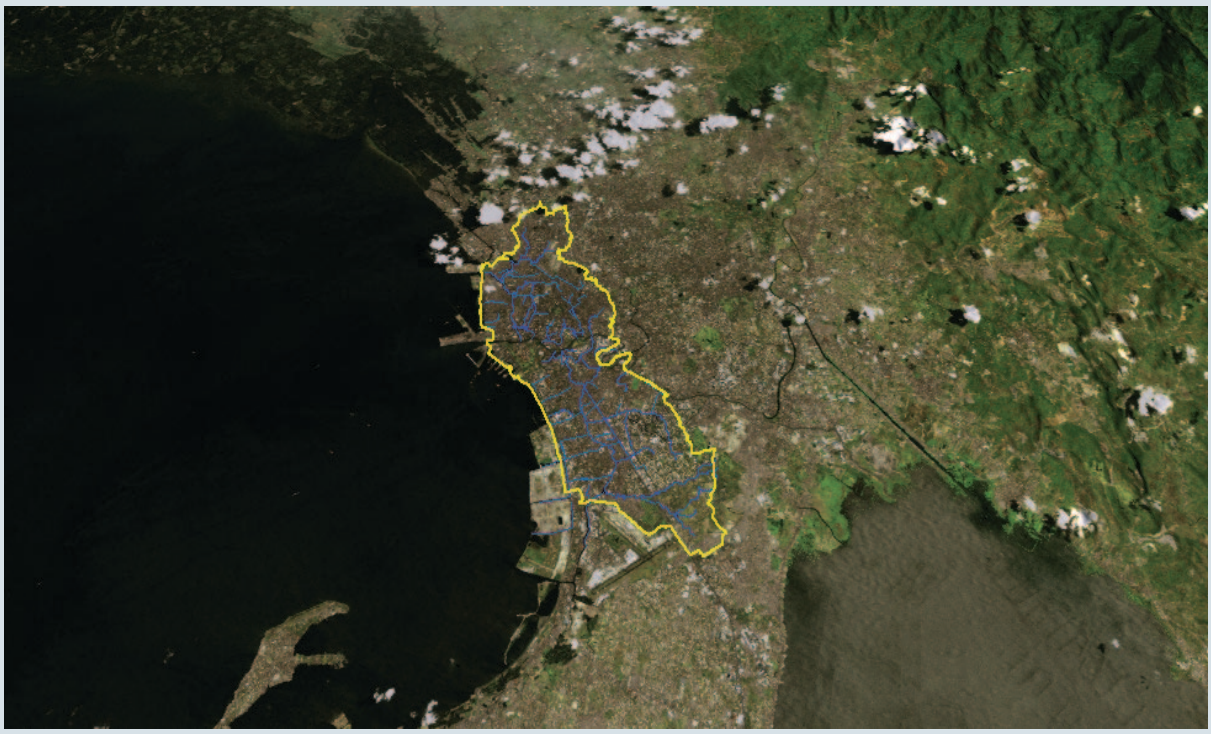
No.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

METROPOLITAN MANILA DEVELOPMENT AUTHORITY (MMDA)
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS (DPWH)
THE REPUBLIC OF THE PHILIPPINES

THE STUDY ON DRAINAGE IMPROVEMENT IN THE CORE AREA OF METROPOLITAN MANILA, REPUBLIC OF THE PHILIPPINES

FINAL REPORT
MAIN REPORT



MARCH 2005

PACIFIC CONSULTANTS INTERNATIONAL
NIKKEN CONSULTANTS, INC

G E
J R
05-025

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

METROPOLITAN MANILA DEVELOPMENT AUTHORITY (MMDA)
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS (DPWH)
THE REPUBLIC OF THE PHILIPPINES

THE STUDY ON DRAINAGE IMPROVEMENT IN THE CORE AREA OF METROPOLITAN MANILA, REPUBLIC OF THE PHILIPPINES

FINAL REPORT
MAIN REPORT

MARCH 2005

PACIFIC CONSULTANTS INTERNATIONAL
NIKKEN CONSULTANTS, INC

Foreign Currency Exchange Rates Applied in the Study

Currency	Exchange Rate/USD
Philippine Peso (Php)	55.0
Japanese Yen (JPY)	110.0

(Rate as of July, 2004)

PREFACE

In response to a request from the Government of the Republic of the Philippines, the Government of Japan decided to conduct the Study on Drainage Improvement in the Core Area of Metropolitan Manila, Republic of the Philippines and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Hajime TANAKA of Pacific Consultants International (PCI) and composed of staff member of PCI and NIKKEN Consultants,Inc. to Philippines, three times between February 2004 and March 2005. In addition, JICA set up an advisory committee headed by Mr. Nobuhisa TAKEDA, Japan International Cooperation Agency, between August 2003 and March 2005, which examined the Study from specialist and technical points of view.

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

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

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

March, 2005

Etsuo Kitahara
Vice-President
Japan International Cooperation Agency

THE STUDY ON DRAINAGE IMPROVEMENT IN THE CORE AREA OF METROPOLITAN MANILA, REPUBLIC OF THE PHILIPPINES

March, 2005

Mr. Etsuo Kitahara
Vice-President
Japan International Cooperation Agency

LETTER OF TRANSMITTAL

Dear Sir,

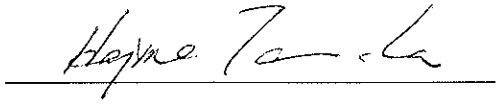
We are pleased to submit you the final report entitled "The Study on Drainage Improvement in the Core Area of Metropolitan Manila, Republic of the Philippines". This report has been prepared by the Study Team in accordance with the contracts signed on 8 August 2003, 30 January 2004 and 16 September 2004 between the Japan International Cooperation Agency and the Joint Study Team of Pacific Consultants International and NIKKEN Consultants,Inc.

The report examines the existing conditions related to drainage in the Core Area of Metropolitan Manila, proposes a master plan for the drainage improvement and presents results of the feasibility study on priority projects identified in the master plan.

The report consists of the Summary, Main Report, Supporting Reports, Data Books (including drawings). The Summary summarizes the results of all studies. The Main Report contains the existing conditions, the proposed master plan, the results of the feasibility study, and conclusions and recommendations. The Supporting Reports include technical details of the Study. The Data Books contain basic data and drawings used in the Study.

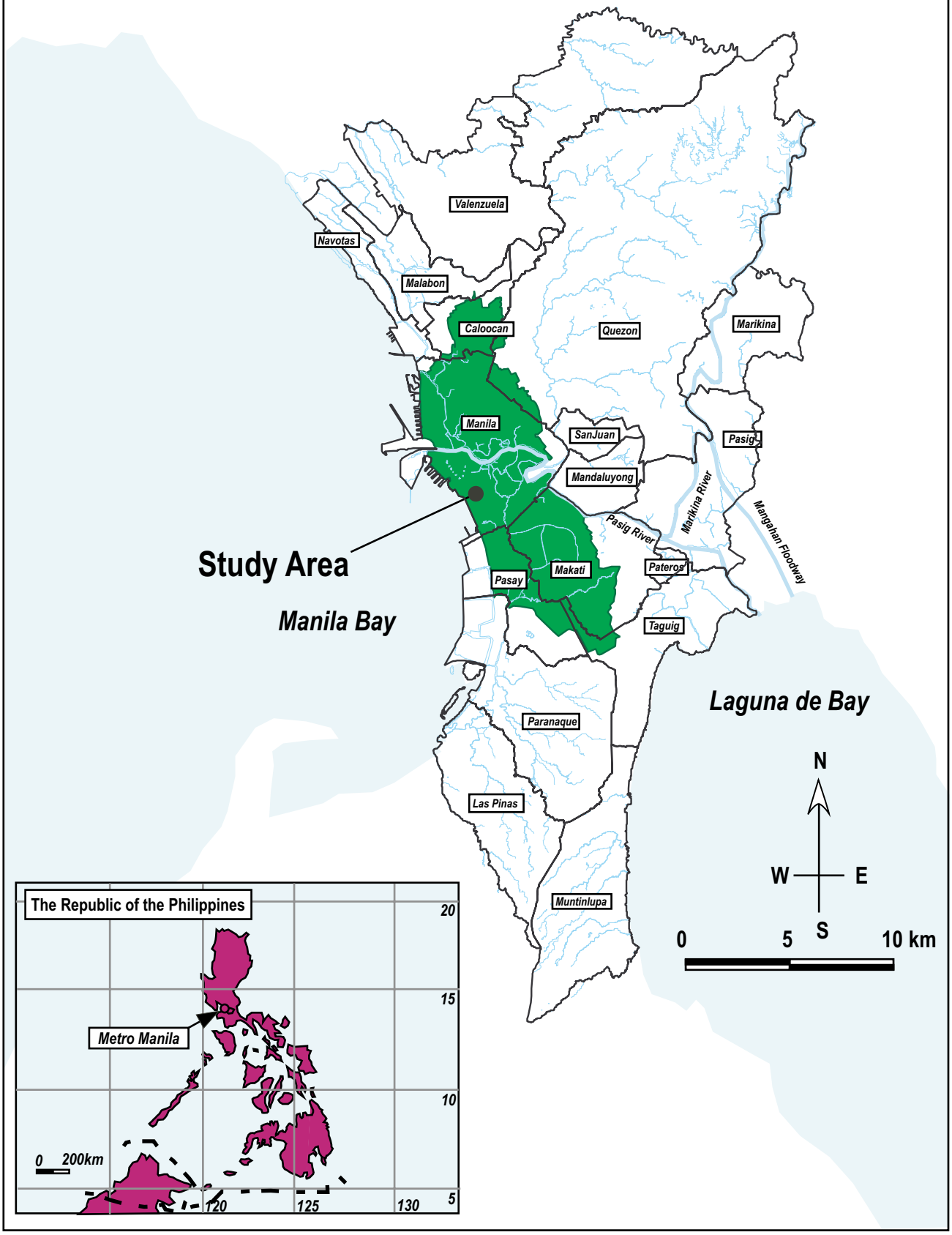
All members of the Study Team wish to express grateful acknowledgement to the Japan International Cooperation Agency (JICA), JICA Advisory Committee, Ministry of Foreign Affairs, Ministry of Land, Infrastructure and Transport, Japan Bank for International Cooperation, Embassy of Japan in the Republic of the Philippines, and other donors, and also to Philippine officials and individuals for their assistance extended to the Study Team. The Study Team sincerely hopes that the results of the study will contribute to the drainage improvement in the Core Area of Metropolitan Manila, and that friendly relations of both countries will be promoted further by this occasion.

Yours faithfully,

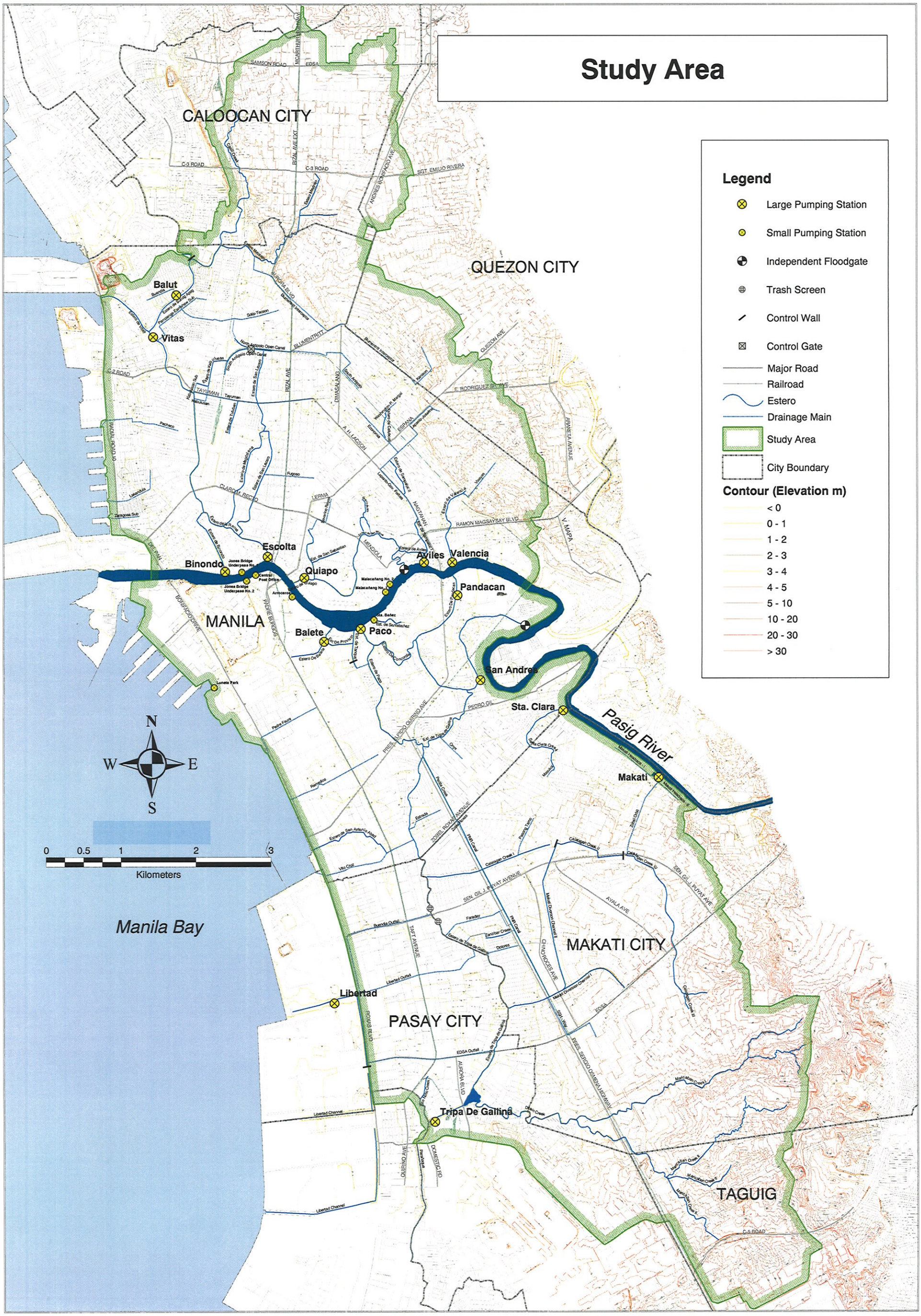


Hajime Tanaka
Team Leader

Study on Drainage Improvement in the Core Area of Metropolitan Manila, Republic of the Philippines



Study Area



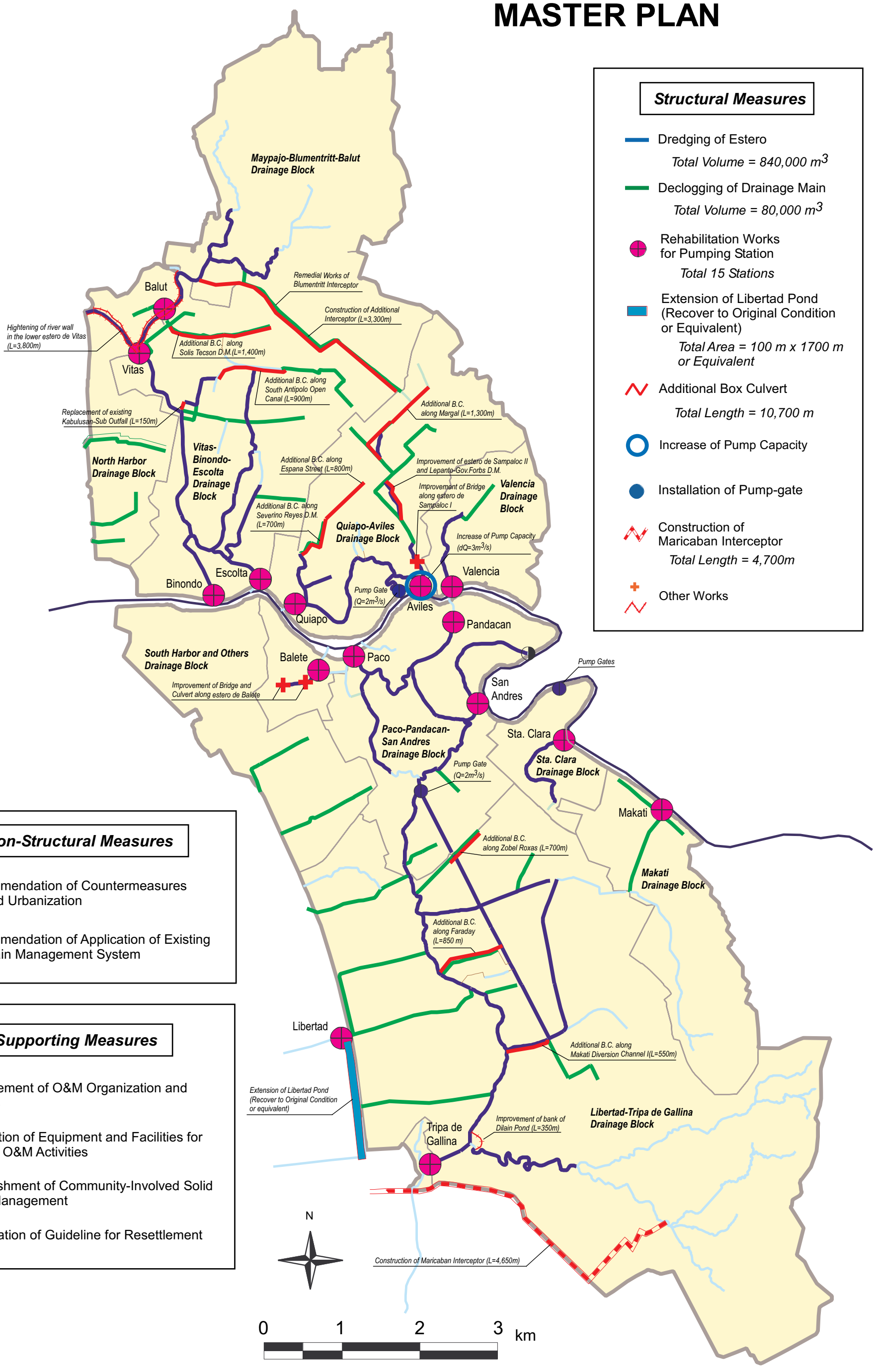
Legend

- Large Pumping Station
- Small Pumping Station
- Independent Floodgate
- Trash Screen
- Control Wall
- Control Gate
- Major Road
- Railroad
- Estero
- Drainage Main
- Study Area
- City Boundary

Contour (Elevation m)

- < 0
- 0 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 10
- 10 - 20
- 20 - 30
- > 30

MASTER PLAN



Structural Measures

- Dredging of Estero
  Total Volume = 840,000 m^3
- Declogging of Drainage Main
  Total Volume = 80,000 m^3
- Rehabilitation Works for Pumping Station
  Total 15 Stations
- Extension of Libertad Pond (Recover to Original Condition or Equivalent)
  Total Area = 100 m x 1700 m or Equivalent
- Additional Box Culvert
  Total Length = 10,700 m
- Increase of Pump Capacity
- Installation of Pump-gate
- Construction of Maricaban Interceptor
  Total Length = 4,700m
- Other Works

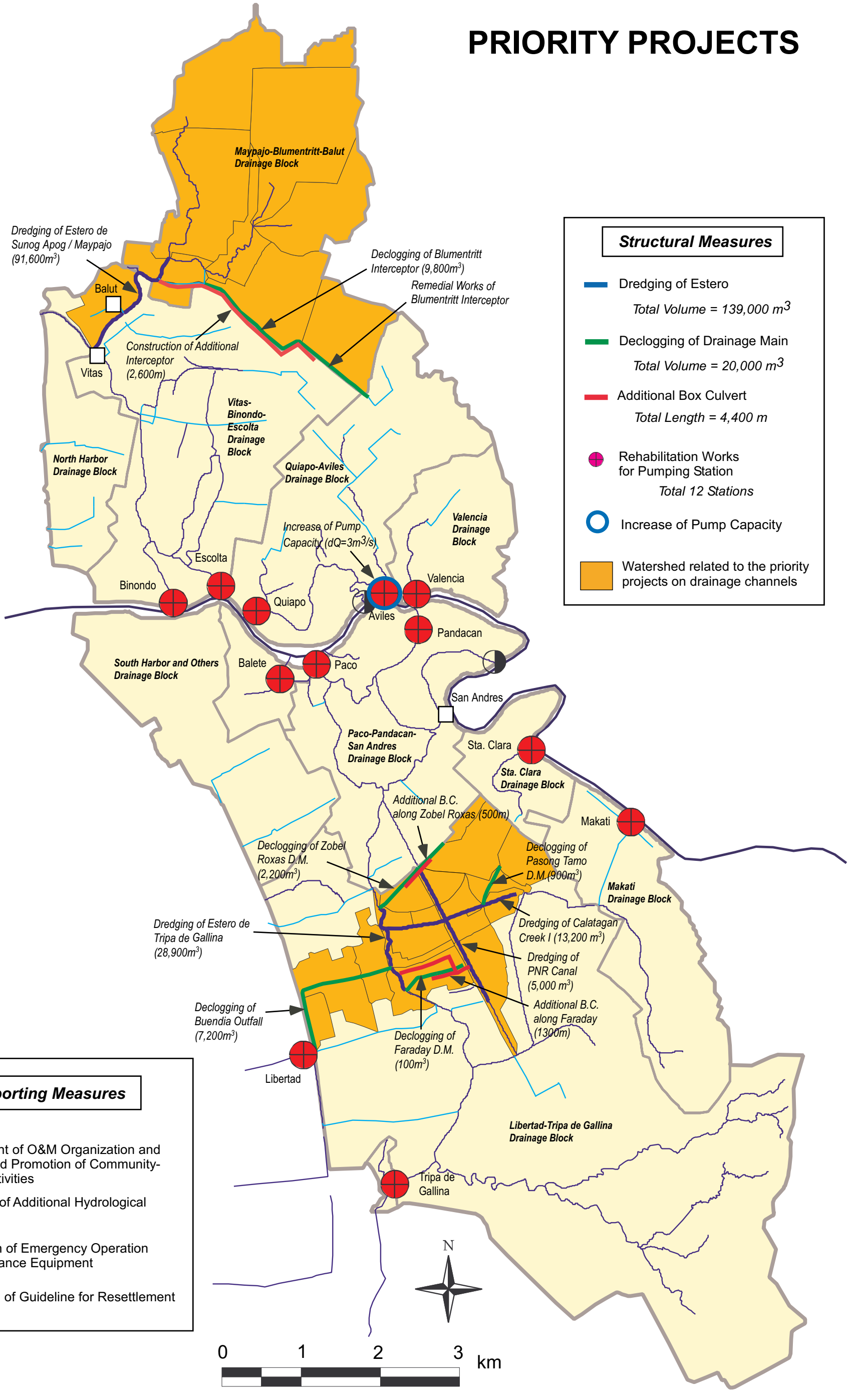
Non-Structural Measures

- Recommendation of Countermeasures for Rapid Urbanization
- Recommendation of Application of Existing Floodplain Management System

Supporting Measures

- Improvement of O&M Organization and Activities
- Installation of Equipment and Facilities for Effective O&M Activities
- Establishment of Community-Involved Solid Waste Management
- Preparation of Guideline for Resettlement

PRIORITY PROJECTS



Structural Measures

- Dredging of Estero
  Total Volume = 139,000 m^3
- Declogging of Drainage Main
  Total Volume = 20,000 m^3
- Additional Box Culvert
  Total Length = 4,400 m
- Rehabilitation Works for Pumping Station
  Total 12 Stations
- Increase of Pump Capacity
- Watershed related to the priority projects on drainage channels

Supporting Measures

- Improvement of O&M Organization and Activities and Promotion of Community-Involved Activities
- Installation of Additional Hydrological Equipment
- Introduction of Emergency Operation and Maintenance Equipment
- Preparation of Guideline for Resettlement

EXECUTIVE SUMMARY

1. Introduction
2. Flood and Inundation Problems
3. Major Drainage Problems and Countermeasures
4. Master Plan
5. Feasibility Study on Priority Pojects
6. Conclusion and Recommendation

1. INTRODUCTION

The Study on Drainage Improvement in the Core Area of Metropolitan Manila is conducted from February 2004 to February 2005 according to the Implementing Arrangement (I/A) on the Technical Cooperation for the Study, which was agreed upon among the Metropolitan Manila Development Authority (MMDA), the Department of Public Works and Highways (DPWH) and the Preparatory Study Team of Japan International Cooperation Agency (JICA) on February 26, 2003. The implementing agency (or counterpart agency) for the Study is DPWH.

The study area that includes the five Cities of Caloocan, Manila, Pasay, Makati and Quezon and the Municipality of Taguig, covers 73 km² of the core area of Metropolitan Manila The area has a population of 2.58 million, but the area is vulnerable to floods from the Pasig River, storm water of own basin and high tides of Manila Bay, because of its low-lying topography and tropical meteorological/hydrological conditions. The drainage improvement in the core area is one of the major tasks of the National Capital Region.

The objectives of the Study are as follows:

- to formulate a Master Plan of comprehensive drainage improvement for the core area of Metropolitan Manila,
- to conduct a Feasibility Study on the priority projects/areas identified in the Master Plan,
- to prepare guidelines for comprehensive drainage improvement, and
- to transfer technology and knowledge of the method and management of comprehensive drainage improvement to Philippine counterpart personnel in the course of the Study.

The Study has been conducted on the existing drainage conditions through various field studies and formulated a Master Plan of comprehensive drainage improvement for the core area and selected Priority Projects during the Phase 1 (February-August 2004), and conducted the Feasibility Study on the Priority Projects during the Phase 2 (September 2004 - March 2005). In the course of the Study guidelines for comprehensive drainage improvement and technology transfer have been prepared and experimental activities have been conducted for barangay-involved activities at three pilot barangays.

The target year of the Master Plan is set for the year of 2020, with 3 terms: 1st phase (2005 to 2010), 2nd phase (2011 to 2015) and 3rd phase (2016 to 2020). The projects proposed for the 1st Phase are selected as the Priority Projects, because the projects are proposed to improve the inundation conditions (depth and duration) of the severest inundation area in both North Manila and South Manila.

2. FLOOD AND INUNDATION PROBLEMS

Though the countermeasures have been conducted for flood control and stormwater drainage improvement since the 1970s, the frequency of flood and inundation is still high in the core area of Metropolitan Manila. The flood in 1999 records that the flood and inundation affected 1.24 million people, 97,000 houses and about a half of the road networks in the core area, and caused various adverse impacts not only to the core area but also to the national capital region, by causing severe traffic congestions and disturbing business and people's lives.

The severe inundation areas are identified at both North Manila and South Manila and they are as follows:

North Manila: Aviles-Sampaloc area in the Quiapo-Aviles, Vitas-Binondo-Escolta and Maypajo-Blumentritt-Balut drainage blocks.

South Manila: San Isidro-San Antonio-Pio del Pilar area in the Libertad-Tripa de Gallina drainage block.

In North Manila the maximum inundation depth recorded is around 1.3 m, which occurs along España Street, and the area in which the inundation is deeper than 0.5 m, extends widely in the central part. The area, in which the duration of inundation exceeds 24 hours, is also identified. In South Manila, deep inundation occurs along the east side of the PNR canal and along the Estero de Tripa de Gallina, but the duration of inundation is less than 12 hours.

3. MAJOR DRAINAGE PROBLEMS AND COUNTERMEASURES

The core area is mostly low-lying and the stormwater from about 70% (52 km²) of the core area depends on the pump drainage system. The drainage facilities are composed of: 15 major drainage pumping stations, 74 km of esteros/creeks, 35 km of drainage mains/outfalls and about 400 km laterals.

However, the existing major drainage pumping stations mostly become old and need rehabilitation, and the existing drainage channels: esteros/creeks and drainage mains/outfalls have lost their original (or design) capacities due to illegal activities: dumping of solid waste/silt into the drainage channels and encroaching numerous informal house buildings/structures in drainage channels.

The discharge capacities of existing drainage channels are assessed mostly as less than the peak discharge with 2-year return period rainfall event, though they were designed to have the capacities to convey the peak discharge with 10-year return period.

The capacities of the existing drainage channels should be rehabilitated, improved and recovered by dredging/declogging, remedial or related works and additional facilities. The volume of bottom deposits of drainage channels to be dredged and declogged is estimated to be 840,000 m³ in esteros/creeks and 80,000 m³ in drainage mains/outfalls, in order to recover the original capacities of the existing drainage channels. The informal house buildings (or structures) and households which are located inside drainage channels, are estimated at about 2,100 structures and 6,000 households respectively.

The drainage problems necessary to be solved are summarized as follows:

Problems to be solved	Countermeasures
Major drainage pumping stations mostly become old and need urgent rehabilitation.	- Early rehabilitation of drainage pumping equipment
Due to the rapid urban development, some of the drainage systems facilities are difficult to meet the current stormwater runoff.	- Remedial or related works and additional facilities are required for drainage improvement
Most of the drainage channels have lost the design drainage capacities due to the heavy channel bottom deposits.	- Rehabilitation by dredging and declogging - Improvement of solid waste collection system at barangay level by innovating inspection system and enhancing public awareness.
Increase of informal settlers in drainage channels to cause decreasing the drainage capacity and become obstacles for O&M activities.	- Relocation of informal settlers in drainage channels - Reduction of informal activities
Insufficient O&M activities.	- Improvement and strengthening of O&M organizations and activities, including budget increase and barangay-involved activities

4. MASTER PLAN

(1) Main Works Cost

Based on the preliminary cost estimation, main works cost for improvement and rehabilitation works for drainage channels are estimated as shown in the following table:

Main Works Cost for Improvement and Rehabilitation Works for Drainage Channels

Item			Amount (Million Peso)
Rehabilitation works of drainage channels			1,140.5
N01	Vitas-Binondo-Escolta	Additional works of South Antipolo area	503.0
N02	Quiapo-Aviles	Additional works of channel to Quiapo Pumping Station	307.5
		Additional works for Aviles drainage area	539.2
N04	Maypajo-Blumentritt-Balut	Additional works of Estero de Vitas	18.0
		Additional works of Blumentritt Interceptor	723.2
S01	Libertad-Tripa de Gallina	Additional works for severe inundation area in South Manila	460.1
		Additional works of Libertad pond	522.0
		Additional Works of Dilain/Maricaban Creek area	1,380.8
S02	Balete	Additional works in Estero de Balete	29.1
Total			5,623.4

Based on the preliminary cost estimation, main works cost for improvement and rehabilitation works for drainage pumping stations are estimated as shown in the following table.

Main Works Cost for Improvement and Rehabilitation Works for Drainage Pumping Stations

Item			Amount (Million Peso)
Rehabilitation works of drainage pumping stations			2,129.0
N02	Quiapo-Aviles	Additional works for Aviles drainage area	160.0
S03	Paco-Pandacan-San Andres	Additional works on Perita Creek	160.0
S04	Sta. Clara	Additional works in Sta. Clara drainage basin	160.0
Total			2,609.0

The estimated cost of main works of the master plan projects is shown below.

- **Total main works cost:** **Php8,232.4 million**
- Rehabilitation works of drainage channels: Php1,140.5 million
- Rehabilitation works of drainage pumping stations: Php2,129.0 million
- Additional works in North Manila: Php2,250.9 million
- Additional works in South Manila: Php2,712.0 million

(2) Other Costs

1) Resettlement cost:

- **Total resettlement cost:** **Php1,510.6 million**
- Resettlement cost excluding land acquisition cost: Php1,289.6 million
- Land acquisition cost for relocation site: Php221.0 million

2) Compensation cost for additional works

- **Total compensation cost for additional works:** **Php3.8 million**
- Land acquisition: Php0.8 million
- House compensation: Php3.0 million

3) Cost for supporting measures

- **Total cost for BEM and Team ESTERO activities:** **Php417.8 million**
- **Total cost for IEC campaign:** **Php71.1 million**

4) Other supporting measures cost

- **Total other supporting measures cost:** **Php177.6 million**
- Various management systems: Php138.5 million
- Additional hydrological equipment: Php1.5 million
- Emergency operation and maintenance equipment: Php37.6 million

Note: The cost is included in civil works cost.

5) Operation and maintenance cost

- **Total O&M cost:** **Php241.0 million per annum**

(3) Project Cost

In line with the above conditions, the project cost is estimated. The total project cost is Php15,367.3 million as summarized in the following table.

Project Cost

Item	Amount (Php million)	Remarks
1. Civil Work	9,703.8	
1.1 Preparatory	411.6	5 % of (1.2)
1.2 Main	8,232.4	
1.3 Other supporting measures	177.6	
1.4 Miscellaneous	882.2	10 % of (1.1+1.2+1.3)
2. VAT	970.4	10 % of (1)
3. Resettlement and Compensation Cost	1,590.1	
3.1 Resettlement cost	1,510.6	
3.2 Compensation cost for additional works	3.8	
3.3 Miscellaneous	75.7	5 % of (3.1+3.2)
4. Government Administration Cost	291.1	3 % of (1)
5. Engineering Services	970.4	10 % of (1)
6. Physical Contingency	1,352.6	10 % of (1+2+3+4+5)
7. Supporting Measure Cost		
7.1 BEM and Team ESTERO	417.8	
7.2 IEC	71.1	
Total	15,367.3	

Total project cost is approximately broken down into the respective 3 phases as follows.

- 1st Phase: Php5,503.9 million
- 2nd Phase: Php5,419.4 million
- 3rd Phase: Php4,444.0 million

(4) Project Justification

1) Technical aspect

The estimated reduction of the floods and inundation damages by the project is evaluated as a part of the impact from the technical aspect. Though 87,000 houses and a half of the roads (1,389 km) were affected in the 1999 floods and inundation, affected population numbers and road networks will be significantly reduced by the project due to the reduction of the depth and duration of the floods and inundation, and the damages caused by the flood and inundation could be minimized with the completion of the Master Plan.

2) Economic aspect

The economic viability of the optimum plan is thus figured out as follows.

Results of Economic Analysis (Future Condition)

NPV	Php27,595 mil.
B/C	5.2
EIRR	42.8%

Source: JICA Study Team

Though social infrastructure projects such as flood control and drainage improvement works are in general put into implementation even at the lower EIRR, compared with other productive projects, the master plan shows a very high viability of 42.8% in EIRR (Future Condition), likewise resulting in high values of B/C (5.2) and NPV (Php27,595 million) for the conceivable reason that socio-economic needs for flood prevention in the study area where the central function of the political and economic activity locates will augment to a maximum degree.

In this context, the Master Plan can be justified from the economic viewpoint to take a next step in accordance with the proposed schedule.

3) Financial aspect

The master plan would be effective to mitigate the damages caused by floods and inundation in the capital area and feasible from technical, economic, and social and environmental aspects. It is surely worthwhile for the Government of the Philippines to consider the increase of budgetary allocation to the floods and drainage improvement in the capital area.

When the annualized cost of proposed cost of Master Plan is compared to the average amount of total expenditure of MMDA and the 6 LGUs for the past 6 years, it is fairly huge and requires almost 1.5 times of annual budget in order to implement the Master Plan.

While, on the assumption that the JBIC loan or other resources of ODA would be appropriated to the Master Plan, the required share of the Government of the Philippines is equivalent to around 31% to present expenditures, and that the said burden is not prohibitive level of their expenditures from the aspect of the financial status of the relevant authorities.

The Government of the Philippines needs to consider the financial arrangement for the implementing agencies to implement the Master Plan.

4) Social and environmental aspects

Major issues related to social and environmental aspects are as follows:

- The rehabilitation of the drainage channels proposed in the Master Plan requires relocation of informal settlers living in houses/structures on the drainage channels before dredging, until the target year of 2020. The families to be resettled during the Master Plan (from 2005 to 2020) are estimated to be about 5,500. It is proposed that the Government of the Philippines shall arrange and develop resettlement sites based on a Resettlement Action Plan (RAP) prepared according to the guidelines for social framework of resettlement proposed in the Study.
- The rehabilitation works also require dredging/declogging a huge volume of bottom deposits of drainage channels, which is estimated to be about 920,000 m^3. It is proposed that the Government of the Philippines shall arrange and develop disposal sites for the dredged materials.

(5) Implementation Plan

1) Implementation agency

It is necessary to decide the implementing agency for the projects and to establish a coordination committee for smooth implementation of the Master Plan and the Priority Projects. DPWH should have a function to coordinate the related government organizations as the main implementing agency for the Study in order to attain the aim of drainage improvement in the core area of Metropolitan Manila.

Though the drainage facilities and solid waste management in the core area of Metropolitan Manila are now under the responsibility of MMDA and LGUs; the implementation of the proposed Master Plan and Priority Projects will require the involvement of various national and local agencies including DPWH, MMDA, NHA LGUs and others as well as a good coordination among them in order to carry out the drainage improvement project.

2) Implementing schedule

Target year of the Master Plan is se at the year of 2020, and divided into three terms as follows

- 1st Phase from 2005 to 2010
- 2nd Phase from 2011 to 2015
- 3rd Phase from 2016 to 2020

The target year of the Master Plan is 2020 and it is scheduled in three phases. Implementation and disbursement schedules are shown in *Figure 1* and *Table 1*, respectively.

(6) Preparation of Guideline for Social Framework of Resettlement

In order to recover the drainage capacity of the existing drainage channels, the relocation of informal settlers who live in house buildings within the drainage should be required. For removal of informal houses buildings (Phase 1: 285, Phase 2: 665, Phase 3: 950) and relocation of informal settlers, the following issues should be considered:

- Every effort should be made to avoid unwilling relocation such as “summary eviction”
- Participation of project affected people on creating a better solution for resettlement is crucial.
- Clarification of the responsibility and fulfillment of the mandate of the implementing agency, and establishment of a coordination committee consisting of relating agencies: LGUs, MMDA, DPWH, NHA, HUDCC etc., is necessary.
- Establishment of uniformed standard in application of RA 7279 is recommended.
- Resettlement sites with basic infrastructure are fundamental.
- A separate third party Monitoring team that can monitor the entire resettlement operation throughout the project from the initial stage of the project should be established.
- Dynamics and capacity of the people should be considered as resources

(7) Priority Projects

The projects proposed for the Phase 1 in the Master Plan are selected as the Priority Projects, because the projects selected for the Phase 1 are proposed to improve the inundation conditions (depth and duration) of the severest inundation areas in both North Manila and South Manila. The Priority Projects are composed of structural measures: rehabilitation of drainage facilities, remedial (or related) works and additional facilities, and non-structural supporting measures.

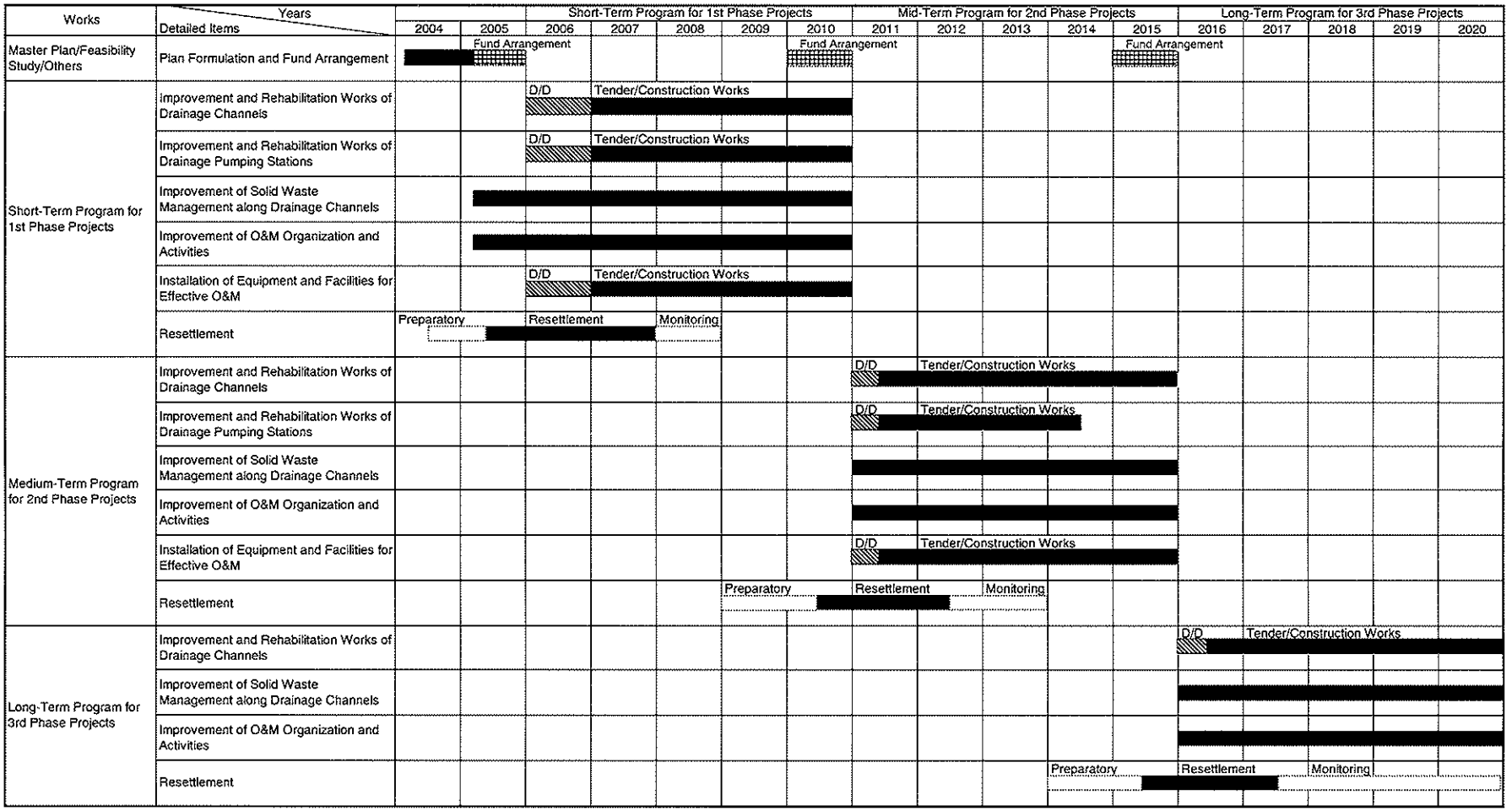


Figure 1 Implementation Schedule of the Master Plan

Table 1 Disbursement Schedule of the Master Plan

Unit: Million Peso

Work Item	Project Cost				Phase 1						Phase 2					Phase 3					Total
	Phase 1	Phase 2	Phase 3	Total	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Civil Works	3,806.9	3,432.0	2,464.9	9,703.8	0	0	0	2315	756.1	735.5	0	156.2	1160.2	1069.3	1046.3	0	117.4	782.7	782.5	782.3	9703.8
1) Preparatory	162.9	142.0	106.7	411.6	0	0	0	162.9	0	0	0	142.0	0	0	0	0	106.7	0	0	0	411.6
2) Main	3,258.8	2,839.5	2,134.1	8,232.4	0	0	0	1921.6	668.6	668.6	0	0	1008.5	925.9	905.1	0	0	711.5	711.4	711.2	8232.4
- Rehabilitation of Drainage Channels	199.8	514.5	426.2	1,140.5	0	0	0	40.0	79.9	79.9	0	0	171.5	171.5	171.5	0	0	142.1	142.1	142.0	1140.5
- Additional Works in North Manila	723.2	1,229.7	298.0	2,250.9	0	0	0	144.6	289.3	289.3	0	0	409.9	409.9	409.9	0	0	99.4	99.3	99.3	2250.9
- Additional Works in South Manla	330.8	971.3	1,409.9	2,712.0	0	0	0	66.2	132.3	132.3	0	0	323.8	323.8	323.7	0	0	470.0	470.0	469.9	2712.0
- Rehabilitation of Pumping Station	2,005.0	124.0	0	2,129.0	0	0	0	1670.8	167.1	167.1	0	0	103.3	20.7	0	0	0	0	0	0	2129.0
3) Other Supporting Measures	39.1	138.5	0	177.6	0	0	0	20.3	18.8	0	0	0	46.2	46.2	46.1	0	0	0	0	0	177.6
4) Miscellaneous	346.1	312.0	224.1	882.2	0	0	0	210.5	68.7	66.9	0	14.2	105.5	97.2	95.1	0	10.7	71.2	71.1	71.1	882.2
VAT	380.7	343.2	246.5	970.4	0	0	0	231.5	75.6	73.6	0	15.6	116.1	106.9	104.6	0	11.7	78.3	78.3	78.2	970.4
Resettlement and Compensation Cost	241.8	555.2	793.1	1590.1	95.1	95.1	51.6	0	0	222.1	222.1	111	0	0	317.2	317.2	158.7		0	0	1590.1
1) Resettlement Cost	226.5	528.8	755.3	1510.6	90.6	90.6	45.3	0	0	211.5	211.5	105.8	0	0	302.1	302.1	151.1		0	0	1510.6
2) Compensation Cost for Additional Works	3.8	0	0	3.8	0	0	3.8	0	0	0	0	0	0	0	0	0	0	0	0	0	3.8
3) Miscellaneous	11.5	26.4	37.8	75.7	4.5	4.5	2.5	0	0	10.6	10.6	5.2	0	0	15.1	15.1	7.6	0	0	0	75.7
Government Administration Cost	114.2	103.0	73.9	291.1	0	0	0	69.4	22.7	22.1	0	4.7	34.8	32.1	31.4	0	3.5	23.5	23.5	23.4	291.1
Engineering Services	380.7	343.2	246.5	970.4	0	0	0	231.5	75.6	73.6	0	15.6	116.1	106.9	104.6	0	11.7	78.3	78.3	78.2	970.4
Physical Contingency	492.4	477.7	382.5	1352.6	9.5	9.5	5.2	284.8	93	112.7	22.2	30.3	142.7	131.5	160.4	31.7	30.3	96.3	96.3	96.2	1352.6
			Sub-Total		104.6	104.6	56.8	3132.5	1023.0	1239.6	244.3	333.4	1569.9	1446.7	1764.5	348.9	333.3	1059.1	1058.9	1058.3	14878.4
Supporting Measure Cost	87.2	165.1	236.6	488.9	8.2	9.6	12.4	16.7	18.6	21.7	26.7	29.1	32.6	37.1	39.6	42	45.6	46.9	49.4	52.7	488.9
1) BEM and Team ESTERO	63.3	141.5	213	417.8	3.4	5.9	8.7	12	15.1	18.2	21.3	24.8	28.3	31.8	35.3	37.7	40.2	42.6	45.1	47.4	417.8
2) IEC	23.9	23.6	23.6	71.1	4.8	3.7	3.7	4.7	3.5	3.5	5.4	4.3	4.3	5.3	4.3	4.3	5.4	4.3	4.3	5.3	71.1
				Total	112.8	114.2	69.2	3149.2	1041.6	1261.3	271.0	362.5	1602.5	1483.8	1804.1	390.9	378.9	1106.0	1108.3	1111.0	15367.3

5. FEASIBILITY STUDY ON PRIORITY PROJECTS

(1) Project Cost

1) Main works cost

The works are composed of 3 lots and 11 projects. The main works cost is shown in the following table.

Civil Works Costs of Respective Works

Sub Project	Civil Works Cost (million Pesos)	Procurement of Contractor /Equipment
Lot I: Rehabilitation and Additional Works for Drainage Channel Facilities in North Manila		
1. Estero de Sunog Apog I	20.4	LCB
- Dredging	20.4	
2. Estero de Sunog Apog II	166.7	LCB
- Dredging	166.7	
3. Blumentritt Interceptor	563.2	ICB
- Declogging of existing Blumentritt Interceptor	43.6	
- Construction of additional Blumentritt Interceptor	519.6	
4. Sub total	**750.3**	
Lot II: Rehabilitation and Additional Works for Drainage Channel Facilities in South Manila		
1. Estero de Tripa de Gallina, PNR Canal and Calatagan Creek I	87.5	LCB
- Dredging	87.5	
2. Buendia Outfall	43.5	ICB
- Declogging	43.5	
3. Zobel Roxas Drainage Main	54.9	ICB
- Declogging	7.5	
- Construction of additional box culvert	47.4	
4. Pasong Tamo Drainage Main	2.9	LCB
- Declogging	2.9	
5. Faraday Drainage Main	269.3	ICB
- Declogging	0.3	
- Construction of additional box culvert	269.0	
6. Sub total	**458.1**	
Lot III: Rehabilitation and Additional Works of Pumping Stations		
1. Rehabilitation of 12 Pumping Stations	2,005.0	ICB
- Group 1 (Aviles,Quiapo,Valencia,Tripa de Gallina)	1,057.0	
- Group 2 (Pandacan, Paco, Sta. Clara, Libertad, Makati, Binondo)	880.0	
- Group 3 (Escolta and Balete)	68.0	
2. Sub total	**2,005.0**	
Installation of Equipment and Facilities for Effective O&M Activities	39.1	ICB
1. Emergency O&M equipment	37.6	
2. Rainfall and water level observation facilities	1.5	
3. Sub total	**39.1**	
Grand Total	**3,252.5**	

2) Cost for resettlement (700 families)

- **Total resettlement cost:** **Php192.2 million**
- Resettlement cost excluding land acquisition cost: Php164.1 million
- Land acquisition cost for relocation site: Php28.1 million

3) Cost for compensation for additional works

- **Total compensation cost for additional works:** **Php19.1 million**
- Land acquisition: Php2.3 million
- House compensation: Php16.8 million

4) Cost for community-involved solid waste management

- **Total cost for community-involved SWM:** **Php87.2 million**
- Cost for BEM and Team ESTERO activities: Php63.3 million
- Cost for IEC: Php23.9 million

5) Cost for installation of equipment and facilities for effective O&M activities

- **Total cost for installation of equipment and facilities:** **Php39.1 million**
- Cost for emergency O&M equipment: Php37.6 million
- Cost for additional hydrological equipment: Php1.5 million

Note: The cost is included in civil works cost.

6) Annual O&M cost

- **Annual cost for operation and maintenance activities:** **Php241.0 million**

(2) Project Cost

The project cost of the priority projects except price contingency is estimated at Php4,952.0 million as shown in the following table.

Project Cost

Item	Amount (million Pesos)	Remarks
1. Civil Works cost	3,415.1	
1.1 Main works	3,252.5	incl. preparatory/temporary cost
1.2 Miscellaneous	162.6	5 % of (1.1)
2. VAT	341.5	10 % of (1)
3. Resettlement and Compensation Cost	221.9	
3.1 Resettlement cost	192.2	
3.2 Compensation cost for additional works	19.1	
3.3 Miscellaneous	10.6	5 % of (3.1+3.2)
4. Government administration cost	102.5	3 % of (1)
5. Engineering services cost	341.5	10 % of (1)
6. Physical contingency	442.3	10 % of (1+2+3+4+5)
7. Supporting measures cost	87.2	
7.1 BEM and Team ESTERO	63.3	
7.2 IEC	23.9	
8. Total project cost	4,952.0	

Note: US$1.0=Php55=JY110 (July 2004)

(3) Project Justification

The economic viability of the priority projects was thus figured out as follows.

Results of Economic Analysis (Future Condition, Priority Projects, All Study Area)

NPV	Php 12,191 mil.
B/C	4.3
EIRR	36.6 %

In line with the same reason as described in the Master Plan, the priority projects also can be justified from the economic viewpoint to take a next step in accordance with the proposed schedule.

(4) Implementation Program

1) Implementation agency

The drainage facilities and solid waste management in the core area of Metropolitan Manila are now under the responsibility of MMDA and LGUs, however, the implementation of the proposed Master Plan and Priority Projects will require the involvement of many agencies including DPWH, MMDA, NHA, LGUs and others in order to carry out the drainage improvement project as well as to maintain a good coordination among them.

It is necessary to decide an implementing agency for the implementation of projects and to establish a coordination committee for smooth implementation of the Master Plan and Priority Projects.

It is proposed that DPWH coordinate the related government organizations as the main implementing agency for the Study in order to attain the aim of drainage improvement in the core area of Metropolitan Manila.

2) Implementation Schedule

The target year of the Priority Projects is 2010. The implementation and disbursement schedules are shown in *Figure 2* and *Table 2*.

(5) Resettlement

1) Resettlement action plan guideline

The Action Plan may include, at the least, the following items and contents.

- Rationale and Objectives
- Project Description that includes its Scope and Schedule
- Scale and Types of Impacts
- Legal Bases
- Resettlement Site
- Socio-Economic Profile of the Affected Families and Communities
- Setting of Cut-Off Date
- Compensation
- Demolition Date
- Public Consultation and Hearing
- Options for Resettlement Assistance
- Post-Relocation Assistance for Reconstruction of Livelihood
- Provision of Social Services
- Grievance and Complaints
- Monitoring
- Funds Sources

2) Considerations required

There are particular things to be considered in the preparation of the Resettlement Action Plan in order to have a clear picture of the Plan. First requirements are to draw:

- A flow chart of the resettlement operation plan by step of tasks
- A matrix to explain what section of responsible organization(s) will work on each component/step/task and how many staff members shall be assigned
- What kinds of groups shall be organized at the barangay level and the government level to assist the PAFs on resettlement such as Task Force, Inter-Agency Committee, Monitoring Team, etc. and their duties.

(6) Experimental Activities at Pilot Barangay

The following barangays have been selected as experiment sites on environmental management:

Manila City：Barangay 195 (Population: 1249)
Pasay City： Barangay 46 (Population: 4509)
Makati City：Barangay Palanan (Population: 16,614)

Community activities being conducted by Experiment are as follows:

- Conduct of IEC at barangay level
- Garbage/solid waste collection management at barangay level
- Cleaning of drainage channels at barangay level
- Pollution control at barangay level

The results of the experiment show the effectiveness of barangay environmental management activities with the appointment of a Barangay Environmental Manager (BEM) and the formation of Team ESTERO (Environmental Strategic Task for Estero Renewal Organization). The barangay people that participated in the experiment mostly have a positive attitude towards the process experienced in the experimental activities and the promotion of community-involved solid waste collection management and maintenance of drainage channels.

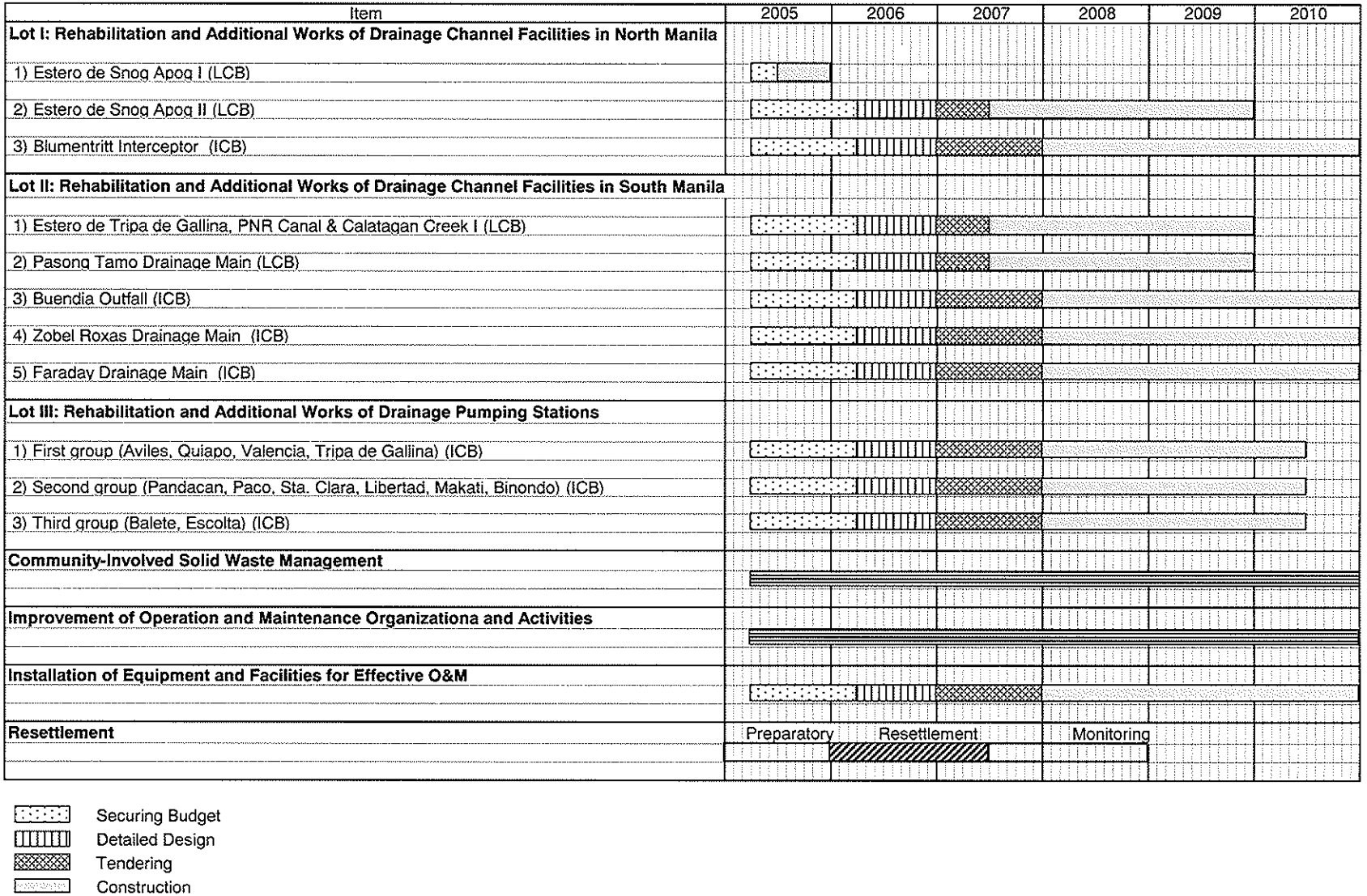


Figure 2 Implementation Schedule of the Priority Projects

Table 2 Disbursement Schedule of the Priority Projects

Unit: Million Peso

Work Item	Project Cost	Year						Total
		2005	2006	2007	2008	2009	2010	
Civil Works	3,415.1	21.4	0.0	53.9	2209.6	629.0	501.2	3,415.1
1) Main	3,252.5	20.4	0.0	51.3	2104.4	599.1	477.3	3,252.5
- Rehabilitation and Additional Works for Drainage Channel facilities in North Manila	750.3	20.4	0	33.3	254.5	254.4	187.7	750.3
a) Estero de Sunog Apog I	20.4	20.4	0	0	0	0	0	20.4
b) Estero de Sunog Apog II	166.7	0	0	33.3	66.7	66.7	0	166.7
c) Blumentritt Interceptor	563.2	0	0	0	187.8	187.7	187.7	563.2
- Rehabilitation and Additional Works for Drainage Channel facilities in South Manila	458.1	0	0	18	158.8	158.8	122.5	458.1
a) Estero de Tripa de Gallina, PNR Canal and Calatagan Creek I	87.5	0	0	17.5	35	35		87.5
b) Buendia Outfall	43.5	0	0	0	14.5	14.5	14.5	43.5
c) Zobel Roxas Drainage Main	54.9	0	0	0	18.3	18.3	18.3	54.9
d) Pasong Tamo Drainage Main	2.9	0	0	0.5	1.2	1.2		2.9
e) Faraday Drainage Main	269.3	0	0	0	89.8	89.8	89.7	269.3
- Rehabilitation of Pumping Station	2,005.0	0	0	0	1671	167.1	167.1	2,005.0
a) Group 1	1,057.0	0	0	0	880.8	88.1	88.1	1,057.0
b) Group 2	880.0	0	0	0	733.4	73.3	73.3	880.0
c) Group 3	68.0	0	0	0	56.6	5.7	5.7	68.0
- Installation of Equipment and Facilities	39.1	0	0	0	20.3	18.8	0.0	39.1
2) Miscellaneous	162.6	1	0	2.6	105.2	29.9	23.9	162.6
VAT	341.5	2.1	0.0	5.4	221.0	62.9	50.1	341.5
Resettlement and Compensation Cost	221.9	0	134.5	87.4	0	0	0	221.9
1) Resettlement Cost	192.2	0	128.1	64.1	0	0	0	192.2
2) Compensation cost for additional works	19.1	0	0	19.1	0	0	0	19.1
3) Miscellaneous	10.6	0	6.4	4.2	0	0	0	10.6
Government Administration Cost	102.5	0.6	0	1.6	66.3	18.9	15.1	102.5
Engineering Services	341.5	2.1	0	5.4	221	62.9	50.1	341.5
Physical Contingency	442.3	2.6	13.5	15.4	271.7	77.4	61.7	442.3
Sub-Total		28.8	148.0	169.1	2989.6	851.1	678.2	4,864.8
Supporting Measure Cost	87.2	8.2	9.6	12.4	16.7	18.6	21.7	87.2
1) BEM and Team ESTERO	63.3	3.4	5.9	8.7	12	15.1	18.2	63.3
2) IEC	23.9	4.8	3.7	3.7	4.7	3.5	3.5	23.9
Total		37.0	157.6	181.5	3006.3	869.7	699.9	4,952.0

6. CONCLUSION AND RECOMMENDATION

The proposed Master Plan and Priority Projects for the core area are effective in terms of technical, economic, social and environmental aspects for drainage improvement in the core area. By the implementation of the proposed drainage improvement plan, the severe inundation area will significantly be reduced and improved. It is recommended for the Government of the Philippines to take immediate actions for the implementation of the proposed measures, because the core area of Metropolitan Manila is very important economically and socially in the country, but extremely vulnerable to flood and inundation problems. The Study recommends the actions as follows.

(1) The rehabilitation of the existing major drainage facilities: drainage channels and drainage pumping stations, shall be conducted according to the proposed schedule in order to prevent/mitigate the damages caused by floods and inundation in the core area of Metropolitan Manila. The Priority Projects identified in the Master Plan shall require immediate actions, and be conducted duly according to the schedule.

(2) The relocation of informal settlers living inside the target drainage channels (esteros/creeks) shall be conducted before dredging. The implementing agencies shall select resettlement sites and prepare a "Resettlement Action Plan" for the Priority Projects and the Master Plan through a series of public consultation, based on the resettlement guideline prepared in the Study and the JICA guideline for environmental and social awareness, and shall avoid executing any summary evictions and returnees. Although there are some structures encroaching partly the drainage channel, the detailed number of project affected people for relocation or structure for compensation shall be decided based on the detailed design.

(3) The O & M organizations shall be improved and barangay-involved O & M system shall be established, and those organization shall conduct not only proper O & M activities for drainage facilities but also carry the responsibility for proper solid waste collection management at the barangay level to avoid illegal activities for sustaining the capacity of the drainage facilities after the rehabilitation/improvement of drainage channels.

(4) The major drainage pumping stations require detailed rehabilitation programs through overhauling and the 12 drainage pumping stations require rehabilitation, but the 4 drainage pumping stations: Quiapo, Aviles, Valencia and Tripe de Gallina, are critical conditions requiring immediate actions for rehabilitation.

(5) The implementing agency shall be decided and organize a coordination committee for the implementation of the Master Plan and Priority Projects, because the implementation of the Master Plan and Priority Projects shall require various concerned central and local government agencies and stakeholders.

(6) The barangay environmental management shall be extended to other barangay along esteros/creeks to promote the community participation for improvement of various barangay activities including improvement/sustainment of the drainage capacity. The BEM (Barangay Environmental Manager) and Team ESTERO (Environmental Strategic Task for Estero Renewal Organization) activities conducted at three pilot barangays (Manila: Barangay 195, Pasay: Barangay 46, Makati: Barangay Palanan) as an experiment, would be an effective way for enhancement of public awareness through public education, for promotion of public participation for solid waste collection management as well as for prevention against illegal activities like dumping solid waste into drainage channels and informal settlement in public spaces.

(7) The database for the Study, which has been developed and transferred to the implementing agency and concerned organizations (DPWH, MMDA and LGUs), shall be utilized and updated periodically for the O & M of drainage facilities and the coordinated activities shall be required among the concerned agencies.

(8) DPWH as the implementing agency shall take the initiative to continue the preparation for the implementation of Priority Projects as follows:

- Preparation of the Environmental Impact Statement (EIS) based on the Environmental Impact Assessment (EIA) prepared in the Study and get an Environmental Compliance Certificate (ECC) for Priority Projects.
- Preparation of a Resettlement Action Plan (RAP) shall be conducted according to the proposed the guideline of social awareness and resettlement, enough consideration of necessary social and basic infrastructures.
- Preparation of Implementation Program (IP) for financial arrangement shall include necessary measures for drainage improvement of the core area of Metropolitan Manila and also necessary measures required for the resettlement plan.
- Preparation for resettlement sites for the Phases 2 and 3 in the Master Plan shall be conducted according to the proposed relocation schedule of project affected people along the drainage channels.
- Preparation for countermeasures for rapid urbanization to lower runoff coefficient shall be conducted in order to establish sustainable drainage system.

TABLE OF CONTENTS

Page

CHAPTER 3 DATABASE AND HYDRODYNAMIC MODEL DEVELOPMENT

CHAPTER 4 MASTER PLAN

CHAPTER 5 FEASIBILITY STUDY

CHAPTER 7 CONCLUSION AND RECOMMENDATION

APPENDICES

LIST OF TABLES

Page

CHAPTER 2 CHARACTERISTICS OF STUDY AREA

CHAPTER 3 DATABASE AND HYDRODYNAMIC MODEL DEVELOPMENT

CHAPTER 4 MASTER PLAN

CHAPTER 5 FEASIBILITY STUDY

CHAPTER 6 EXPERIMENTAL RESEARCH FOR COMMUNITY PARTICIPATION

LIST OF FIGURES

Page

CHAPTER 2 CHARACTERISTICS OF STUDY AREA

CHAPTER 3 DATABASE AND HYDRODYNAMIC MODEL DEVELOPMENT

CHAPTER 4 MASTER PLAN

CHAPTER 5 FEASIBILITY STUDY

CHAPTER 6 EXPERIMENTAL RESEARCH FOR COMMUNITY PARTICIPATION

ABBREVIATION

AASHTO: American Association of State Highway and Transportation Official
ABC: Association of Barangay Captains
ADB: Asian Development Bank
ASEP: Association of Structural Engineers of the Philippines
ATC: Applied Technical Council
BOC: Bureau of Construction
BOD: Bureau of Design
BOE: Bureau of Equipment
BOM: Bureau of Maintenance
BPW: Bureau of Public Works
CH: City Hall
CHR: Commission for Human Rights
CIDSS: Comprehensive and Integrated Delivery of Social Service
CLUP: Comprehensive Land Use Plan
CMP Community Mortgage Program
CSC: Civil Service Commission
DAO: DENR Administrative Order
DBM: Department of Budget and Management
DBP Development Bank of Philippines
DECS: Department of Education, Culture and Sports
DILG: Department of the Interior and Local Government
DENR: Department of Environment and Natural Resources
DPWH: Department of Public Works and Highways
DSWD: Department of Social Welfare and Development
DOF: Department of Finance
DOH: Department of Health:
DOT: Department of Tourism
DOTC: Department of Transportation and Communications
DWO: Drainage and Waterways Operation, MMDA
ECC: Environmental Compliance Certificate
EIA: Environmental Impact Assessment
EIS: Environmental Impact Statement
EFCOS: Effective Flood Control and Operation System
FAPs: Foreign Assisted Projects
FCDD: Flood Control and Drainage Division. DPWH
FCSEC: Flood Control and Sabo Engineering Center
GDP: Gross Domestic Product
GIS: Geographic Information System
GOJ: Government of Japan
GOP: Government of Republic of the Philippines
GNP: Gross National Product
GPS: Global Positioning System
GRDP: Gross Regional Domestic Product
GSIS: Government Service Insurance System
HES: Human Ecology and Security
HGC: House Guarantee Corporation
HDMF: Home Development Mutual Fund
HIGC: Home Insurance Guaranty Corporation (Now called HGC)
HLURB: The Housing and land Used Regulatory Board
HUDCC: Housing and Urban Development Coordinating Council
ICSI: Institute of Church and Social Issues
IBRD: International Bank for Reconstruction and Development (World Bank)

JICA: Japan International Cooperation Agency
JBIC: Japan Bank for International Cooperation
LGC: Local Government Code
LGU: Local Government Unit
LGU-Makati: Local Government Unit Makati City
LGU-Manila: Local Government Unit City of Manila
LGU-Pasay: Local Government Unit Pasay City
LRT: Light Rail Transit
MBN: Minimum Basic Needs
MDF: Municipal Development Fund
MLLW: Mean Lower Low Water Level
MMC: Metropolitan Manila Council
MMDA: Metropolitan Manila Development Authority
MNH: Manila North Harbor
MSH: Manila South Harbor
MSL: Mean Sea Level
MWSS Metropolitan Waterworks and Sewerage System
NAIA: Ninoy Aquino International Airport
NAMRIA: National Mapping and Resources Information Authority
NAPC: National Anti-Poverty Commission
NCR: National Capital Region, DPWH
NCSO: National Census and Statistics Office
NDCC: National Disaster Coordinating Council
NEDA: National Economic and Development Authority
NGO: Non-Government Organization
NHA: National Housing Authority
NAMRIA: National Mapping & Resources Information Authority
NHMFC: National Home Mortgage Finance Corporation
North Manila: North or right bank of the Pasig River
NSO: National Statistics Office
NWRB: National Water Resources Board
NWSS: Manila Waterworks and Sewerage System
OCD: Office of Civil Defense
OECF: Oversea Economic Cooperation Fund
PAGASA: Philippines Atmospheric, Geophysical & Astronomical Services Administration
PCUP: Presidential Commission for the Urban Poor
PD: Presidential Decree
PPA: Philippine Port Authority
PNP: Philippine National Police
PSFO: Pumping Stations and Floodgates Operation, MMDA
PMO: Project Management Office
PNR: Philippine National Railway
PO: People's Organization
PRRC: Pasig River Rehabilitation Commission
RA: Republic Act
South Manila: South or left bank of the Pasig River
SSS: Social Security System
SWMO: Solid Waste Management Office
TWG: Technical Working Group
UDHA: Urban Development and Housing Act
UNHCR: United Nations High Commissioner for Refugees
UN-OCHA: United Nations Office for the Coordination of Humanitarian Affaires
UTM: Universal Transverse Mercator Projection
UP: University of Philippines
UPO: Urban Poor Organization

WB: World Bank
WHO: World Health Organization

(Study and Project)

MMEIRS: Earthquake Impact Reduction Study for Metropolitan Manila (JICA), 2004
MMUTIS: Metro Manila Urban Transport Integration Study, 1999
PRDP: Pasig River Environment Management and Rehabilitation Sector & Development Program
SEDLMM: Study on the Existing Drainage Laterals in Metro Manila (JICA), 2000

(Unit)

ha: Hectare
Php: Philippine peso

Chapter 1

INTRODUCTION

CHAPTER 1 INTRODUCTION

1.1 BACKGROUND

This Final Report presents all the results of the Study conducted from February 2004 to March 2005. The Study has been conducted according to the Implementing Arrangement (I/A) on the Technical Cooperation for the Study agreed among Metropolitan Manila Development Authority (MMDA), Department of Public Works and Highways (DPWH) and the Preparatory Study Team of Japan International Cooperation Agency (JICA) on February 26, 2003.

The study area covers Metropolitan Manila's core area, which is vulnerable to floods from the Pasig River, and stormwater and high tides of Manila Bay, because of its low-lying topography and meteorological/hydrological conditions.

The basic concepts of the existing drainage improvement measures for the core area are based on "Plan for the Drainage of Manila and Suburbs", prepared by the Bureau of Public Works (BPW) of the Government of the Philippines in 1952, which is composed of flood control measures and stormwater control measures for the city of Manila and its suburbs. The Plan was reviewed by international agencies in the 1960s.

After the severe flood in 1972 the Government of Japan (GOJ) started the financial assistance to the Government of the Philippines (GOP) for the flood control project for the Pasig River and the stormwater drainage improvement project for the core area. The Mangahan Floodway and the 10 major drainage pumping stations were completed by 1984 and five other major drainage pumping stations were completed by 1997. Accordingly, the floods from the Pasig River and the inundation area/depth/duration by stormwater have significantly been reduced in the core area.

However, still there are remaining severe inundation areas locally in the core area, which cause heavy traffic and disturbance in the commercial activities and urban living. The 1999 severe inundation revealed that the drainage facilities need to be reviewed and improved for their discharge capacities through various measures such as remedial and additional works to the existing drainage facilities, improvement of O & M organizations and activities, improvement of solid waste management practices, prevention of illegal activities and promotion of public participation through enhancement of public awareness for drainage improvement.

The drainage channels have lost their original discharge capacities because the illegal dumping of solid waste into drainage channels and the encroachment of numerous informal settlers inside drainage channels, disturbing proper O & M activities are decreasing their conveyance capacities. Also the dumped solid waste flows into the drainage pumping stations and affects the lifespan of the pump facilities by overloading together with their poor water quality.

Due to the request from the Government of the Philippines, the Government of Japan decided to conduct a Comprehensive Study on Drainage Improvement in the Core Area of Metropolitan Manila through JICA, which is the official agency responsible for the implementation of technical cooperation programs of GOJ.

1.2 OBJECTIVES OF THE STUDY

The objectives of the Study are:

- to formulate a Master Plan of comprehensive drainage improvement for the core area of Metropolitan Manila,
- to conduct a Feasibility Study on the priority projects/areas identified in the Master Plan,
- to prepare guidelines for comprehensive drainage improvement, and
- to transfer technology and knowledge of the method and management of comprehensive drainage improvement to Philippine counterpart personnel in the course of the Study.

1.3 STUDY AREA

The study area is the core area (73 km^2) of Metropolitan Manila, covering the City of Manila and parts of the Cities of Caloocan, Quezon, Pasay, Makati and Municipality of Taguig, and composed of about 1,200 barangays, which are the smallest administrative units.

1.4 STUDY SCHEDULE

The Study is conducted for a period of 14 months, which is composed of two phases as follows:

(1) 1st Phase (From February 2004 to August 2004): Master Plan Study

The task is formulating a Master Plan and selecting priority projects for F/S. During the phase the 1st field works were conducted. The reports issued are as follows:

- Inception Report in February 2004
- Progress Report in April 2004
- Interim Report in August 2004

During the period the workshops and technical seminar held are as follows:

- 1st Public Participation Workshop on March 10, 2004 after the Inception Report
- 1st Technical Seminar on May 19,2004 after the Progress Report
- 2nd Public Participation Workshop on May 21, 2004 after the Progress Report
- 3rd Public Participation Workshop on July 22, 2004 after the 1st Field Works
- 1st Barangay Cluster Workshop on July 23, 2004 after the 1st Field Works

(2) 2nd Phase (From September 2004 to March 2005): F/S on the Priority Projects

The task is to conduct F/S on the priority projects selected in the Master Plan. During this phase the 2nd field works were conducted. The reports issued are as follows:

- Draft Final Report in February 2005
- Final Report in March 2005

During the period the workshops and technical seminar held are as follows:

- 4th Public Participation Workshop on October 1, 2004 after the Interim Report
- 2nd Barangay Cluster Workshop on October 22, 2004 after the Interim Report
- 2nd Technical Seminar on January 18, 2005 after the 2nd Field Work
- 5th Public Participation Workshop on January 19, 2005 after the 2nd Field Works
- 3rd Barangay Cluster Workshop on January 20, 2005 after the 2nd Field Works
- 6th Public Participation Workshop on March 2, 2005 after the Draft Final Report

The workshops and technical seminars conducted are outlined and shown in *Annex-1.1* to *Annex 1.3*, and the detailed information is shown in *Supporting Report N.*

The public consultation meetings for the Project Affected People were held in November 2004 and January 2005 in the EIA study. The detailed information is shown in *Supporting Report K.*

1.5 APPROACH AND METHODOLOGY

In order to cope with the drainage problems in the core area, the Study has been conducted with due consideration of the existing drainage conditions as follows:

(1) Through investigation and analysis on the existing drainage systems, land use, drainage facilities and their discharge capacities, the problems are identified, and the existing drainage systems are assessed with and without improvement conditions by the hydrological and hydraulic model developed for the Study.

(2) The existing drainage channels have mostly been without their original discharge capacities because of heavy illegal dumping of solid waste in drainage channels and numerous informal settlers encroaching drainage channels. The basic measures are to recover the original discharge capacities of the existing drainage channels by relocation of informal settlers and by dredging.

(3) The flood/inundation area maps for the 1999 flood have been prepared. In the core area severe inundation areas are identified and improvement measures by remedial works and additional facilities are studied.

(4) The existing conditions of dumped solid waste have been surveyed at 5 major drainage pumping stations and 20 spots at drainage channels, in order to assess the solid waste dumped into the drainage channels.

(5) O & M organizations and their activities have been investigated for major pumping stations, drainage channels and solid waste collection management. Proper O & M activities are fundamental to improve and sustain the discharge capacities of existing drainage channels and involvement of barangay communities for O & M activities of drainage channels is considered.

(6) Illegal activities and informal settlers have been investigated along drainage channels through social questionnaire and interview surveys because the public participation shall be a basic need for improvement and sustainment of the capacity of drainage facilities.

(7) In order to conduct proper O & M activities and to reduce heavy sedimentation and dumped solid waste, the problem caused by informal settlers and informal activities along drainage channels should be addressed through enhancement of public awareness.

(8) Database has been developed for the Study to support planning and future O & M activities of the responsible organizations as one of the supporting tools.

(9) The Master Plan and priority projects are prepared after assessing the existing conditions from technical, social, economic and environmental aspects.

(10) For effective technical transfer daily on-the-job training and periodical technical meetings together with technical seminars and workshops have been conducted.

1.6 FIELDS OF THE STUDY

During the Study the collection and analyses of data and information have been conducted in the following field:

- Meteorology and hydrology
- Hydrological and hydraulic modeling
- Drainage planning
- Drainage facility design
- Solid waste management
- Social issues/Public participation
- Operation and maintenance for drainage
- Construction plan and cost estimation
- Socio-economy
- Environment
- Database development

During the Study supplementary cross-sectional surveys on drainage channels, questionnaire survey for social aspects, IEE and field investigation in general are conducted in the Phase 1, and supplementary cross-sectional/longitudinal survey, geological investigation, EIA and supplementary field investigation for priority projects are conducted in Phase 2 to support the available data and information for the Study.

For supplementary longitudinal and cross-sectional surveys, the benchmarks used in the JICA Study in 2000 (SEDLMM) were checked based on the primary benchmark (BM-ML3) that was used for the digital topographic map (1:5000) prepared by the JICA Study in 2004 (MMEIRS).

1.7 COMPONENT OF THE REPORTS

This report presents all results of the Study conducted during the period from February 2004 to March 2005. The report consists of the following:

- Summary
- Main Report
- Supporting Reports (Volumes I, II and III):

  (Volume I)

  A Database
  B Meteorology and Hydrology
  C Flood and Inundation
  D Mathematical Model and Simulation
  E Drainage Facility Plan
  F Preliminary Design
  G Cost Estimation
  H Economic Evaluation

  (Volume II)

  I Social Issues
  J Public Participation
  K Environment (IEE and EIA)
  L Solid Waste Survey on Esteros
  M Guideline for Drainage Improvement
  N Workshop / Seminar

  (Volume III)

  O Experiment at Pilot Barangays

- Data Books I and II

1.8 EXECUTION OF THE STUDY

The Study Team is composed of the consultants selected by JICA. The main counterpart agency of the Study, DPWH, assigned the members of the counterpart team to work closely with the consultants. DPWH has organized a Technical Working Group and a Steering Committee for the Study as well. JICA organized an advisory committee for the Study in Japan. The 3rd Steering Committee held on July 20, the committee decided to organize a sub-committee for resettlement issues and the 6th Steering Committee on March 1, 2004 decided to be kept for following up the projects. Members of each organization and staff are listed and shown in *Annex 1.4* to *Annex 1.7*.

In addition, MMDA and the LGUs have assigned responsible supporting staff for the Study.

Annex 1.1: Public Participation Workshop

Main Target Group: Concerned Government and Non-Government Organizations

No.	Date	Time	Venue	Number of Participants	Contents
1	March 10, 2004	9:00 - 17:30	Philippine Trade Training Center	66	- To understand and appreciate the Study - To identify the concerns, problems/issues on drainage
2	May 21, 2004	8:00 - 17:00	Philippine Trade Training Center	65	- To discuss the present state of the structural, non-structural and supporting measures for drainage improvement - To propose the structural, non-structural, and supporting measures
3	July 22, 2004	8:00 - 17:00	Philippine Trade Training Center	57	- To analyze the major factors that influence the successful implementation of the project using S.W.O.T. analysis
4	October 1, 2004	8:00 - 17:00	Traders Hotel, Manila	72	- To develop and prepare the LGU Operation/Maintenance guidelines for priority projects
5	January 19, 2005	8:00 - 17:00	Traders Hotel, Manila	49	- To classify the O & M as activities for pre-construction, construction and operation - To identify the responsible agency and its specific role during each stage - To prepare the guidelines for the monitoring of the O & M
6	March 2, 2005	8:00 - 17:00	Traders Hotel, Manila	106	- To elicit reactions and comments about the final result of the Study - To discuss how the proposed project from the Study could be incorporated into the LGU's Development Plan.

Annex 1.2: Barangay Cluster Workshop

Main Target Group: Barangays Affected by the Project

No.	Date	Time	Venue	Number of Participants	Contents
1	July 23, 2004	8:00 - 17:00	Bayview Park Hotel, Manila	43	- To analyze the major factors that influence the successful implementation of the project using S.W.O.T. analysis
2	October 22, 2004	8:00 - 17:00	Traders Hotel, Manila	166	- To develop and prepare the Barangay Operation/Maintenance guidelines for priority projects
3	January 20, 2005	8:00 - 17:00	Traders Hotel, Manila	109	- To classify the O & M as activities for pre-construction, construction and operation - To identify the responsible agency and its specific role during each stage - To prepare the guidelines for the monitoring of the O & M

Annex 1.3: Technical Seminar

Main Target Group: Concerned Government and Non-Government Organizations

No.	Date	Time	Venue	Number of Participants	Contents
1	May 19, 2004	8:00 - 17:00	Bayview Park Hotel, Manila	53	- Study Approach /Methodology and Finding and Observation ・ Drainage System Assessment ・ Hydrological/Hydraulic Analysis ・ Drainage Planning ・ Solid Waste Management
2	January 18, 2005	8:00 - 17:00	Traders Hotel, Manila	47	- Drainage and Solid Waste Management in Japan - Result and Output of the Study ・ Database ・ Existing Condition of Drainage System ・ Drainage Improvement Plan

ANNEX 1.4: JICA ADVISORY COMMITTEE AND JICA STUDY TEAM

JICA Advisory Committee

Name	Position	Affiliation
Nobuhisa TAKEDA	Chairman of Advisory Committee	Senior Advisor (Public Participation) Japan International Cooperation Agency
Takaaki KUSAKABE	Member of Advisory Committee	Senior Research Fellow (Flood Control) National Institute for Land and Infrastructure Management Ministry of Infrastructure, Land and Transportation
Kazuhiko KOMINE	Member of Advisory Committee	Senior Engineer (Urban Drainage and Sewerage) Department of Sewerage Fukuoka City

JICA Study Team

Name	Assignments
Hajime TANAKA	Team Leader
Takayuki NOBE	Deputy Team Leader / Drainage Planning (1)
Akinori SATO	Deputy Team Leader / Environment / Solid Waste Management
Tadanori KITAMURA	Drainage Planning (2) / Hydraulics
Ryosaku NAGATA	Drainage Facility Design
M. M. Sabbir Hassan	Hydrological and Hydraulic Modeling
Akio ISHII	Solid Waste Analysis
Sonoe YAMADA	Social Issue / Public Participation (1)
Felixberto Hansen Roquia, Jr.	Public Participation (2)
Tsutomu KAMEYAMA	Operation and Maintenance
Kenji MORITA	Database
Hidemaro SAIGA Toshiro IWAHASHI	Construction Planning / Cost Estimation
Shingo SATO	Economics / Finance

ANNEX 1.5: COUNTERPART TEAM

Name	Designation	Office	Responsibility
Napoleon S. Famadico	Engineer IV	DPD-PS	Team Leader
Orlando M. Casio	Engineer III	DPD-PS	Deputy Team Leader Drainage Planning
Jesus O. Averilla	Sr.Env'I.Plng.Sp.	DPD-PS	Deputy Team Leader Env't Solid Waste Management
Leonila Mercado	Engineer IV	PMO-MFCP	Coordinator Drainage Planning, Hydraulics
Elmo F. Atillano	Engineer III	DPD-PS	Hydrological and Hydraulic Modeling
Marceline G. Tolentino, Jr.	Engineer III	DPD-PS	Drainage Facility Design
Manuel M. Leano		PMO-MFCP	Solid Waste Analysis
Leonardo P. Sanchez		NCR	Social Issue/Public Participation (1)
Joselito B. Manoos		NCR	Public Participation (2)
Myrna M. Rodriguez		NCR	Social Issues/Relocation
Aquilina T. Decilos	Engineer III	DPD-PS	Const'n Planning/Cost Estimation
Diana Parubrub	Data Encoder	DPD-PS	Database
Silverio Auxtero	Engineer Asst.	DPD-PS	Operation and Maintenance
Estelita M. Leonado	Economist III	DPD-PS	Economics/Finance

ANNEX 1.6: STEERING COMMITTEE

	Name	Designation	Office	Responsibility
1	Manuel M. Bonoan	Undersecretary	DPWH	Chairman
2	Cesar Lacuna	Deputy Chairman	MMDA	Co-Chairman
3	Ruben S. Reinoso, Jr	Asst. Director General	NEDA	Member
4	Percival C. Chavez	Chairperson	PCUP	Member
5	Rolu P. Encarnacion	Weather Service Chief	PAGASA	Member
6	Lailani C. Basig	Project Officer II	HUDCC	Member
7	Ma. Alma T. Valencia	Deputy Manager	NHA	Member
8	Alicia R. Bala	Regional Director	DSWD	Member
9	Leonor C. Cleopas	Manager	MWSS	Member
10	Resito David	Project Director	PMO-FCSEC	Member
11	Toshiyuki KANO	JICA Advisor	PMO-FCSEC	Member
12	Akito KAGAWA	JICA Expert	DPWH	Member *(- May 2004)*
13	Shunta DOZONO	JICA Expert	DPWH	Member *(June 2004 -)*
14	Jejomar C. Binay	City Mayor	Makati City	Member
15	Jose L. Atienza	City Mayor	Manila City	Member
16	Wenceslao B. Trinidad	City Mayor	Pasay City	Member
17	Feliciano R. Belmonte	City Mayor	Quezon City	Member
18	Sigfrido R. Tinga	City Mayor	Taguig City	Member
19	Enrico Recom Echiverri	City Mayor	Caloocan City	Member

ANNEX 1.7: TECHNICAL WORKING GROUP

	Name	Designation	Office	Responsibility
1	Patrick Gatan	Project Director	DPWH-PMO-MFCP 1	Head
2	Vernon M. Espiritu	Planning Officer IV	MMDA	Co-Head
3	Alejandro F. Salvador	Principal Engineer	NEDA	Member
4	Resito V. David	Project Director	PMO-FCSEC	Member
5	Gerome M. Dela Rosa	Assistant Director	NCR	Member
6	Gilberto S. Reyes	Assistant Director	BOD	Member
7	Camilo G. Foronda	Office-in-Charge	Legal Service	Member
8	Mario G. Navarro	Project Manager II	PMO-MFCP I	Member
9	Dolores Hipolito	Project Manager II	PMO-FCSEC	Member
10	Rebecca T. Garsuta	Engineer V	Planning Service	Member
11	Nelson A. Morales	City Engineer	Makati City	Member
12	Armando L. Andres	City Engineer	Manila City	Member
13	Edwin Y. Javaluyas	City Engineer	Pasay City	Member
14	Joselito B. Cabungkal	City Engineer	Quezon City	Member
15	Rolando D. Eduria	City Engineer	Caloocan City	Member
16	Marcelo M. Sertajuan	City Engineer	Taguig City	Member