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)
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)
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).
2. Pursuing Integrated Flood Risk Management (IFRM)

Note:

Estimated population in Flood Risk Level-3 & 4:
- 773,940 (NCR)
- 294,000 (Laguna Lake)
3. Water Convergence Projects

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.
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

- River Channel Improvement with RAM (C)
- Spillway or Floodway
- Existing River Channel Condition
- Land Reclamation with FPM
- Dike or Land Reclamation with FPM
- Dredging
- Control Gate
- Diversion Tunnel
- Diversion Channel
- Water Pipe Line
- River Flow
- Existing Road
- Ring Road Dike
- Floodway (Marikina R. to Laguna)
- Underground Water Storage

Improvement of Drainage System

Marilao
Malabon
Meycauayan
Tullahan
San Juan
Pasig
Marikina
Mangahan
Mahaba
Cainta
Tanay
Sta. Maria
Parañaque
P'que Spillway
Sta. Rosa
Sta. Cruz
Pagsanjan
San Cristobal
San Juan

: Partial Land Reclamation

Parañaque Spillway
Partial Lake Shore Dike & Land Rising
Spillway to Pacific Ocean by Tunnel

Improvement of Tanay River
Improvement of St. Maria River
Improvement of Sta. Cruz River
Improvement of Sta. Rosa River
Improvement of Sta. Cruz River
Improvement of Sta. Rosa River
Improvement of San Fuan

: Partial Land Reclamation
## Laguna Lakeshore: Long Flood Control Projects

### Short-listed Structural Mitigation Measures (1/3)

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

Priority (Tentative) VH: Very High, H: High, M: Marginal
East Mangahan Floodway
Including Improvement of Inflow Rivers
Malabon – Tullahan River Improvement

Legend:
- Major Roads
- Concrete Dike
- MUN/CITY BDY.
- Earth Dike

MAP:
- Malabon – Tullahan River Improvement area
- 500 m³/s flow rate
- Possible check points to slow down flow of water
- Building flood gate
- Proposed floodgate as part of 2nd Marikina mega flood project

1,000 m³/s

MALABON – TULLAHAN RIVER IMPROVEMENT PROGRAMME

The Malabon – Tullahan River Improvement Programme aims to enhance the river's capacity to prevent flooding. The programme includes the construction of concrete dikes and the building of flood gates to regulate water flow and protect nearby areas. The area is marked with key points such as check points for water flow control and proposed locations for floodgates, illustrating the comprehensive approach to flood management in the region.
Meycauayan River Improvement

4,900 m$^3$/s with the discharge of Sta. Maria

1,400 m$^3$/s

2,500 m$^3$/s

LEGEND

- MAJOR ROADS
- CONCRETE DIKE
- MUN/CITY BDY.
- EARTH DIKE

Map showing the river and surrounding areas with discharge rates and markers for major roads.
Las Pinas and Zapote River Improvement

Map showing the Las Pinas and Zapote Rivers, with flow rates of 620 m³/s and 270 m³/s. The map also indicates major roads and the locations of Las Pinas and Bacoor. The image includes a photo of a person standing in a flooded area.
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
## Laguna Lakeshore: Long Flood Control Projects

### Short-listed Structural Mitigation Measures (2/3)

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

Priority (Tentative) VH: Very High, H: High, M: Marginal
Optimum solution in solving the flooding situation in the Laguna lakeshore area

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
### Short-listed Structural Mitigation Measures (3/3)

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

(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

**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**

<table>
<thead>
<tr>
<th>PROJECT NAME/SCOPE OF WORK</th>
<th>Implementing Contractor</th>
<th>Implementation Sched.</th>
<th>Amount Allocation (1st-6th Batch)</th>
<th>% Phy.</th>
<th>Revised Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>III. REGION IV-A</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Package II - Sta. Maria-Mabatoc River</td>
<td>LLDA</td>
<td>a. April 11, 2013</td>
<td>a. 400,000,000.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.10 Construction of River Control Project, Brgy.</td>
<td>Tokwing Const. Corp.</td>
<td>b. April 5, 2013</td>
<td>b. 400,000,000.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.20 Construction of River Control Project, Brgy. Adia, Sta. Maria, Laguna</td>
<td>c. May 21, 2013</td>
<td>c. 400,000,000.00</td>
<td>c. 373,757,915.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.30 Construction of River Control Project, Brgy. San Antonio to Brgy. Pag-as, Mabatoc, Laguna</td>
<td>d. 400,000,000.00</td>
<td>d. 373,757,915.33</td>
<td>d. 373,757,915.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Package I - Sta. Cruz River, San Pedro, Binal</td>
<td>LLDA</td>
<td>a. April 5, 2013</td>
<td>a. 380,000,000.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.10 Construction of River Control Project, Poblacion</td>
<td>JV of ITP Const. Inc. / Tokwing Const. Corp.</td>
<td>b. 380,000,000.00</td>
<td>b. 380,000,000.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.20 Construction of River Control Project, Sto. Angel Norte, Sta. Cruz, Laguna</td>
<td>c. 380,000,000.00</td>
<td>c. 380,000,000.00</td>
<td>c. 380,000,000.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.30 Construction of River Control Project, Sto. Angel Central, Sta. Cruz, Laguna</td>
<td>d. 380,000,000.00</td>
<td>d. 380,000,000.00</td>
<td>d. 380,000,000.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.40 Construction of River Control Project, Santisima</td>
<td>e. 355,302,279.84</td>
<td>e. 355,302,279.84</td>
<td>e. 355,302,279.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. San Pedro River</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.10 Construction/Improvement of River Control Structures at San Pedro River, San</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Binal River</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.10 Construction/Improvement of River Control Structures at Binal River, Binal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TOTAL - REGION IV-A (LLDA)**

| a. 780,000,000.00 | b. 780,000,000.00 | c. 780,000,000.00 | d. 729,070,915.17 | e. 729,070,915.17 |
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

[Diagram showing various flood control projects and partnerships]