Department of Public Works and Highways
Flood Control and Sabo Engineering Center

World Bank Sustainable Development Network (WB-SDN)
Washington D.C. ,February 25-28, 2013

Policies, Direction and Issues

Flood Mitigation in Laguna Lake Basin

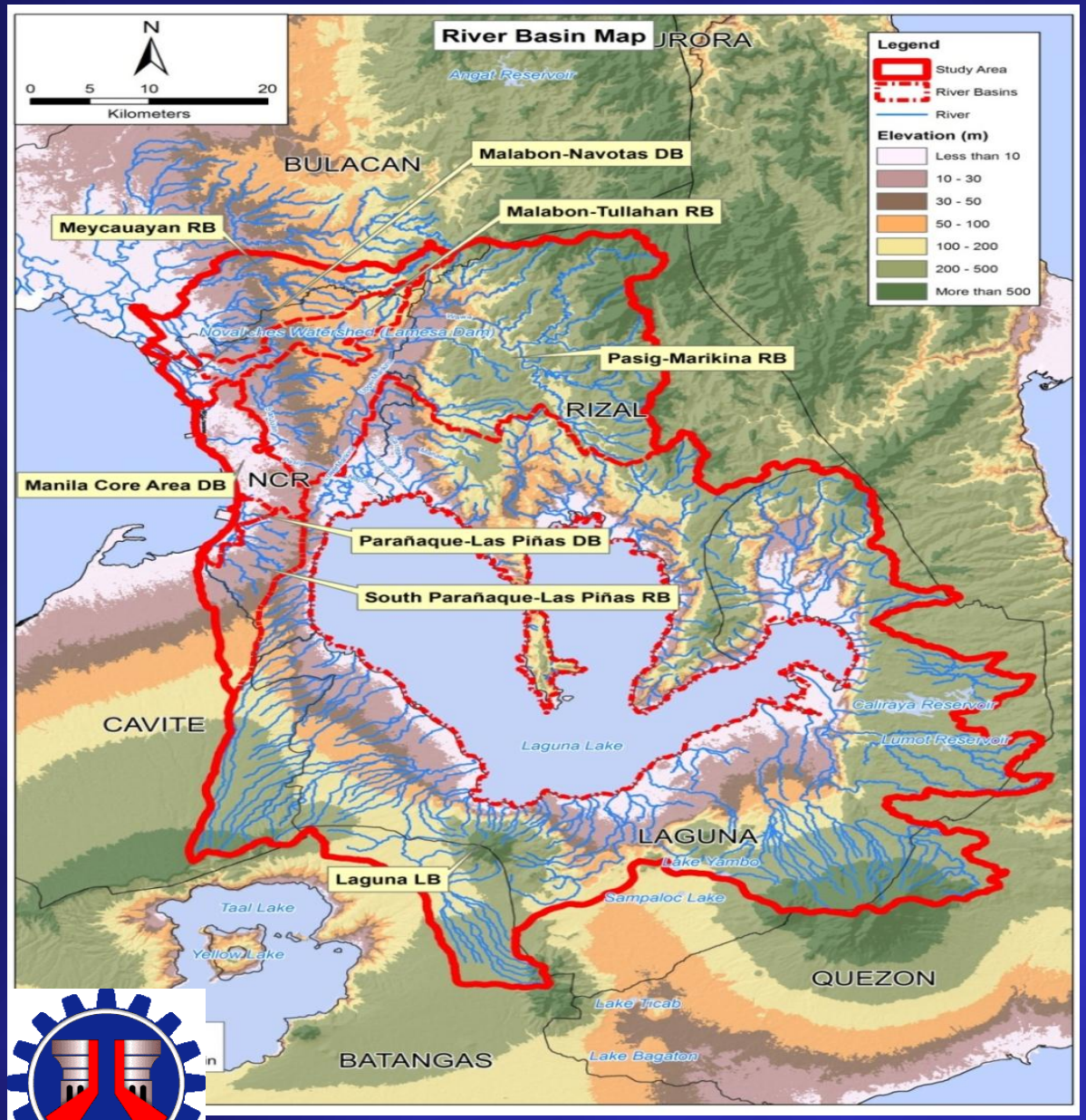
JERRY A. FANO
DPWH - FCSEC

Outline of Presentation

1. Recent Mega Water-Disasters
   - 2009 Ondoy / Pepeng Metro Manila Flooding
   - 2012 Typhoon Gener / Habagat (Southwest Monsoon)
   - 2013 Typhoon Maring / Habagat

2. DPWH Efforts to Mitigate Flooding in Laguna Lake
   - Flood Management Master Plan (Metro Manila and Laguna Lake)
   - Completed and On-going Initiatives
     - 11 Long Term Flood Control Projects (P 351B)
     - Short Term / Priority LLDA Projects (P 5B)

Main Causes of Flooding in Laguna Lake



(1) Huge volume of water coming from Sierra Madre and Marikina Watersheds

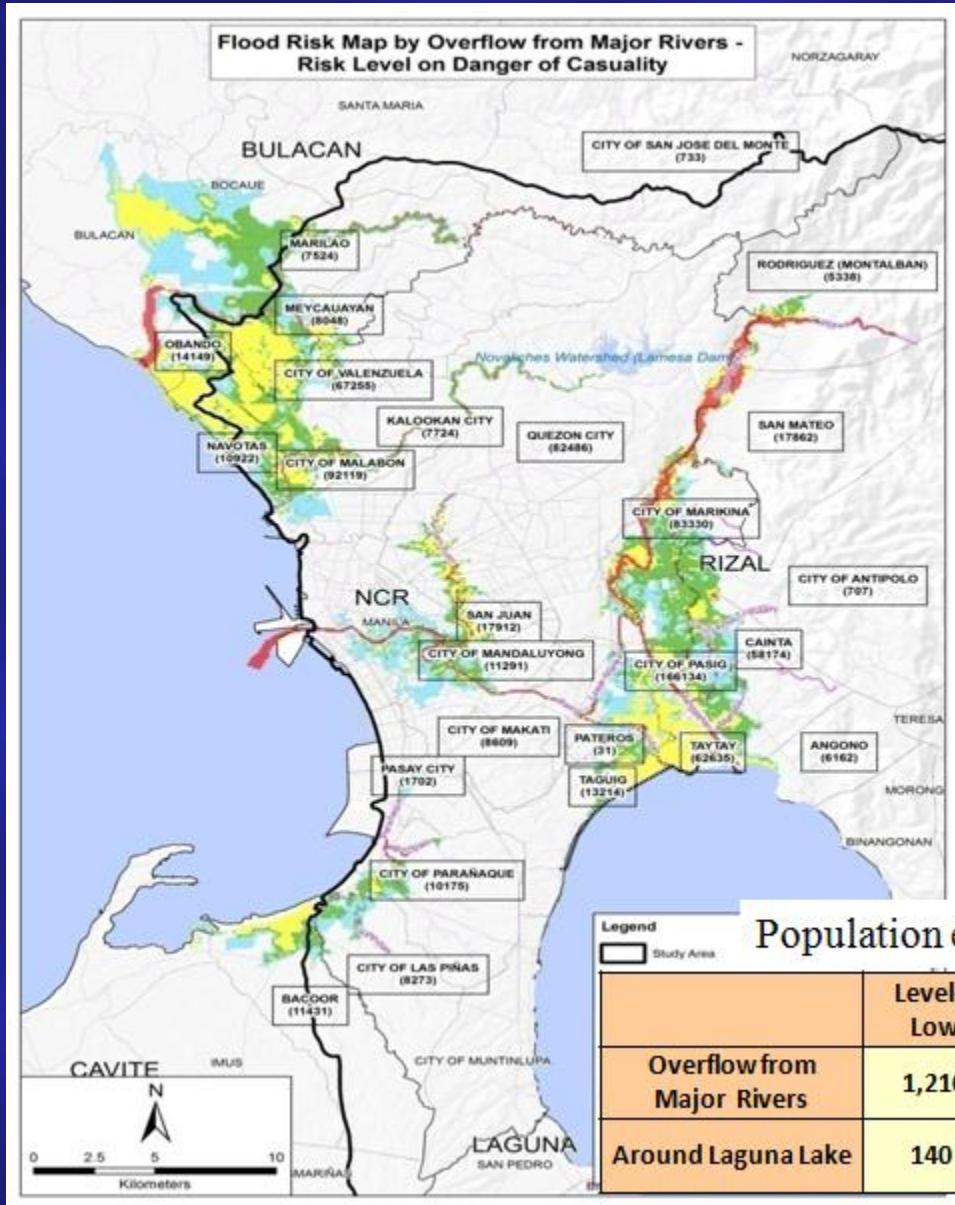
(2) With intense rainfall, waterways with reduced carrying capacities overflow

(3) Drainage capacity constraints in core area of Metro Manila

(4) Low lying communities around Manila Bay & Laguna Lake

Flood Risk Map on Danger of Casualty-Risk Level

(100-year Flood for rivers and 2009 water level for Laguna Lake)



Note:

Estimated population in Flood Risk Level-3 & 4.:

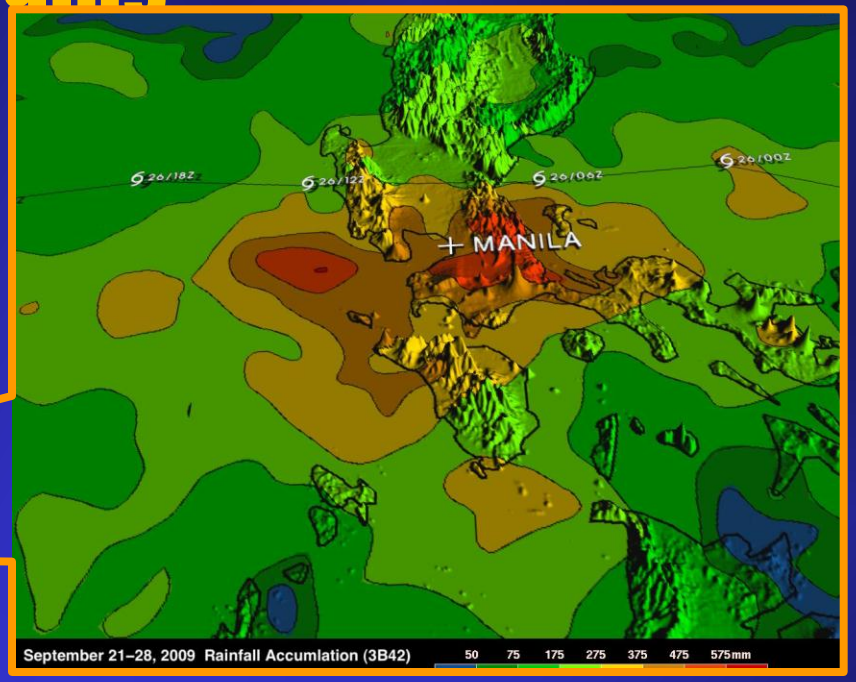
- 773,940 (NCR)
- 294,000 (Laguna Lake)

Population exposed to Flood Risk (unit:1000)

	Level-1 Low	Level-2 Medium	Level-3 High	Level-4 Very High	Total 1-4
Overflow from Major Rivers	1,210	929	696	175	3,010
Around Laguna Lake	140	7	294	0	441

2009 Metro Manila Flooding

Typhoon Ondoy (26 Sept 2009)

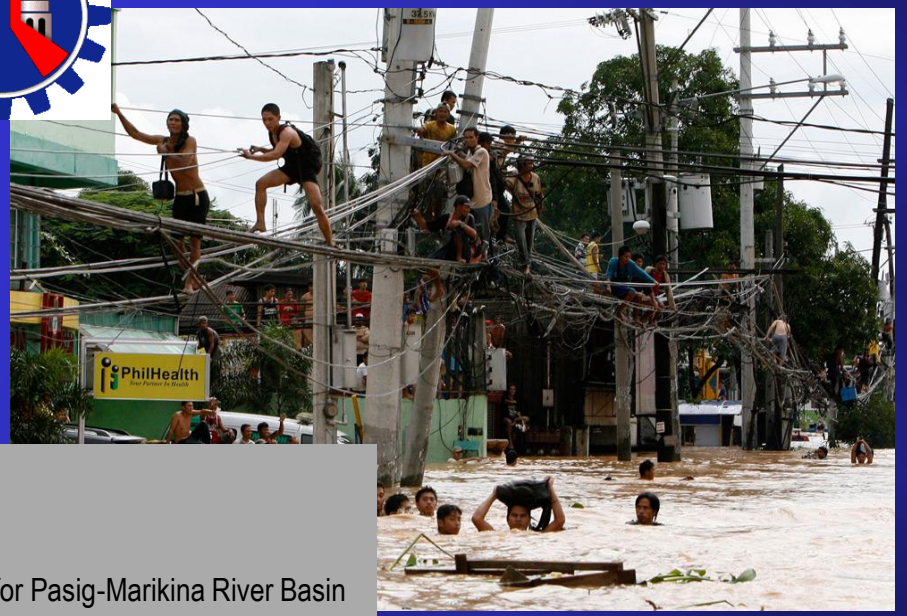


- Tropical Rainfall Measuring Mission (TRMM) / NASA – Multi Satellite Precipitation Analysis (MPA) showed Typhoon 'Ketsana' poured 575mm of rainfall (6hr Rainfall)

- Monthly ave. (November) rainfall in manila was poured over in 1 day.

2009 Metro Manila Flooding

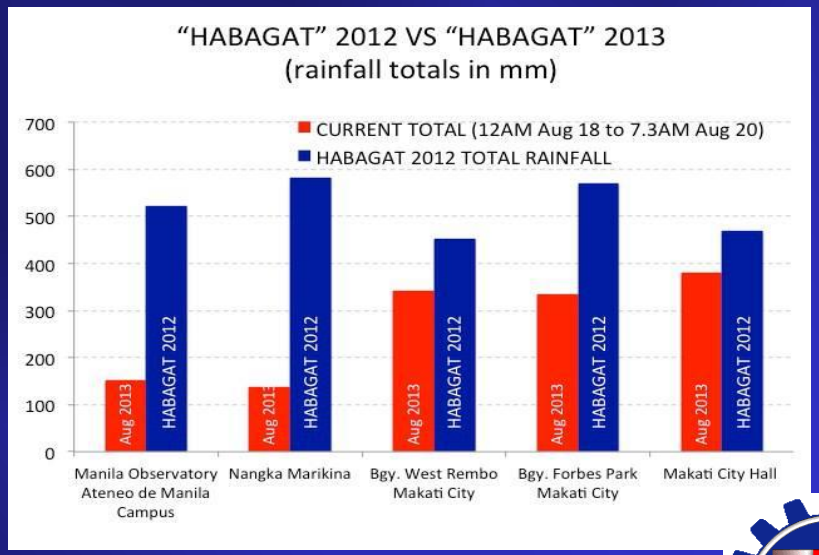
Typhoon Ondoy (26 Sept 2009)



- Affected 9.3 million
- Casualty 1,000 people dead
- Damage 2.7% of GDP
- 1:70 yr-return period rainfall for Pasig-Marikina River Basin

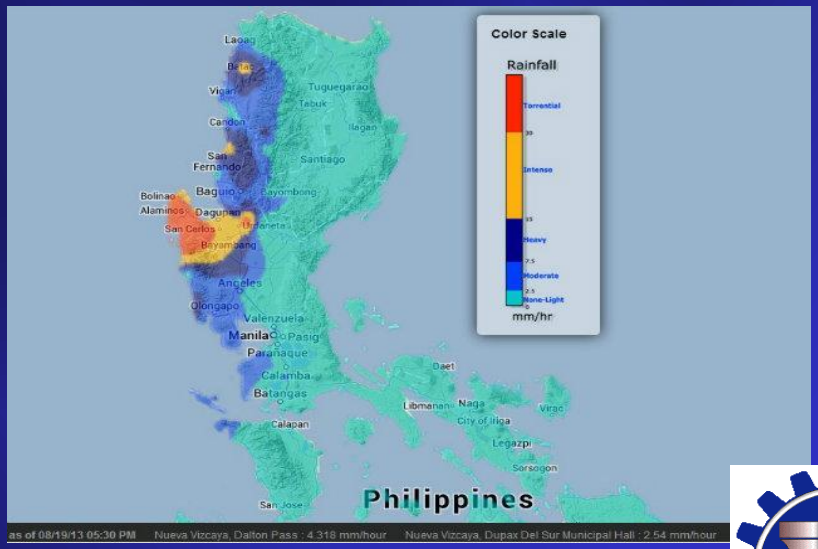
2012 Habagat FLooding

Typhoon Gener (1-8 August 2012)



2013 Habagat FLooding

Typhoon Maring (18-20 August 2013)



Policy and Direction

DPWH Efforts to Mitigate Flooding in Laguna Lake

1. Flood Management Master Plan for Metro Manila

- The Master Plan is prepared to establish the road map/vision for sustainable and effective Flood Management in Metro Manila
- Prioritize the construction of flood structures in highly vulnerable areas
- Upgrades on Flood Control and Drainage Standards (min. flood return periods of drainage pipes (15 yr flood); esteros/creeks(15 yr flood); principal and major rivers (50 yr flood).

Proposed Target Flood Safety Levels for Mitigation Measures

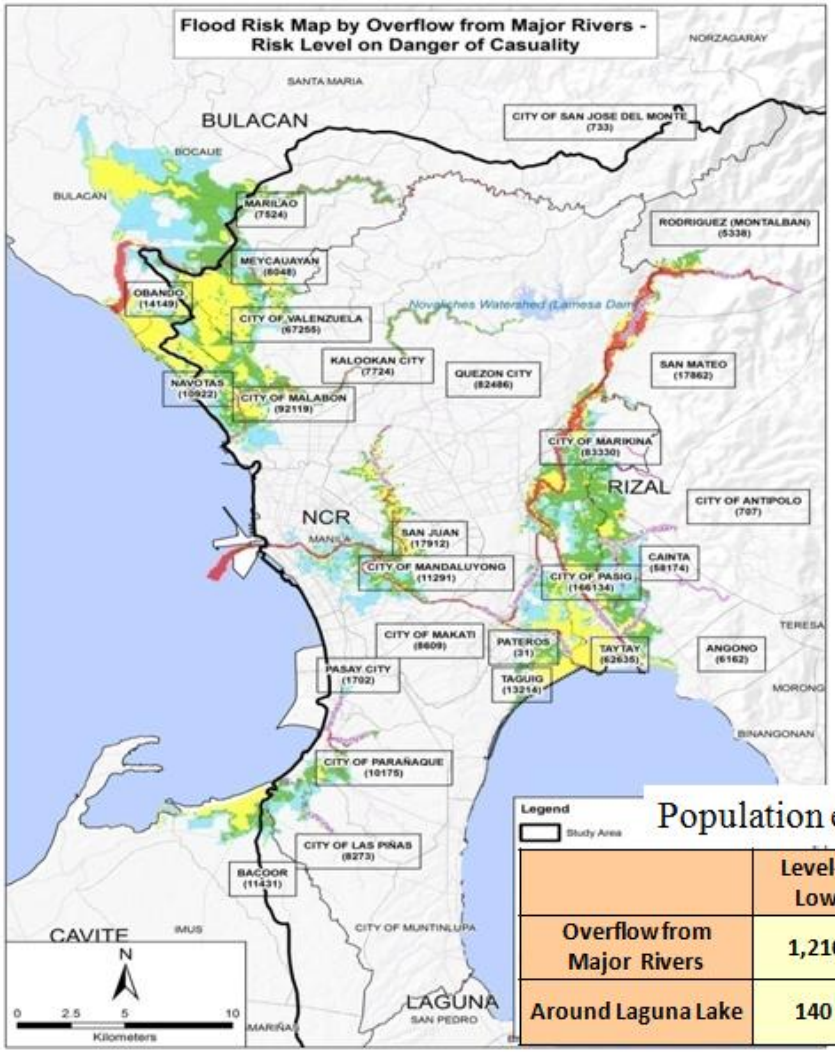
River / Lake	Recorded Max. Return Period (RP)	Target Flood Safety Level	Basis
1. Pasig-Marikina River	70-year (Ondoy)	100-year RP	2-day rainfall
2. Malabon-Tullahan River	45-year (Ondoy)	50-year RP	2-day rainfall
3. Meycauayan River	40-year (Ondoy)	50-year RP	2-day rainfall
4. South Parañaque-Las Piñas River	30-year (1986)	30-year RP	2-day rainfall
5. Inflow Rivers to Laguna Lake	30-year (others)	30-year RP	2-day rainfall
6. Laguna Lake	60-year (1972)	60-year RP	Water level

Pasig-Marikina River Channel Improvement

Policy and Direction

DPWH Efforts to Mitigate Flooding in Laguna Lake

2. Pursuing Integrated Flood Risk Management (IFRM)



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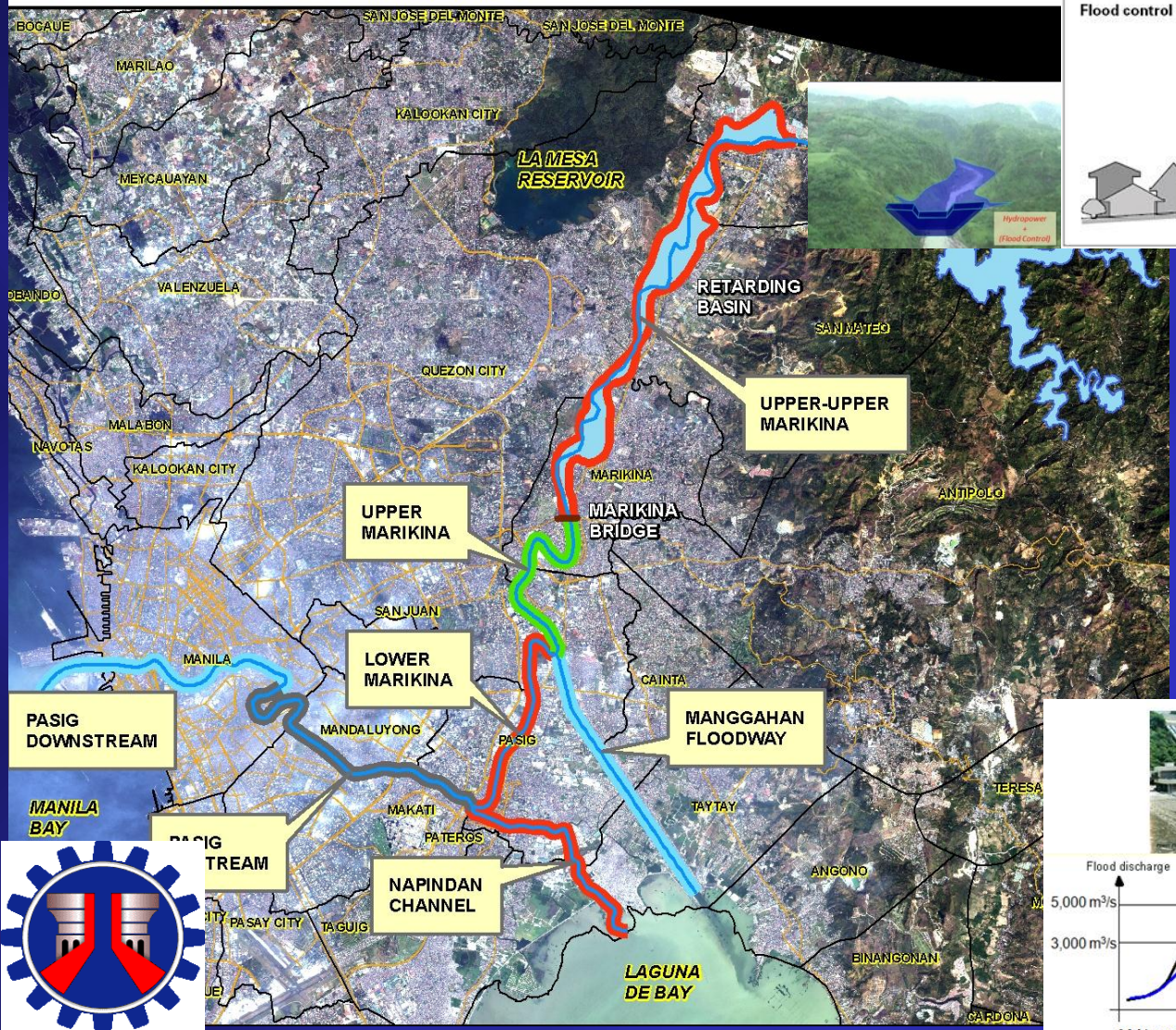
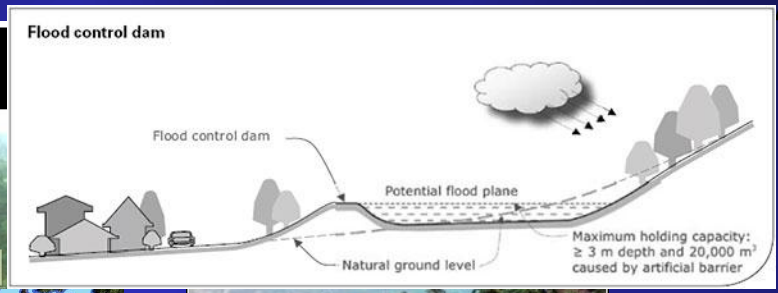
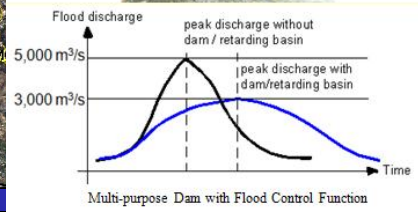
Policy and Direction

DPWH Efforts to Mitigate Flooding in Laguna Lake

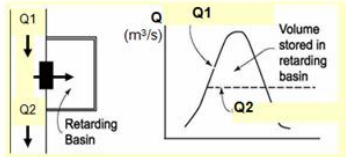
3. Water Convergence Projects

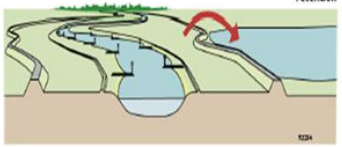






Multi-purpose Dam with Flood Control Function





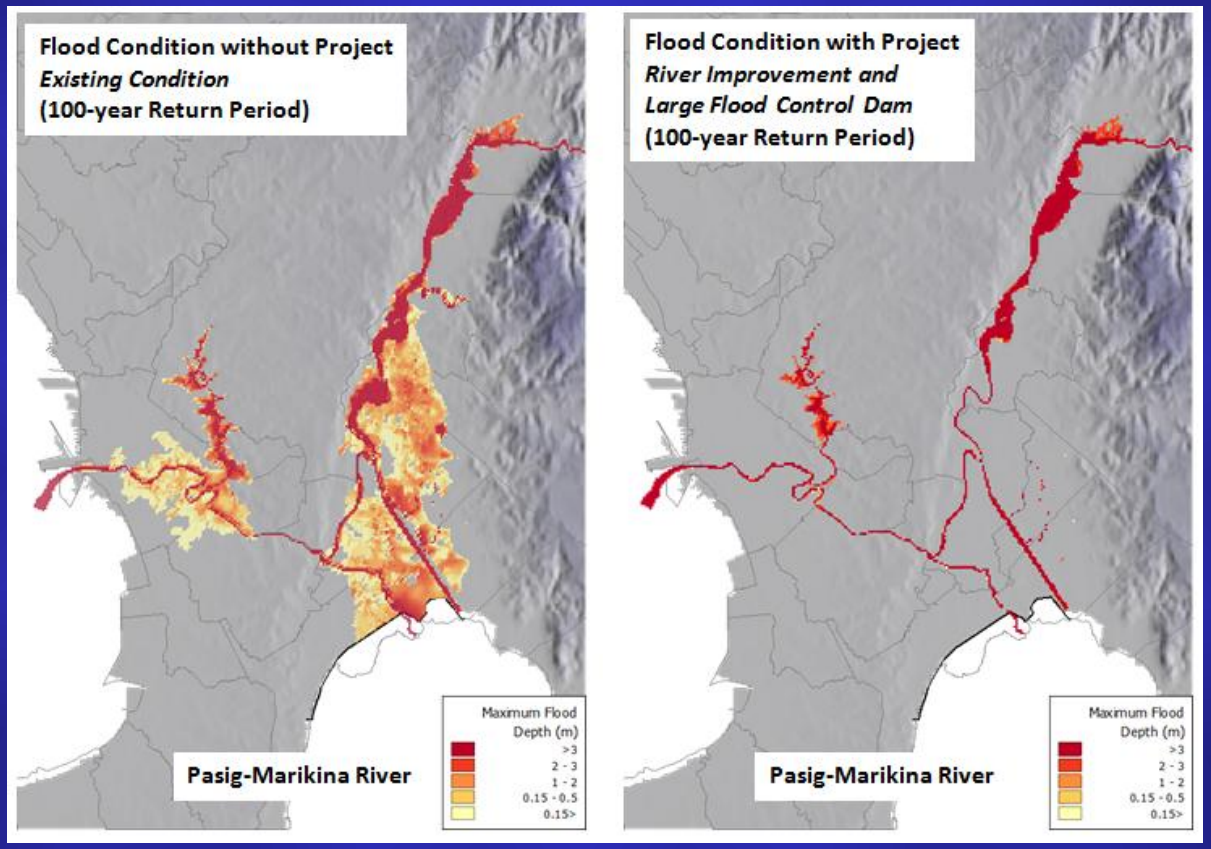
Retarding Basin

Policy and Direction

DPWH Efforts to Mitigate Flooding in Laguna Lake

4. Integrated Flood Hazard Map

Flood Hazard Map – The FMMP for Metro Manila has developed a flood inundation map, pre-and-post Typhoon Ondoy. that shows flood prone areas without the project – and with river improvement and flood control dam.



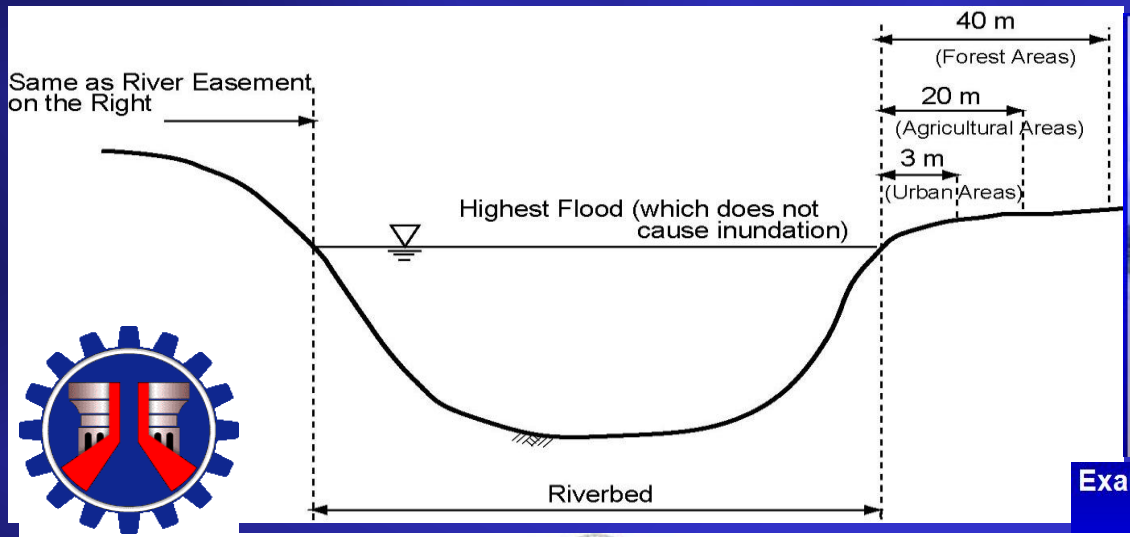
Policy and Direction

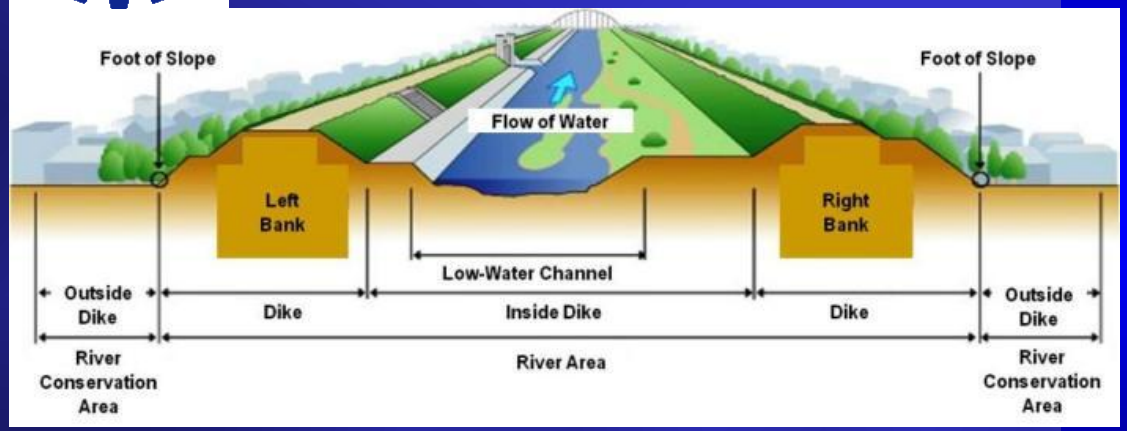
DPWH Efforts to Mitigate Flooding in Laguna Lake

5. Enforcement of PD 1067 (Water Code of the Philippines)

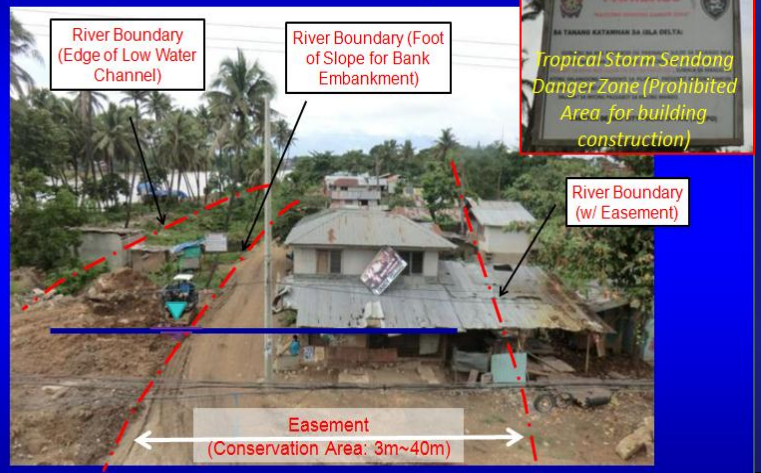
Article No. 51 - Designation of River Easements

Article No. 53 - Declaration of Flood Control Areas (No Build Zones)





Example of Options of River Boundary



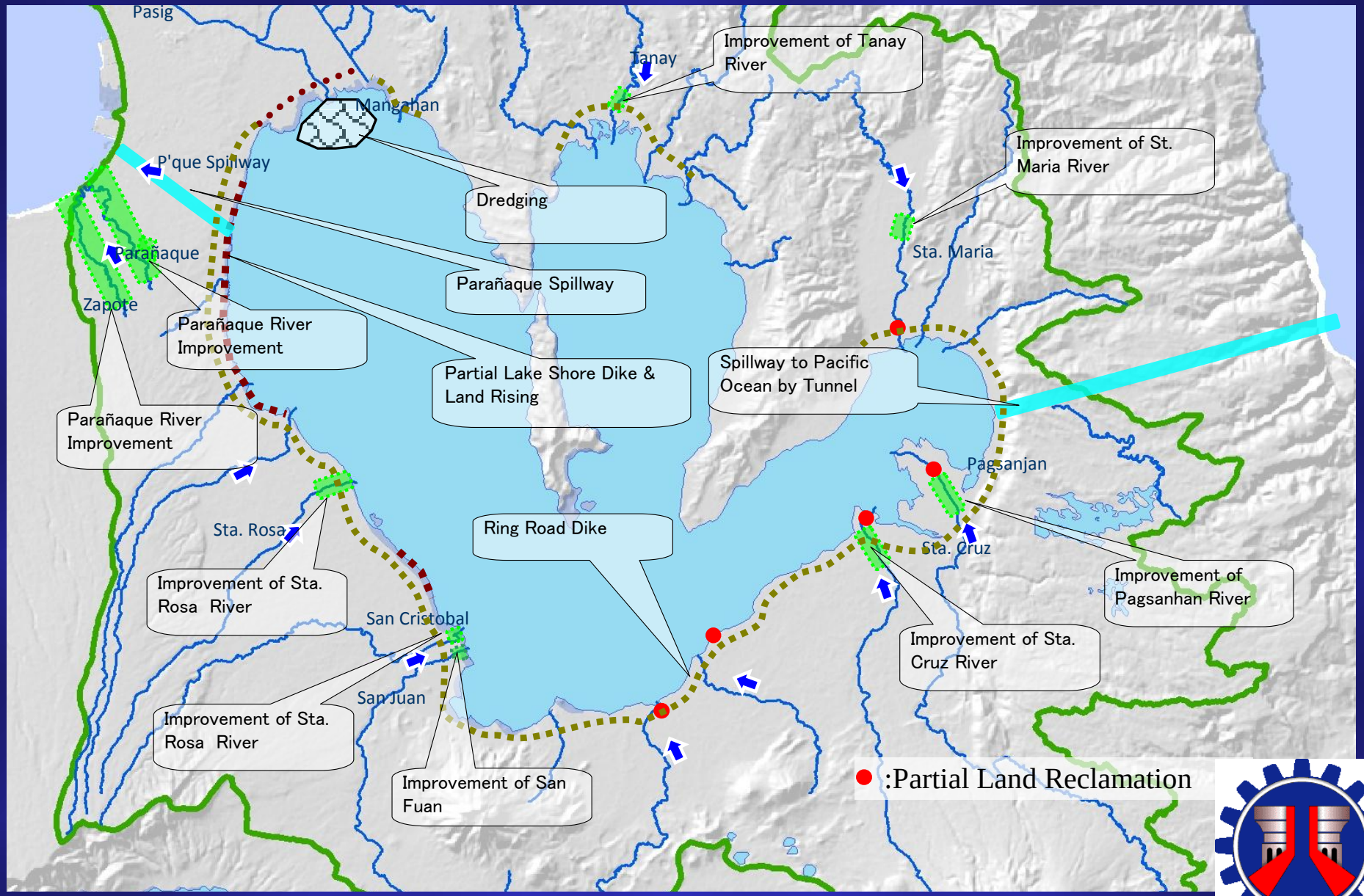
Policy and Direction

DPWH Efforts to Mitigate Flooding in Laguna Lake

6. Improving Watershed / River Basin Management

- Rehabilitation of watersheds / Reforestation
- Practice of appropriate land cultivation technologies to prevent degradation, erosion and siltation of water bodies
- Land use plan and zoning should consider the hazard prone areas

Laguna Lakeshore: Long Flood Control Projects



Laguna Lakeshore: Long Flood Control Projects

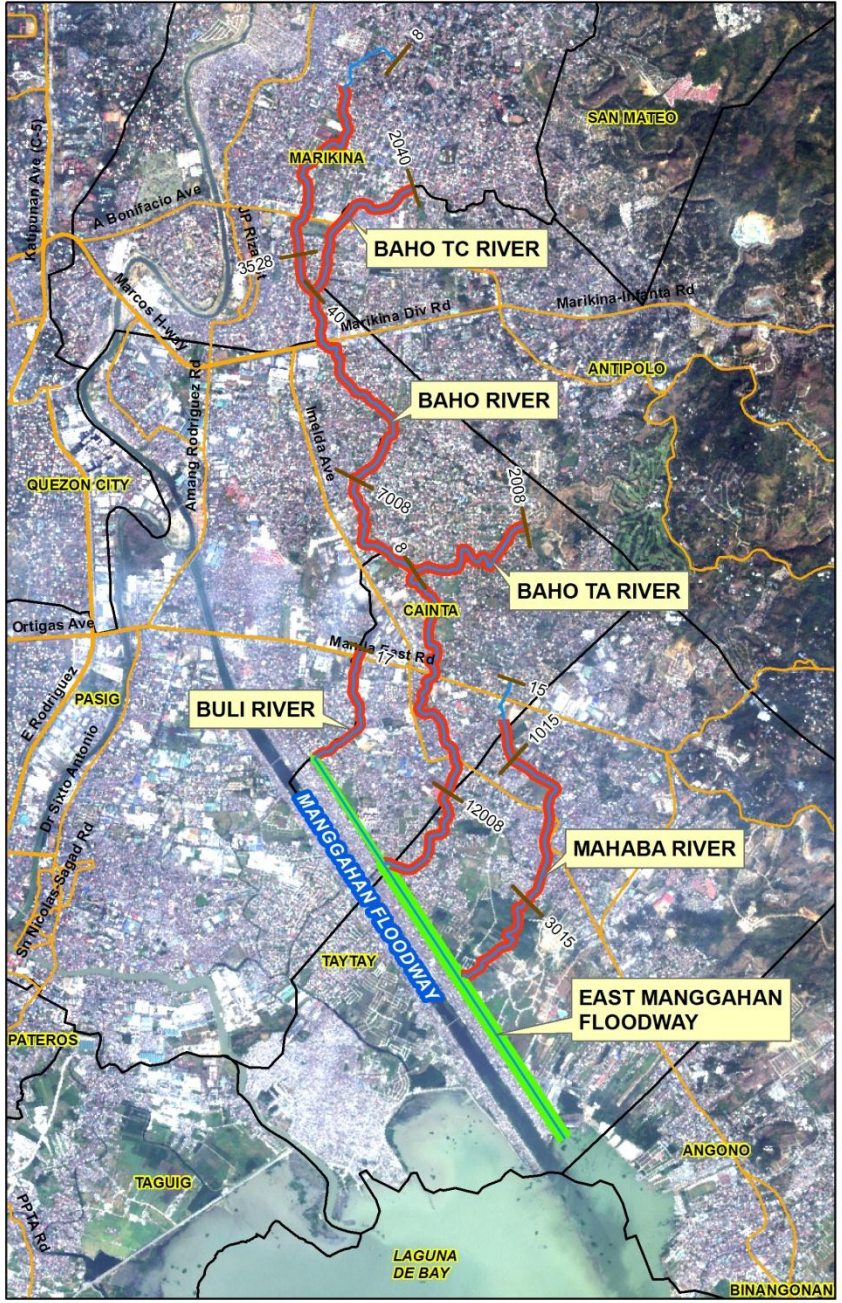
Short-listed Structural Mitigation Measures (1/3)

No.	Item	Flood Risk Level	Target Flood Safety (R.P.)	Total Cost (Mil. Pesos)	EIRR	Resettlement (1000 person)	Beneficiary (1000 person)	Preliminary Environmental Assess.
1 (VH)	Pasig-Marikina River Improvement (RI) + Dam	4	100-y	198,435	16.4%	331	1,593	Moderate due to some negative social impact by dam (possible)
2 (H)	Meycauayan RI	3	50-y	14,040	22.9%	35	199	Positive due to improve. envir. (recommended)
3 (H)	Malabon-Tullahan RI	3	50-y	21,635	22.3%	39	298	Positive due to improve. envir. (recommended)
4 (M)	South Parañaque – Las Piñas RI	3	30-y	17,335	12.2%	30	104	Positive due to improve. envir. (recommended)
5 (H)	East Mangahan Floodway (Cainta & Taytay RIs)	3	30-y	25,901	26.8%	25	227	Positive due to improve. env (recommend

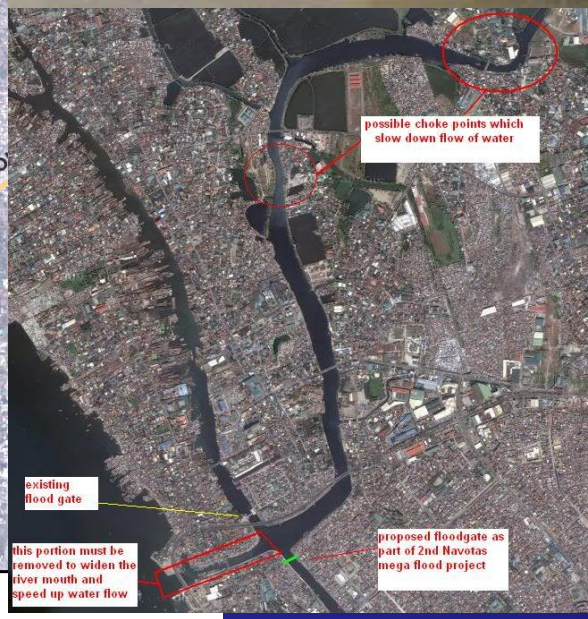
Priority (Tentative) VH: Very High, H: High, M: Marginal

East Mangahan Floodway

Including Improvement of Inflow Rivers



Malabon – Tullahan River Improvement



Meycauayan River Improvement

MARILAO RIVER

SANTA MARIA

SAN JOSE DEL

BOCAUE

Marilao - San Jose Del Monte Road

McArthur Highway

Lias Road

MARILAO

Old Zabarte Road

BULACAN

Paliwas Road

1,400m³/s

2,500m³/s

4,900m³/s with the discharge of Sta. Maria

MEYCAUAYAN

OBANDO

MEYCAUAYAN RIVER

Gen. Luiz

Quirino Ave.

MANILA BAY

LEGEND

MAJOR ROADS

MUN/CITY BDRY.

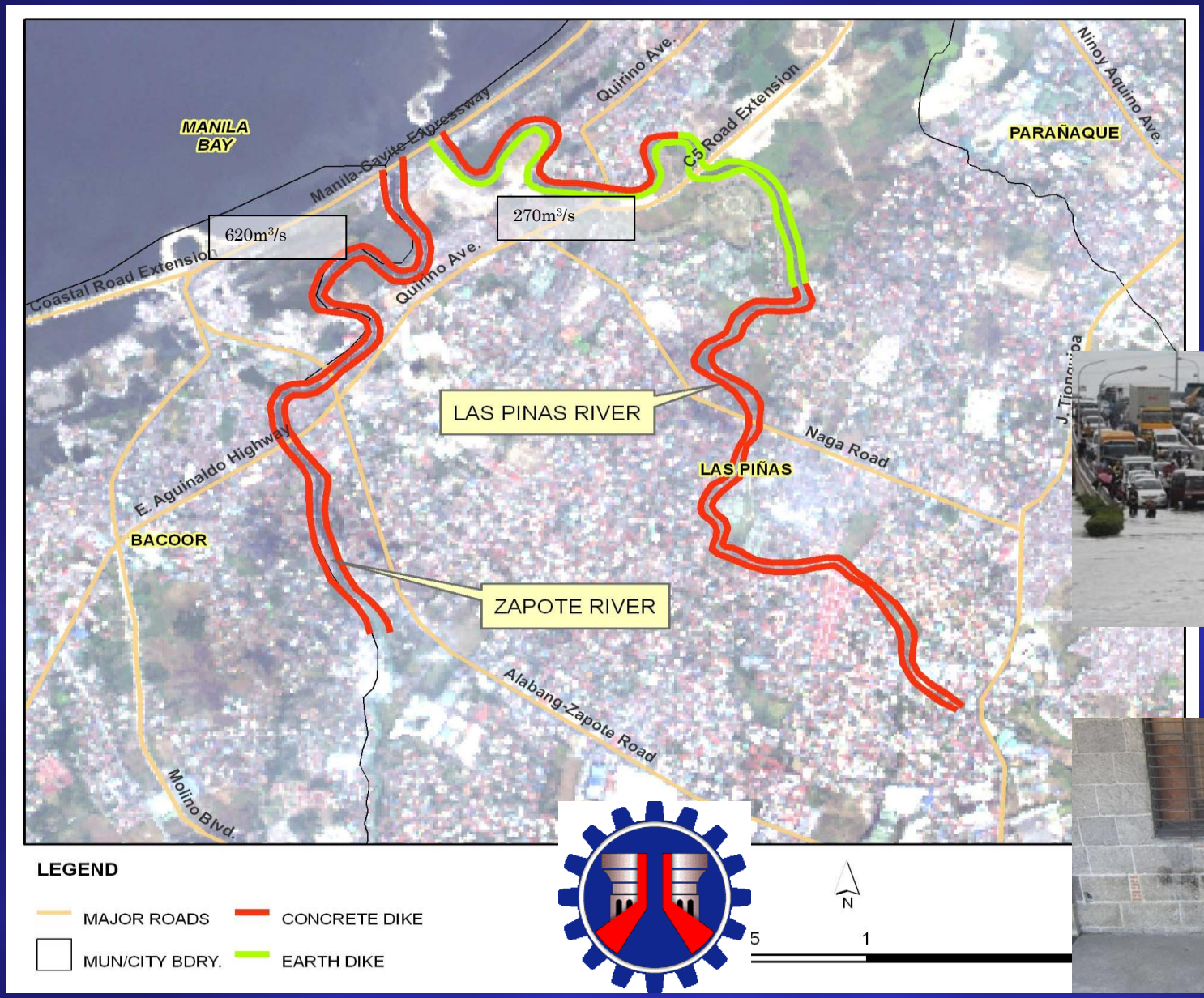
CONCRETE DIKE

EARTH DIKE

N

1 2 4

Las Pinas and Zapote River Improvement



South Paranaque River Improvement

C-6 Extension (Flood Control Dike Expressway)

C-6 Extension (Flood Control Dike Expressway)

PROJECT OBJECTIVE:

- To ease traffic congestion along Muntinlupa and Calamba area. Also serve as flood control measure in Laguna de Bay coastal area.

PROJECT DESCRIPTION:

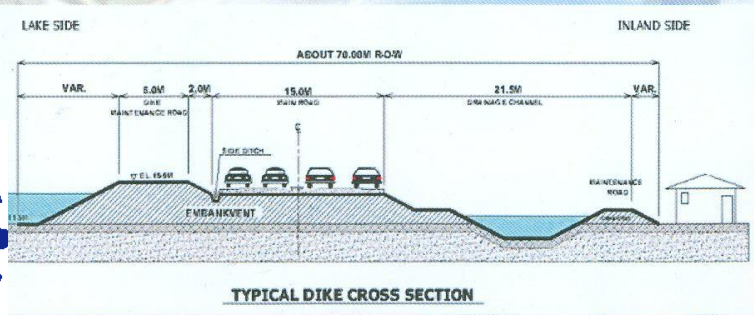
- Construction of a 43.6 km, 4-lane highway from the coastal area of Laguna de Bay from Taguig, Rizal to Los Baños, Calamba.

PROJECT COST:

- Php 18.59 B (US$ 413 M)

PROJECT STATUS:

- Business Case Study on-going from January to June 2012
- Feasibility Study proposed for KOICA Grant



TYPICAL DIKE CROSS SECTION

Laguna Lakeshore: Long Flood Control Projects

Short-listed Structural Mitigation Measures (2/3)

No.	Item	Flood Risk Level	Target Flood Safety (R.P.)	Total Cost (Mil. Pesos)	EIRR	Resettlement (1000 person)	Beneficiary (1000 person)	Preliminary Environmental Assess.
6 (VH)	West Laguna Lakeshore Land Raising	3	60-y	25,185	17.2%	114	114	Positive due to improvement of environment and potential of development (recommended)
7 (H)	Land Raising for Small Cities around Laguna Lakeshore	3	60-y	7,158	17.2%	8.8	8.8	Positive (same as 6) (recommended and to be studied more)
8 (H)	Improvement of the Inflow Rivers to Laguna Lake	3	30-y	637	N.A.	N.A.	N.A.	Positive due to improve. of environment (recommended and to be studied more)

Priority (Tentative) VH: Very High, H: High, M: Marginal

Laguna Lakeshore Dike

Options for the Lakeshore Area from Taguig to Muntinlupa

Option-1: Image of Lakeshore Dike with Road

Option-2: Image of Raising Lakeshore Land with Road and Future Developments

Optimum solution in solving the flooding situation in the Laguna lakeshore area

Laguna Lakeshore: Long Flood Control Projects

Short-listed Structural Mitigation Measures (3/3)

No.	Item	Flood Risk Level	Target Flood Safety (R.P.)	Total Cost (Mil. Pesos)	EIRR	Resettlement (1000 person)	Beneficiary (1000 person)	Preliminary Environmental Assess.
9 (H)	Manila Core Area Drainage Improvement	2	10-y	27,257	19.1%	24	270	Positive due to improvement of environment (recommended)
10 (M)	West Mangahan Area Drainage Improvement	2	5-y	5,522	11.1%	3.2	25.6	Positive due to improvement of environment (recommended)
11	Valenzuela, Obando and Meycauayan (VOM) Improve.(to be studied further)			8,613 (Est. only)				
	TOTAL			351,718				

(1) Priority (Tentative) VH: Very High, H: High, M: Marginal
(2) Priority is set by considering 1) severity of floods or flood risk level, 2) cost and economic efficiency (EIRR≧15%), and 3) social and natural impacts and preliminary environmental assessment.

Calamba Los Banos Expressway

Calamba – Los Baños Expressway

PROJECT DESCRIPTION:

- Supports tourism development of Los Baños and its nearby tourism spots
- Decongest existing national road leading to Laguna. It will branch off from SLEx at Calamba and passes through Los Baños City and ends at Bay
- Combined structure of a flood control dike along Laguna de Bay and a highway, thus two (2) purposes will be achieved
- 4 lanes, length 15.5 km

IMPLEMENTATION SCHEDULE:

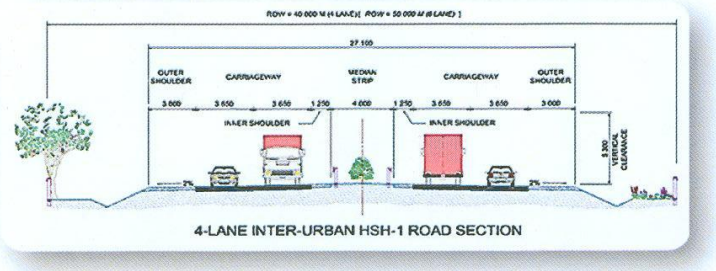
- 2014-2016

PROJECT COST:

- Php 5.90 Billion (US$ 131.11 M)

PROJECT STATUS:

- Business Case Study on-going from January to June 2012

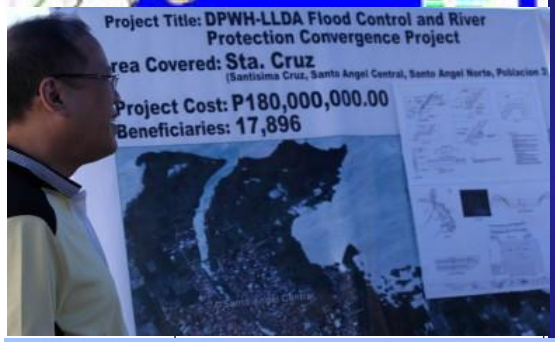


Priority Flood Control Projects for LLDA

P5.0 BILLION PRIORITY FLOOD CONTROL PROJECTS

As of 25 August 2013

	PROJECT NAME/SCOPE OF WORK	a. Implementing b. Contractor c. Project Engineer	Implementation Sched. a. Date Started b. Orig. Completion c. Revised Completion d. Contract Time	Amount a. Allocation (1st-6th Batch) b. Allocation (1st-7th Batch) c. Released d. ABC e. Contract Cost f. Revised Cost	% Phy a. b. c.
	III. REGION IV-A **1. Package II - Sta. Maria-Mabitac River**	a. LLDA b. Tokwing Const. Corp.	a. April 11, 2013 b. April 5, 2013 c. May 21, 2013 d. 406 c.d.	a. 400,000,000.00 b. 400,000,000.00 c. 400,000,000.00 d. e. 373,767,915.33 f.	a. b. c.
	1.10 Construction of River Control Project, Brgy. 1.20 Construction of River Control Project, Brgy. Adia, Sta. Maria, Laguna 1.30 Construction of River Control Project, Brgy. San Antonio to Brgy. Pag-asa, Mabitac, Laguna				
	2. Package I -Sta. Cruz River, San Pedro, Binan	a. LLDA b. JV of ITP Const. Inc./ Tokwing Const. Corp.	a. April 5, 2013 b. c.	a. 380,000,000.00 b. 380,000,000.00 c. 380,000,000.00 d. e. 355,302,279.84	a. b. c.
	2.10 Construction of River Control Project, Poblacion III, Sta. Cruz, Laguna 2.20 Construction of River Control Project, Sto. Angel Norte, Sta. Cruz, Laguna 2.30 Construction of River Control Project, Sto. Angel Central, Sta. Cruz, Laguna 2.40 Construction of River Control Project, Santisima **3. San Pedro River** 3.10 Construction/Improvement of River Control Structures at San Pedro River, San **4. Biñan River** 4.10 Construction/Improvement of River Control Structures at Biñan River, Biñan,				
	TOTAL - REGION IV-A (LLDA)			a. 780,000,000.00 b. 780,000,000.00 c. 780,000,000.00 d. e. 729,070,195.17 f.	



Non-Structural Measures

Proposed Non-Structural Measures

1. Strengthening of the Flood Information and Warning System (FIWS)
   - Effective Flood Control Operation and Warning System (EFCOS) improvement
   - New telemetric rainfall and water level gauging stations
2. Capacity Building for Strengthening Community-based FRM
   - Update and implement Information and Education Campaign (IEC) programs
   - Rainfall and water level monitoring by Barangay Disaster Risk Reduction and Management Councils (BDRRMCs)
   - Construction of evacuation routes and temporary evacuation centers
3. Improvement of Management Information System (MIS) for Disaster Risk Management
   - Improvement and development of MIS
   - Capacity building
4. Reforestation and Watershed Management

Flood Disaster Mitigation








JBIC

OECF

JICA

FLOOD CONTROL PROJECTS

NDRRMC