# 添付資料　1

## 添付資料 1-2　2nd Steering Committee

# Data Collection Survey on Paranaque Spillway in Metro Manila

## 2nd Steering Committee Meeting

November 03, 2017

**Japan International Cooperation Agency**

**CTI Engineering International Co., Ltd. (CTII)**
**Nippon Koei Co., Ltd. (NK)**
**CTI Engineering Co., Ltd. (CTIE)**



## ■ Topic

1. Activities (Commencement to Present)
2. Findings
3. Concepts for the Comprehensive Flood Management Plan
4. Project Implementation Schedule

# 1. Activities (Commencement to Present)

- July 31: Started the Survey in the Philippines
- August 10-11: Site Investigation (around the Laguna de Bay)
- August 17: First Steering Committee

Work Plan

| Work Items \ Period | 2017 | | | | | | 2018 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 |
| [A] Domestic Preparation Works and Consultation of IC/R with JICA | | | | | | | | | | | | |
| [B] Comprehensive Flood Management Plan of Laguna de Bay Lakeshore Area | | | | | | | | | | | | |
| [C] Pre-Feasibility Study of Paranaque Spillway | | | | | | | | | | | | |
| Report | | △ IC/R | | | | △ IT/R | | | | △ DF/R | | △ F/R |

Source: JICA Survey Team



# 1. Activities (Commencement to Present)

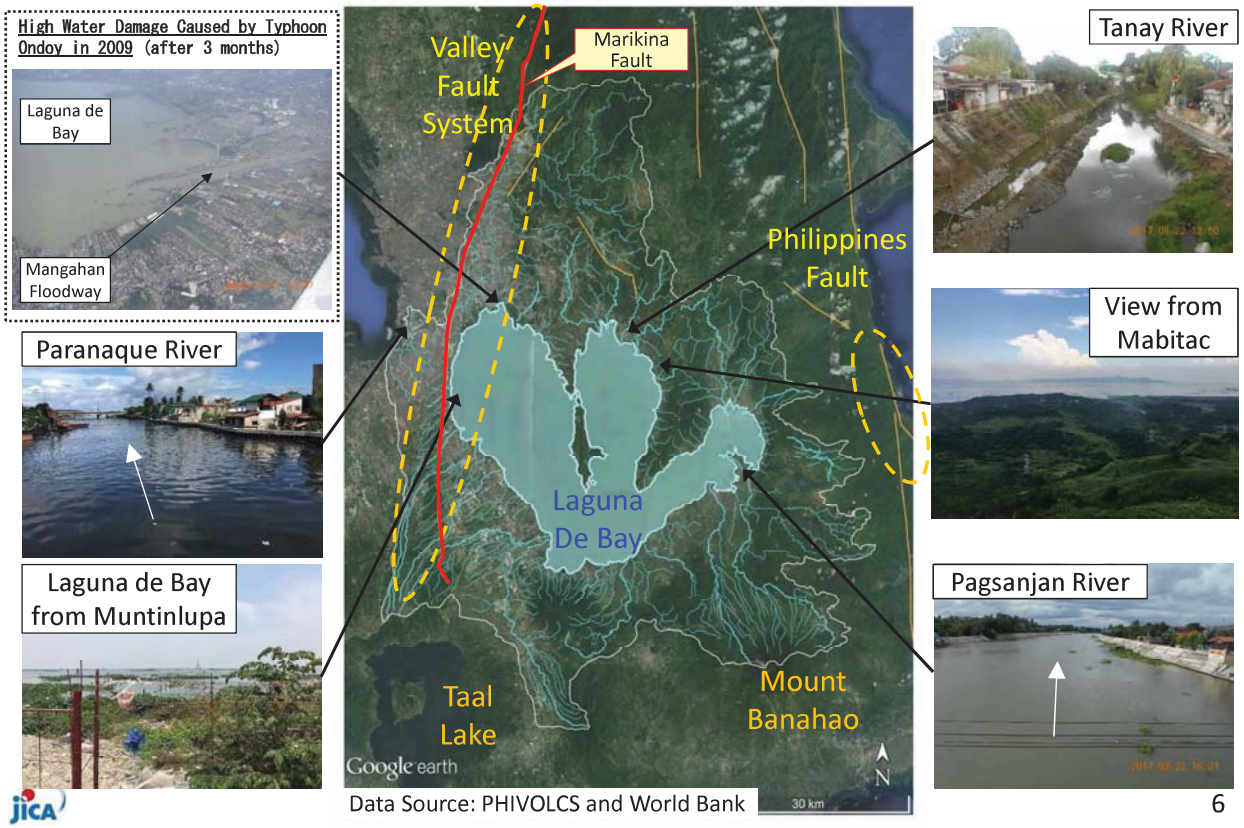
- On-going Activities:
  - ✓ Site Investigation by the each expert (as needed)
  - ✓ Data Collection from related organizations (DPWH, LLDA, MMDA, LGU, etc.)
  - ✓ Crystalizing the concepts and conditions for Comprehensive Flood Management Plan
  - ✓ Hydrological and Hydraulic Analysis

# 2. Findings

a. Topographical Characteristics
b. Administrative Jurisdiction and Land use
c. Major Flood Control Projects around Laguna de Bay
d. Development Plan at and around Laguna de Bay
e. Hydrological Basic Data Collection
f. DPWH Flood Control Criteria
g. Geological Characteristics
h. Concerns for Paranaque Spillway Outlet

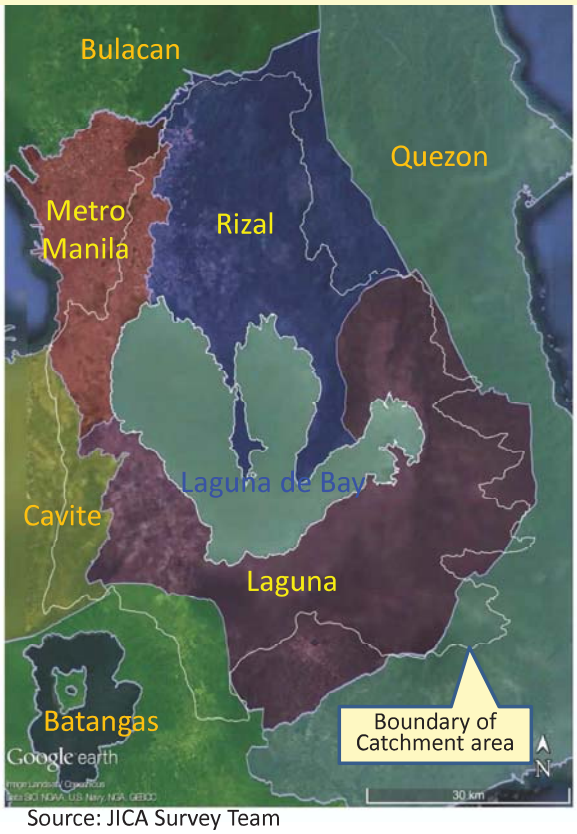


# 2. Findings, a. Topographical Characteristics




Data Source: PHIVOLCS and World Bank

# 2. Findings, b. Administrative Jurisdiction and Land use

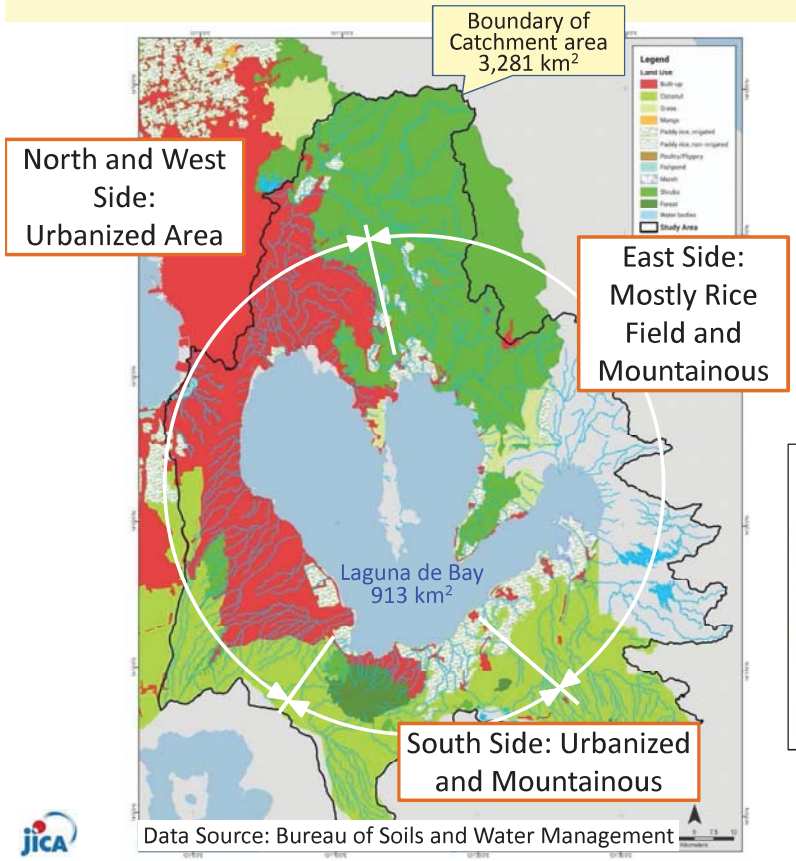



Source: JICA Survey Team

- Major part of the survey area is under Metro Manila, Rizal Province, Laguna and Cavite Province.
- LLDA manages the lakeshore area, below EL. 12.5m （Republic Act No. 4850, Presidential Decree No. 813)



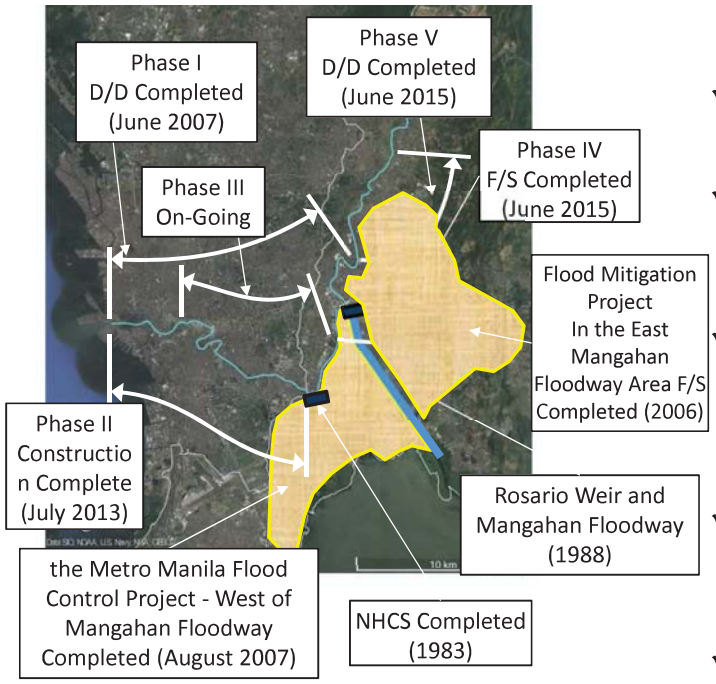
# 2. Findings, b. Administrative Jurisdiction and Land use




Data Source: Bureau of Soils and Water Management

- Residences can be seen at EL. 12.0m and above, and more varieties of facilities can be seen at EL.12.5m and above.

# 2. Findings, c. Major Flood Control Projects around Laguna de Bay




- Major flood control projects are as follows:

✓ Pasig-Marikina River Channel Improvement (Phase I to Phase V)

✓ Construction of the Metro Manila Flood Control Project - West of Mangahan Floodway

✓ Construction of Mangahan Floodway, Construction of Rosario Weir and Napindan Hydraulic Control Structure (NHCS)

✓ Flood Mitigation Project
In the East Mangahan Floodway Area (F/S)

✓ Effective Flood Control Operation System (EFCOS)

Source: JICA Survey Team



# 2. Findings, d. Development Plan at and around Laguna de Bay


Laguna Lakeshore Expressway Dike Project (LLEDP, as PPP)

Component 1. Expressway-Dike: 47 km

Component 2. Reclamation: 700 ha

Source: LLEDP, a public-private partnership project (PPP), presentation to UK Transport Solutions

# 2. Findings, e. Hydrological Basic Data Collection

## 1) Rainfall

6 organizations which are shown in below, are monitoring ground rainfall data in around study area.

1. PAGASA (Philippine Atmospheric, Geophysical and Astronomical Services Administration)
2. EFCOS,MMDA (Effective Flood Control Operating System)
3. PRBFFWC (Pampanga River Basin Flood Forecasting and Waring Center, PAGASA)
4. NPC (National Power Corporation)
5. MWSS (Metropolitan Waterworks and Sewerage System)
6. DOST-ASTI (Advanced Science and Technology Institute)

Table 2.e.1 Outline of Rainfall Observed Data

| NO. | Organization | Department | No of Stations | Daily | Hourly | Remarks |
|---|---|---|---|---|---|---|
| 1 | PAGASA | DOST | 24 | ● | ▲ | ▲ : 3-hour rainfall data is available during typhoon or flood period |
| 2 | EFCOS | MMDA | 7 | | ● | monitoring start from 2003 |
| 3 | PRBFFWC | DOST | 3 | | ● | |
| 4 | NPC | - | 2 | ● | | |
| 5 | MWSS | DPWH | 2 | ● | | |
| 6 | ASTI | DOST | 15 | | ● | |

Source: JICA Survey Team

● : Available ▲ : 3-hour rainfall data is available

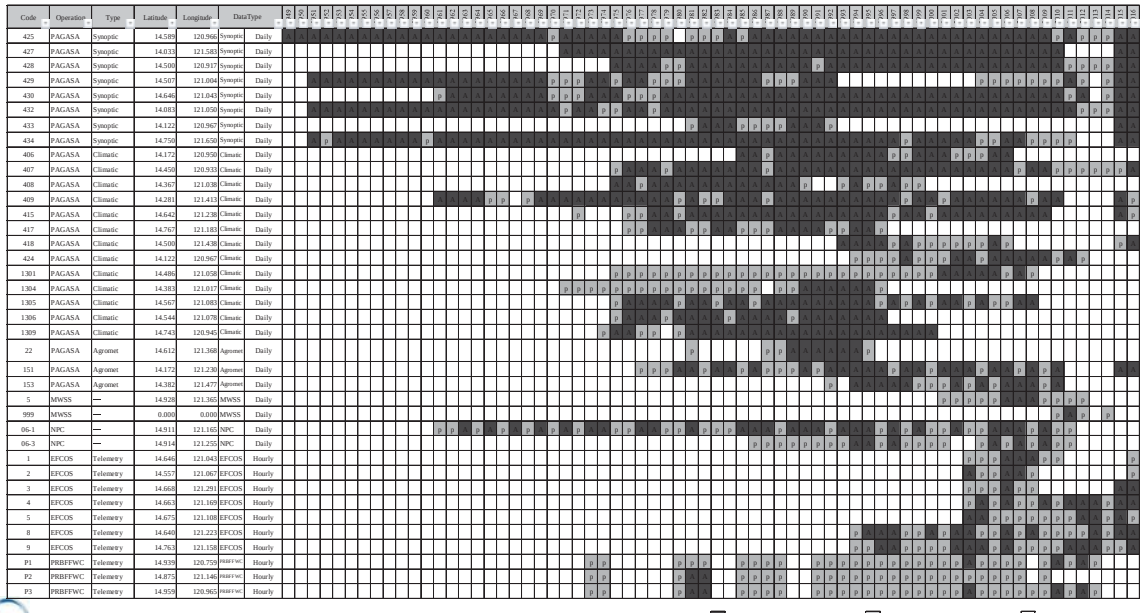


# 2. Findings, e. Hydrological Basic Data Collection

## 1) Rainfall

38 rainfall gauging stations in this study area are shown in Table 2.e.2 and location of stations is shown in figure 2.e.1.

Table 2.e.2 Inventory of Rainfall




Source: JICA Survey Team

# 2. Findings, e. Hydrological Basic Data Collection

## 2) Water Level

The water level gauging stations in this study area are shown in Table 2.e.3, 2.e.4 and location of stations is shown in figure 2.e.2.

10 river water level gauging stations

Table 2.e.3 Inventory of Pasig-Marikina River Water Level Observed Data

| Name | River | Code | Operation | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rosario JS | Marikina | 001a | EFCOS | | | | | | | | | | | | | | | P | P | P | | | | | | |
| Rosario LS | Marikina | 001b | EFCOS | | | | | | | | | | | P | P | P | P | | | | P | | | | | |
| Napindan JS | Pasig | 002a | EFCOS | | | | | | | P | | | | | P | | | | | | | P | P | | | |
| Napindan LS | Pasig | 002b | EFCOS | | | P | P | | | | | | | | P | P | P | | | | | P | P | | | |
| Nangka | Marikina | 005 | EFCOS | | | | | | | | | | | | | | | | P | P | | | | | | |
| San Juan | San Juan | 007 | EFCOS | | | | | | | | | | | | P | | | P | P | P | | | | | | |
| Montalban | Marikina | 013 | EFCOS | | P | P | P | | | | | P | | | P | | | P | P | P | | | | | | |
| Sto. Nino | Marikina | 014 | EFCOS | | | | | | | | | | P | | P | | | | P | P | | | | | | P |
| Pandacan | Pasig | 015 | EFCOS | | | | | | | | | | | | P | | | P | P | P | | | | | | |
| Fort Santiago | Pasig | 016 | EFCOS | | | | P | | | | P | | | | P | | | P | P | P | | | | | | |

Source: JICA Survey Team

: Completely available : Partly available : Not available

4 Laguna de Bay water level gauging stations

Table 2.e.4 Inventory of Laguna de Bay Water Level Observed Data

| Name | Code | Operation | 1946 | 1947 | 1948 | 1949 | 1950 | 1951 | 1952 | 1953 | 1954 | 1955 | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Los Banos | 114 | BRS | P | | | | | | | | | | | | | | | | | | | | | | | | P | | | | | | | | | | | |
| Looc | 201 | LLDA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Angono | 017 | EFCOS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Caliraya | 301 | NPC | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Name | Code | Operation | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Los Banos | 114 | BRS | | | | | | | | | | | | | | | | | | | | | | | | | | P | P | P | P | P | P | P | P | P | |
| Looc | 201 | LLDA | P | | | | | | | | P | | P | | | P | P | P | | | | | | | | | | P | P | P | | | | | | | | |
| Angono | 017 | EFCOS | | | | | | | | | | | | | P | P | | | | | | | | | P | P | P | | P | P | P | | | | P | P | |
| Caliraya | 301 | NPC | | | | | | | | | | | | | | | | | | | | P | | | P | | | | | | | | | | | | |

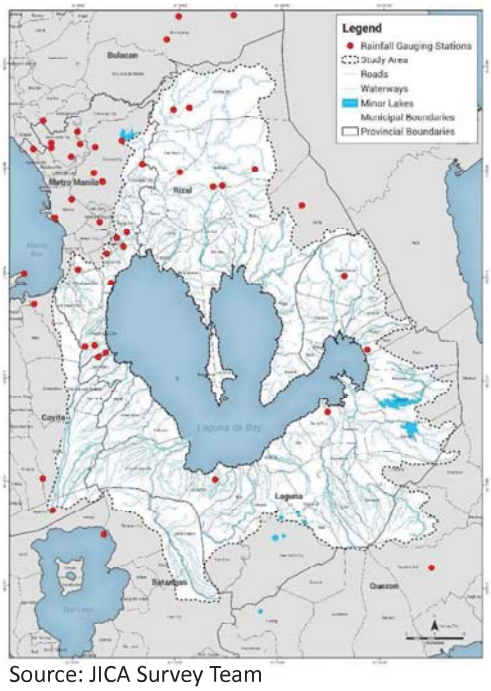
Source: JICA Survey Team

: Completely available : Partly available : Not available



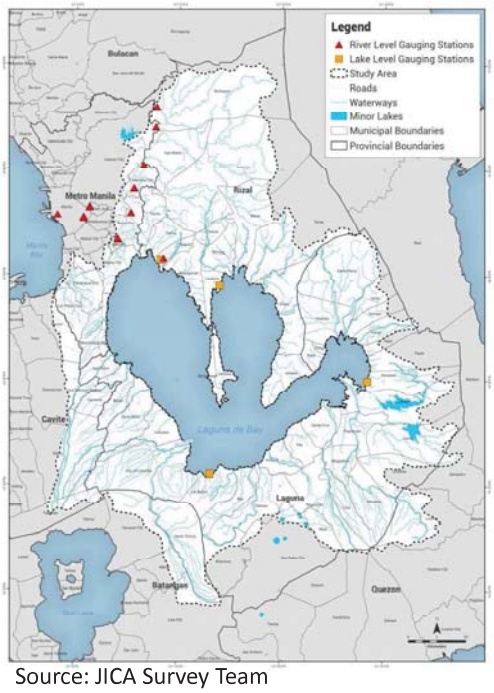
# 2. Findings, e. Hydrological Basic Data Collection

Location of Rainfall and Water level Gauging Stations




Source: JICA Survey Team

Figure2.e.1 Location of Rainfall Gauging Stations

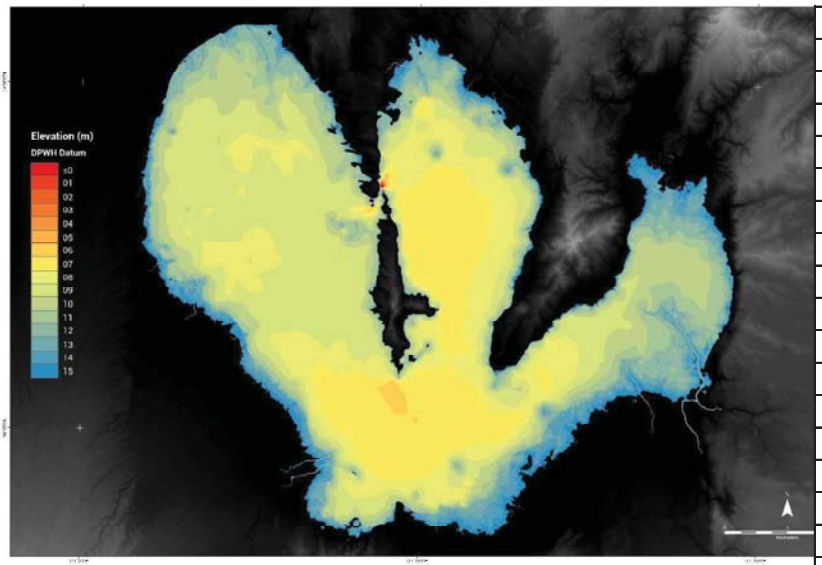



Source: JICA Survey Team

Figure 2.e.2 Location of Water level Gauging Stations

# 2. Findings, e. Hydrological Basic Data Collection

3) Bathymetric Condition of Laguna de Bay




Data Source: Laguna De Bay Depth in Meters published by NAMRIA
2nd Edition, 1st March, 2016

Figure 2.e.3 Bathymetric Condition of Laguna de Bay
2017 latest Version

| H (m) | A (sqkm) | V (mcm) |
|---|---|---|
| 6.00 | 0.37 | 0.90 |
| 6.50 | 4.86 | 2.21 |
| 7.00 | 66.06 | 19.94 |
| 7.50 | 167.18 | 78.25 |
| 8.00 | 240.24 | 180.11 |
| 8.50 | 331.20 | 322.97 |
| 9.00 | 493.95 | 529.26 |
| 9.50 | 609.75 | 805.18 |
| 10.00 | 670.89 | 1,125.34 |
| 10.50 | 740.44 | 1,478.17 |
| 11.00 | 789.43 | 1,860.64 |
| 11.50 | 842.47 | 2,268.62 |
| 12.00 | 892.24 | 2,702.29 |
| 12.50 | 913.00 | 3,153.60 |
| 13.00 | 936.87 | 3,616.07 |
| 13.50 | 961.87 | 4,090.75 |
| 14.00 | 987.87 | 4,578.19 |
| 14.50 | 1,013.14 | 5,078.44 |
| 15.00 | 1,035.26 | 5,590.54 |

Source: JICA Survey Team



# 2. Findings, f. DPWH Flood Control Criteria

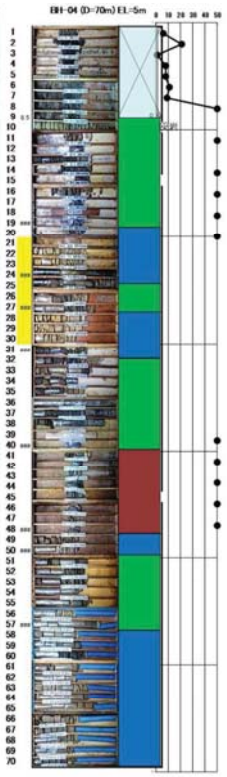
**The design flood of rivers and the minimum capacity of drainages**

| Type | | Target Level | 2011 Memorandum | 2015 DGCS[1)] |
|---|---|---|---|---|
| River | Principal and Major Rivers (40 km$^2$ drainage area and above) | D.F.L.[2)] | 50-year | 100-year |
| | | D.F.L. + Freeboard | 100-year | - |
| | For Smaller Rivers (below 40 km$^2$ drainage area) | D.F.L. | 25-year | 50-year |
| | | D.F.L. + Freeboard | 50-year | - |
| Drainage | Drainage Pipes[3)], Esteros/creels, Pipe Culverts | D.F.L. | 15-year | 15-year |
| | | D.F.L. + Freeboard | 25-year | 25-year |
| | Box Culverts | D.F.L. | 25-year | 25-year |
| | | D.F.L. + Freeboard | 50-year | 50-year |
| | Drainage Channels | D.F.L. | - | 15-year |
| | | D.F.L. + Freeboard | To be adopted | 25-year |

1) Design Guidelines, Criteria and Standards, 2015 Vol. 3, 2) D.F.L.: Design Flood Level,
3) Minimum size of drainage pipes shall be 910 millimeters in diameter.

- In the absence of a risk assessment or master plan, above table provides design floods that can be adopted for different river sizes and drainages (referring to 2015 DGCS).

# 2. Findings, g. Geological Characteristics

Source: JICA Survey Team

Figure 2.g.1 Location of Geotechnical Investigation (6 Drillings, On-going under JICA Survey Team)

Source: JICA Survey Team



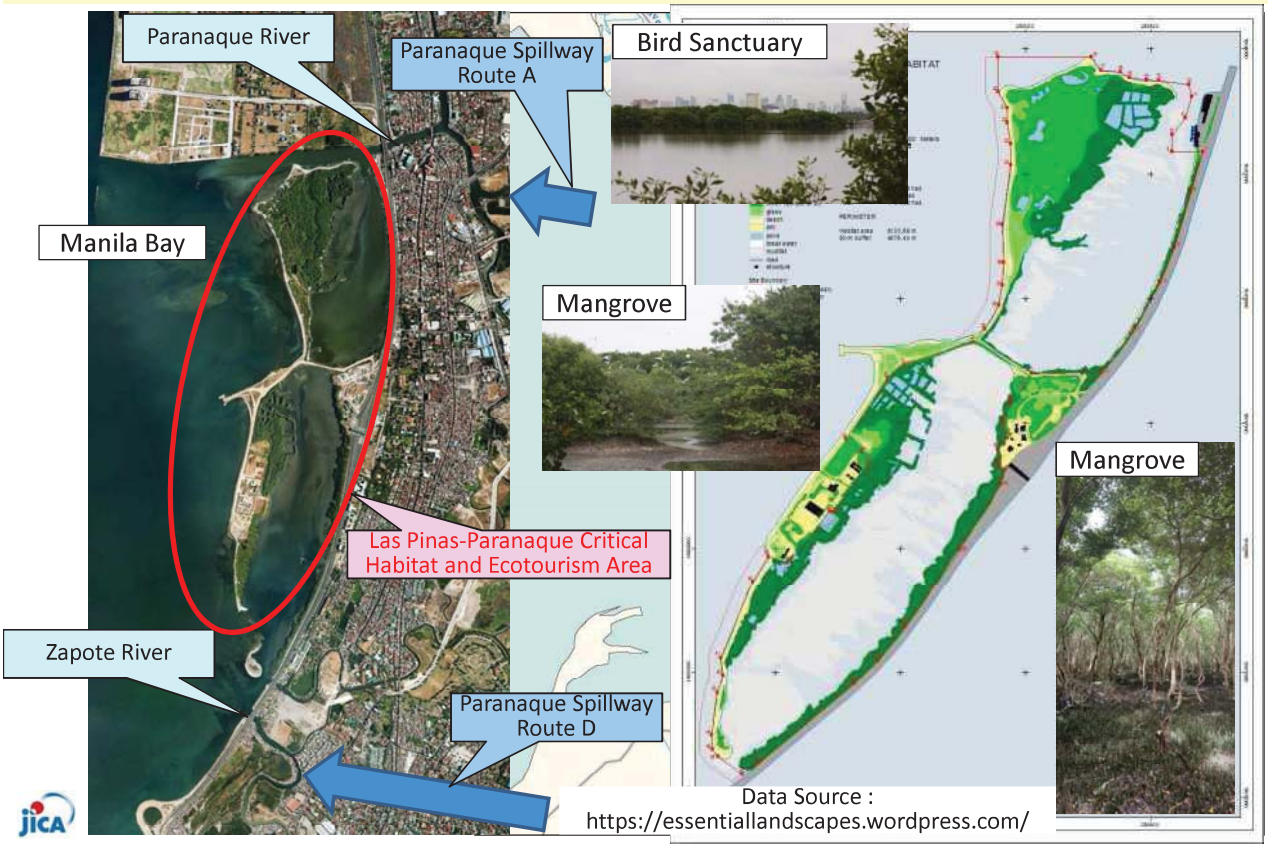
# 2. Findings, g. Geological Characteristics

Source: JICA Survey Team

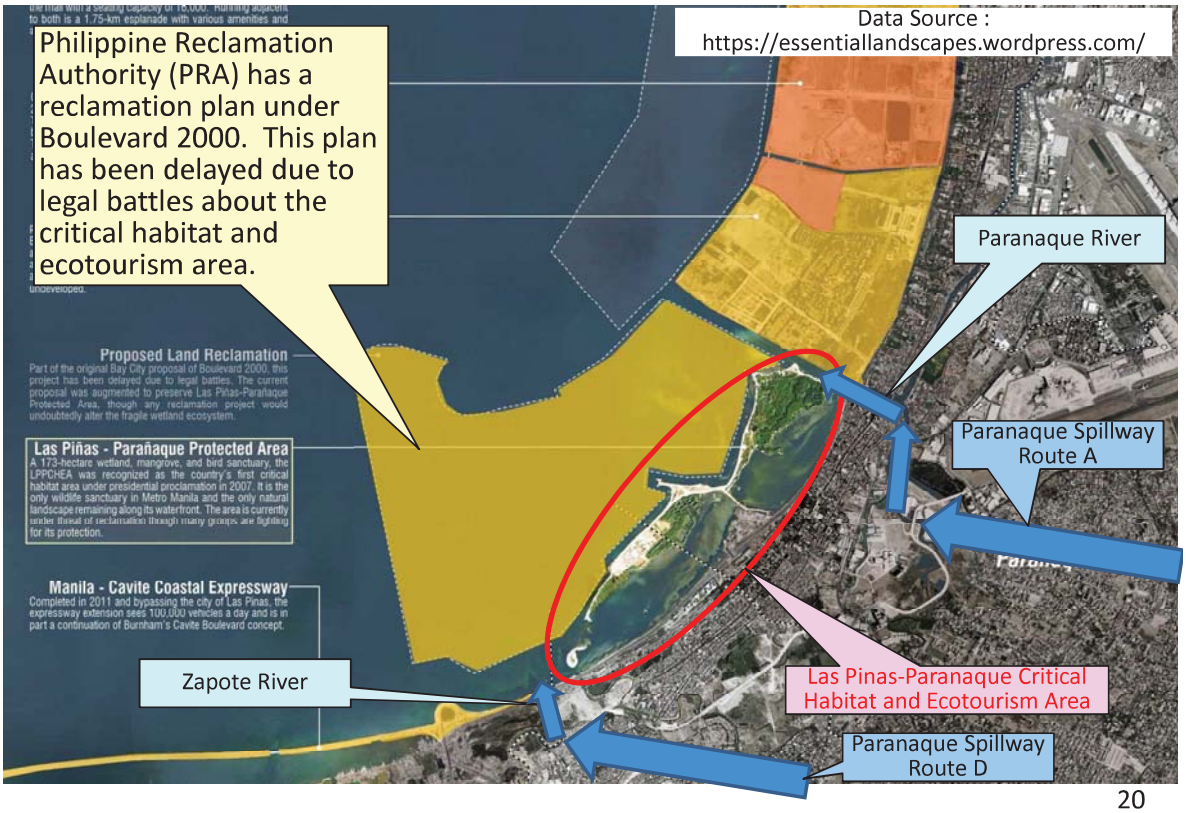
- Most of the areas where alignments of Paranaque Spillway are proposed, the tuff rock or Lapilli tuff (both, soft rock) can be seen at several meters to 10 meters from the ground and below.

(Exposed rock surface can be seen at the street at Lower Bicutan close to DPWH, Regional Equipment Services. )

# 2. Findings, h. Concerns for Paranaque Spillway Outlet




# 2. Findings, h. Concerns for Paranaque Spillway Outlet



# 3. Concepts for the Comprehensive Flood Management Plan

a. Hydrological Statistical Analysis

b. Set of Target Return Period and Target Rainfall

c. Lake Water Level Analysis ,Runoff Inundation Analysis

d. Composition of the flood management at Laguna de Bay

e. Paranaque Spillway

f. Structural Measures

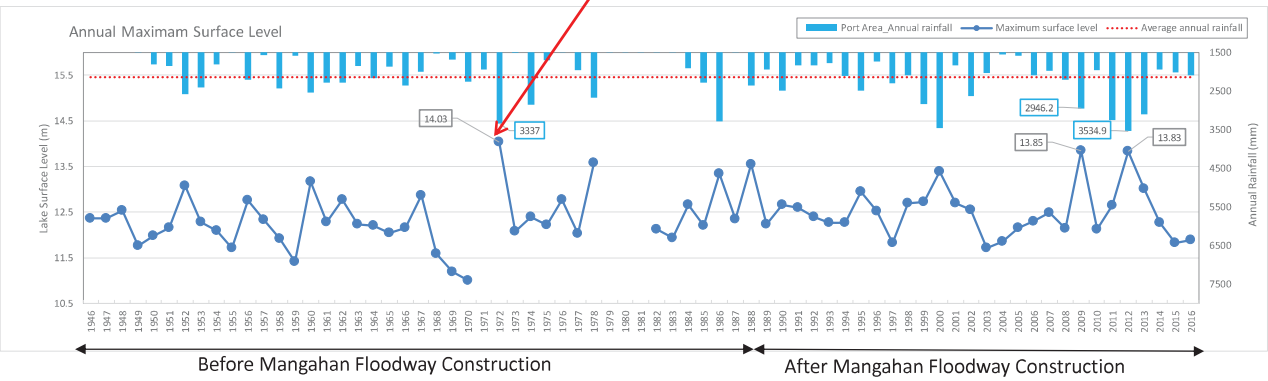
g. Non-structural Measures



# 3. Concepts for the Comprehensive Flood Management Plan
## a. Hydrological Statistical Analysis

1) Lake Water Level Statistical Analysis

The recorded maximum lake water level from 1946 to 2016 is shown in figure 3.a.1.
Maximum lake water level is 14.03m in 1972.




Data Source: LLDA

Figure 3.a.1 Recorded maximum lake water level

# 3. Concepts for the Comprehensive Flood Management Plan
## a. Hydrological Statistical Analysis

### 1) Lake Water Level Statistical Analysis

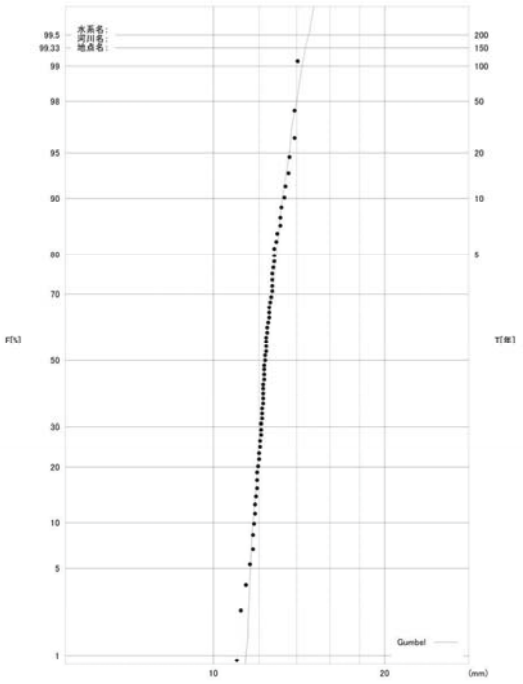
- Probability lake water level was computed using by annual maximum lake water level from 1946 to 2016.
- Lake water level in 100-year return period is at 14.3m.

Table 3.a.1 Probability lake water level

| Return Period (year) | Water Level (m) |
|---|---|
| 2 | 12.3 |
| 3 | 12.6 |
| 5 | 12.9 |
| 10 | 13.2 |
| 20 | 13.6 |
| 30 | 13.7 |
| 50 | 14.0 |
| 80 | 14.2 |
| 100 | 14.3 |

SLSC[1)]: 0.034
Probability analysis Model: Gumbel

1) SLSC: Standard Least Squares Criterion
Source: JICA Survey Team




Source: JICA Survey Team

Figure 3.a.2 Result of Probability lake water level



# 3. Concepts for the Comprehensive Flood Management Plan
## a. Hydrological Statistical Analysis

### 2) Rainfall Analysis in Lakeshore Area

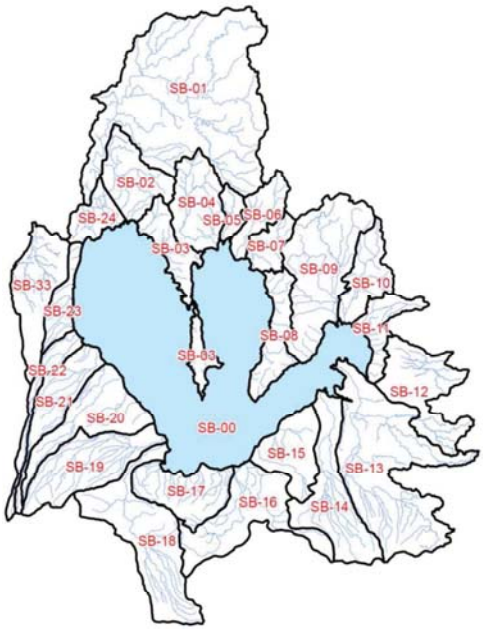
- Probability Basin Mean Rainfall in lakeshore area is shown in below table.
- Set one (1) day for Design rainfall duration.

Table 3.a.3 Probability Basin Mean Rainfall in Lakeshore Area (mm/day)

| Sub-Basin ID | SB03 | SB04 | SB05 | SB06 | SB07 | SB08 | SB09 | SB10 | SB11 | SB12 | SB13 | SB14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Name | Angono | Morong | Baras | Tanay | Pililla | Jala-jala | Sta. Maria | Siniloan | Pangil | Caliraya | Pagsanjan | Sta. Cruz |
| Area(km$^2$) | 86.6 | 95.9 | 21.7 | 52.2 | 40.4 | 70.6 | 202.2 | 71.7 | 50.1 | 128.8 | 301.2 | 146.7 |
| 2 | 117.4 | 154.2 | 150.6 | 141.9 | 135.3 | 114.6 | 128.3 | 135.7 | 137.8 | 135.8 | 122.9 | 120.6 |
| 3 | 140.4 | 185.2 | 181.5 | 169.2 | 162.8 | 136.1 | 150.5 | 161.1 | 170.0 | 165.2 | 144.9 | 142.6 |
| 5 | 168.9 | 219.8 | 217.6 | 201.7 | 194.7 | 162.8 | 175.4 | 189.3 | 208.6 | 199.4 | 171.1 | 168.8 |
| 10 | 209.4 | 263.3 | 265.8 | 246.0 | 236.6 | 200.7 | 207.0 | 224.9 | 261.6 | 244.6 | 206.6 | 204.6 |
| 20 | 254.0 | 305.0 | 315.2 | 292.4 | 278.9 | 242.2 | 237.6 | 259.0 | 317.6 | 290.4 | 243.7 | 242.2 |
| 25 | 269.4 | 318.2 | 331.6 | 308.0 | 292.8 | 256.6 | 247.3 | 269.8 | 336.5 | 305.5 | 256.2 | 254.8 |
| 30 | 282.5 | 329.0 | 345.2 | 321.0 | 304.2 | 268.7 | 255.3 | 278.6 | 352.3 | 318.0 | 266.5 | 265.4 |
| 50 | 321.4 | 359.0 | 384.2 | 358.9 | 336.9 | 304.7 | 277.5 | 303.1 | 398.4 | 353.6 | 296.5 | 296.1 |
| 80 | 360.3 | 386.4 | 421.5 | 395.6 | 367.8 | 340.8 | 298.0 | 325.5 | 443.5 | 387.4 | 325.6 | 325.9 |
| **100** | **380.1** | **399.4** | **439.7** | **413.8** | **382.8** | **359.1** | **307.7** | **336.1** | **465.9** | **403.9** | **340.0** | **340.7** |

| Sub-Basin ID | SB15 | SB16 | SB17 | SB18 | SB19 | SB20 | SB21 | SB22 | SB23 |
|---|---|---|---|---|---|---|---|---|---|
| Name | Pila | Calauan | Los Banos | San Juan | San Cristobal | Sta. Rosa | Binan | San Pedro | Muntinlupa |
| Area(km$^2$) | 89.3 | 154.5 | 102.1 | 191.7 | 140.6 | 119.8 | 84.8 | 46 | 44.1 |
| 2 | 115.8 | 138.3 | 146.2 | 138.5 | 127.2 | 113.9 | 109.3 | 105.5 | 101.4 |
| 3 | 139.0 | 164.5 | 175.8 | 167.5 | 152.4 | 138.7 | 133.2 | 128.9 | 124.9 |
| 5 | 167.3 | 193.8 | 209.2 | 202.5 | 182.4 | 166.4 | 159.9 | 157.3 | 155.8 |
| 10 | 207.0 | 230.9 | 251.9 | 250.7 | 223.1 | 201.6 | 193.3 | 196.5 | 202.9 |
| 20 | 250.1 | 266.8 | 293.7 | 301.1 | 265.6 | 235.6 | 225.5 | 237.7 | 258.7 |
| 25 | 264.8 | 278.3 | 307.1 | 318.0 | 279.8 | 246.4 | 235.7 | 251.5 | 279.0 |
| 30 | 277.3 | 287.6 | 318.0 | 332.0 | 291.7 | 255.3 | 244.0 | 263.0 | 296.5 |
| 50 | 313.9 | 313.8 | 348.8 | 372.6 | 326.1 | 280.0 | 267.1 | 296.2 | 350.5 |
| 80 | 350.4 | 337.8 | 377.4 | 411.6 | 359.4 | 302.8 | 288.2 | 328.2 | 407.5 |
| **100** | **368.7** | **349.3** | **391.0** | **430.6** | **375.9** | **313.7** | **298.2** | **343.8** | **437.4** |

Source: JICA Survey Team




Source: JICA Survey Team

Figure 3.a.3 Sub-Basin ID

## 3. Concepts for the Comprehensive Flood Management Plan
## b. Set of Target Return Period and Target Rainfall

1) Design Flood for Laguna de Bay, Lakeshore Area and Drainage Area

【A】Design Flood for Laguna de Bay

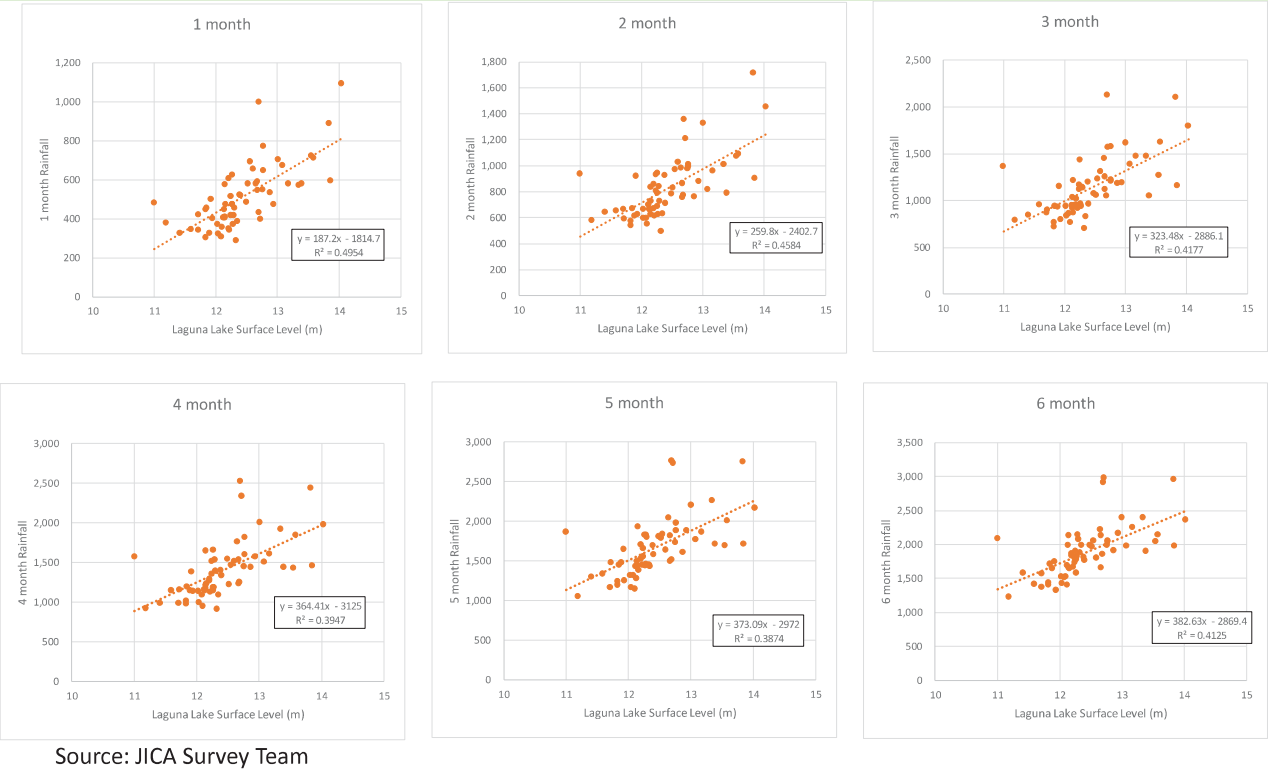
- The area of Laguna de Bay with its catchment area is at 3,280km$^2$.
  (The 100-year flood is generally applied to 18 major river basins. (Area ≧ 1,400 km$^2$))
- Design flood in Marikina River Basin with Marikina Dam and a retarding basin is also in 100-year return period.
- Hence, **100-year return period** is applied for the design flood at Laguna de Bay.
- Inflow volume from lakeshore area and lake water level are not correlated.
  (as shown in the result of 6 different types of correlation in the following slide)
- Therefore, the safety level at Laguna de Bay is expressed with the lake water level.
- Observed lake water level data from 1946 to 2016 was used for statistical analysis.

| Return period | 2 | 3 | 5 | 10 | 20 | 30 | 50 | 80 | 100 | 150 | 200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lake water level | 12.3 | 12.6 | 12.9 | 13.2 | 13.6 | 13.7 | 14.0 | 14.2 | 14.3 | 14.5 | 14.7 |
| Remarks: Observed data from 1946 to 2016（1971,1979-1981 is no data）<br>Statistical analysis model=Gumbel | | | | | | | | | | | |

Source: JICA Survey Team



## 3. Concepts for the Comprehensive Flood Management Plan
## b. Set of Target Return Period and Target Rainfall




Source: JICA Survey Team

Figure 3.b.1 Correlation of Rainfall and Lake Water Level

# 3. Concepts for the Comprehensive Flood Management Plan
## b. Set of Target Return Period and Target Rainfall

### 1) Design Flood for Laguna de Bay, Lakeshore Area and Drainage Area

【B】Design Flood for Lakeshore Area

- Design Flood for lakeshore area is set by DPWH standard guideline depend on each river basin area.
- The list of each river basin design flood discharge is shown in Table2-6.

Table 3.b.1 Design Flood discharge for each return period

| Sub-Basin ID | Sub-Basin NAME | A_SQKM_ New | Main River | River ID | Length (km) | Area (km²) | 100-year |
|---|---|---|---|---|---|---|---|
| SB-03 | Angono | 86.6 | Angono | 1 | 8.2 | 12.85 | |
| | | | | 2 | 5.6 | 8.98 | |
| | | | | 3 | 4.7 | 6.52 | |
| | | | | 4 | 3.9 | 3.30 | |
| | | | | 5 | 3.0 | 2.26 | |
| SB-04 | Morong | 95.9 | Morong | 1 | 29.1 | 69.10 | |
| | | | | 2 | 8.2 | 20.40 | |
| SB-05 | Baras | 21.7 | Baras | 1 | 13.0 | 17.40 | |
| SB-06 | Tanay | 52.2 | Tanay | 1 | 20.7 | 40.05 | |
| SB-07 | Pililla | 40.4 | Pililla | 1 | 16.1 | 32.30 | |
| SB-08 | Jala-jala | 70.6 | Jala-jala | 1 | 4.8 | 10.21 | |
| | | | | 2 | 3.8 | 3.80 | |
| SB-09 | Sta. Maria | 202.2 | Sta. Maria | 1 | 31.9 | 163.80 | |
| | | | | 2 | 3 | 2.72 | |
| | | | | 3 | 3.4 | 3.09 | |
| | | | | 4 | 3.6 | 3.38 | |
| | | | | 5 | 5 | 4.36 | |
| SB-10 | Siniloan | 71.7 | Siniloan | 1 | 10.9 | 56.30 | |
| SB-11 | Pangil | 50.1 | Pangil | 1 | 13.7 | 22.31 | |
| | | | | 2 | 2.4 | 1.52 | |
| | | | | 3 | 2.8 | 2.91 | |

Less than 40km² ⇒ Design Flood Level = 25-year Return Period

More than 40km² ⇒ Design Flood Level = 50-year Return Period

Under consideration

Small Drainage⇒ Design Flood Level = 15-year Return Period

Source: JICA Survey Team



# 3. Concepts for the Comprehensive Flood Management Plan
## c. Lake Water Level Analysis ,Runoff Inundation Analysis

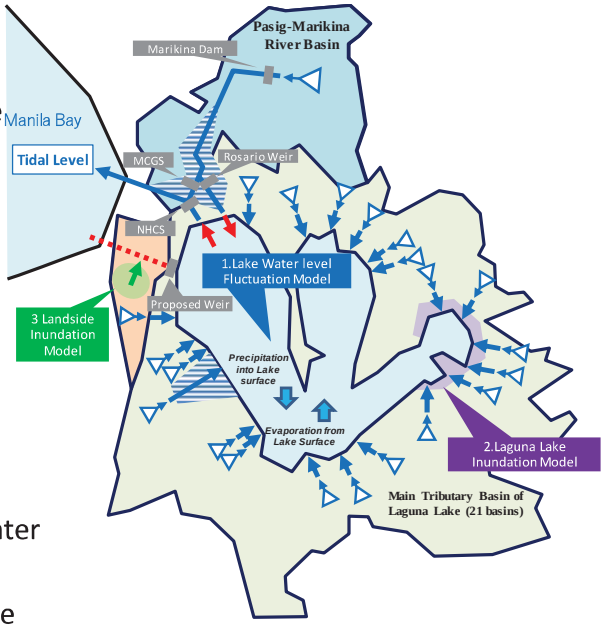
### 1) Outline of Analysis Models

#### i) Lake Water Level Fluctuation Model

- To grasp the annual lake water level change
- Long-term Runoff analysis model using by NAM and MIKE11 analysis model.
- The simulation period is daily calculation.
- Calibration and verification year is 1947, 2009 and 2012 which were recorded high lake water level.

#### ii) Lakeshore Area Runoff Inundation Analysis

- To grasp inundation area and flood river discharge in lakeshore area relating lake water level raising and probability rainfall.
- Short-term Rainfall Runoff Inundation Mode (RRI model) used in lakeshore area.
- The simulation period is hourly calculation.



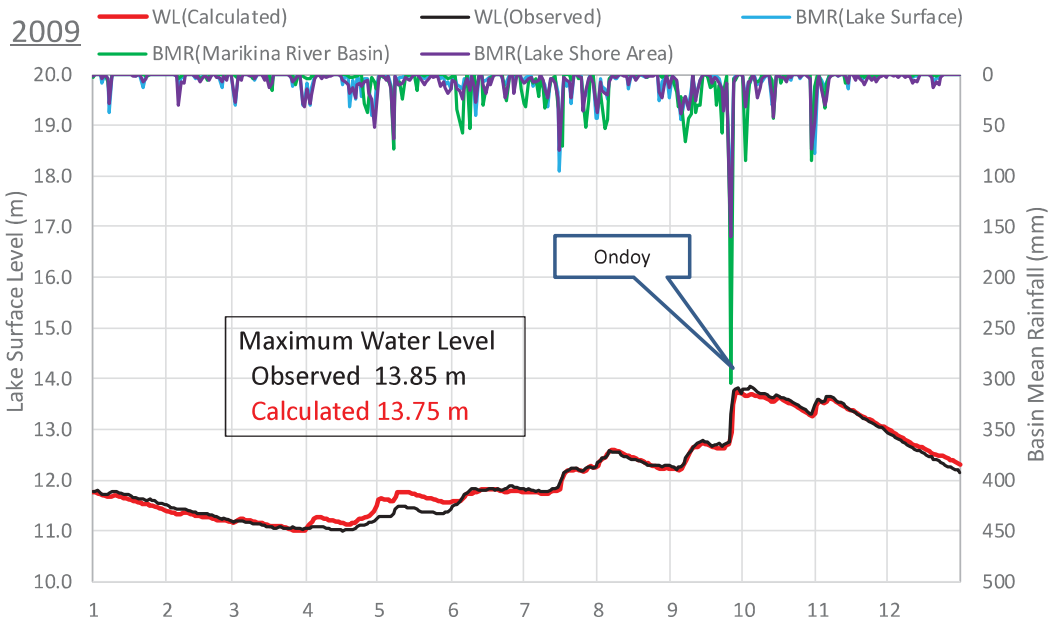

Source: JICA Survey Team

Figure 3.c.1 Conceptual Diagram of the Analysis Model in Laguna de Bay Basin

## 3. Concepts for the Comprehensive Flood Management Plan
## c. Lake Water Level Analysis ,Runoff Inundation Analysis

2) Lake Water Level Analysis Calibration in **2009** and 2012

【Calibration:2009】




Source: JICA Survey Team

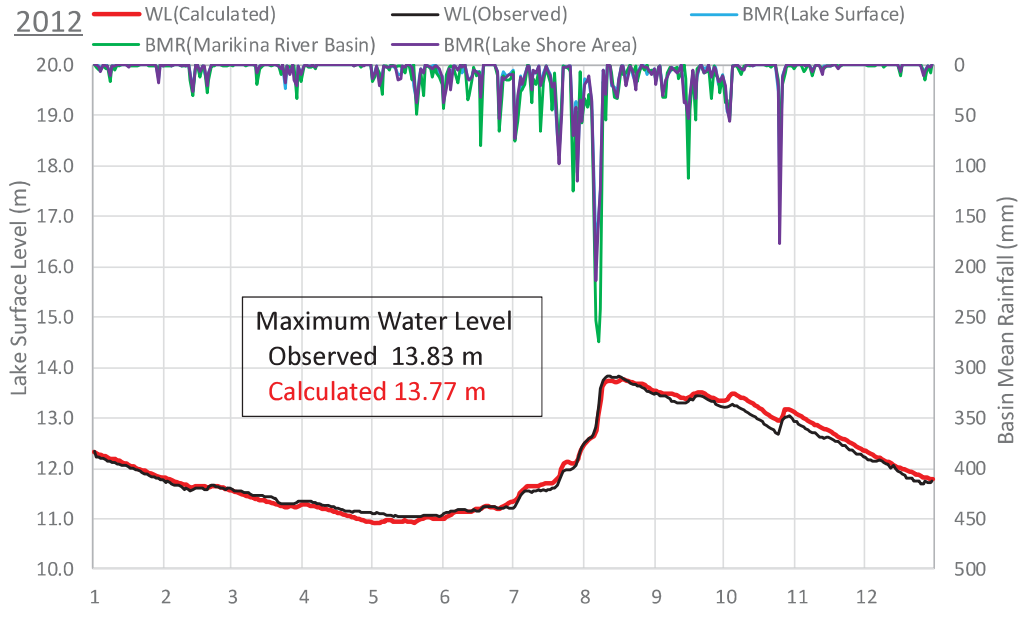
Figure 3.c.2 Result of Lake Water Level Analysis in 2009



## 3. Concepts for the Comprehensive Flood Management Plan
## c. Lake Water Level Analysis ,Runoff Inundation Analysis

2) Lake Water Level Analysis Calibration in 2009 and **2012**

【Verification: 2012】




Source: JICA Survey Team

Figure 3.c.3 Result of Lake Water Level Analysis in 2012

## 3. Concepts for the Comprehensive Flood Management Plan
## c. Lake Water Level Analysis ,Runoff Inundation Analysis

### 3) Runoff Inundation Analysis in Lakeshore Area

Source: JICA Survey Team

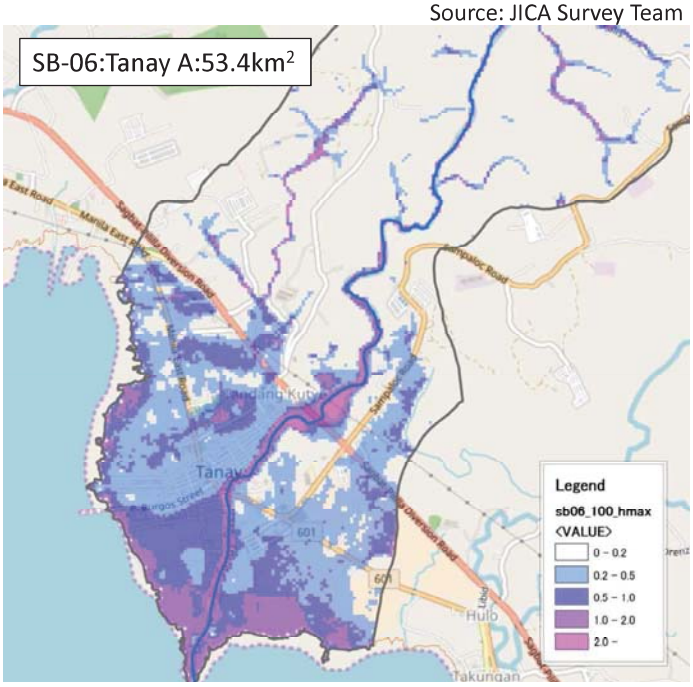


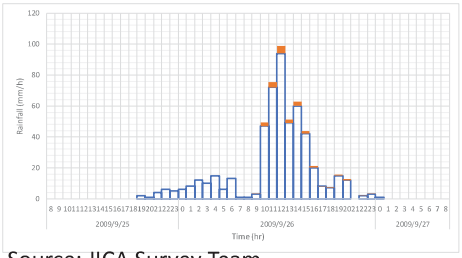

Figure2-11 Example of Runoff-Inundation Analysis in 100-year return period

- Probability Basin Mean Rainfall; 413.8mm/day (100-year)

| Return Period (year) | Rainfall (mm) |
|---|---|
| 2 | 141.9 |
| 3 | 169.2 |
| 5 | 201.7 |
| 10 | 246.0 |
| 20 | 292.4 |
| 25 | 308.0 |
| 30 | 321.0 |
| 50 | 358.9 |
| 80 | 395.6 |
| **100** | **413.8** |

Source: JICA Survey Team

- Model Hyetograph ;100-year




Source: JICA Survey Team



## 3. Concepts for the Comprehensive Flood Management Plan
## d. Composition of the flood management at Laguna de Bay

Full Menu of the Comprehensive Flood Management Plan (Primary Step)

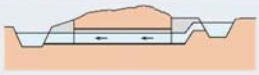
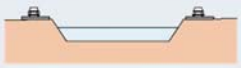
| Measures | | Contents |
|---|---|---|
| Structural Measure | Control and Prevention of Water Level Rise | • Strengthening Outflow Discharge Capacity of Napindan Channel and Mangahan Floodway<br>• Construction of Paranaque Spillway<br>• Construction of Pacific Ocean Spillway<br>• Dredging of Laguna de Bay<br>• Excavation of Lakeshore Area of Laguna de Bay |
| | Mitigation of Inundation Damage | • Construction of Lakeshore Diking System (including Installation of Flood Gates, Pumping Stations for Inland Flood and Bridges) with River Improvement |
| Non-Structural Measure | | • Discharge Operation for Lowering Water Level<br>• Inundation Map<br>• Land Use Regulation<br>• Resettlement of Inhabitants at Lower Area to High Land<br>• Widening EFCOS Jurisdiction Area |

Source: JICA Survey Team

# 3. Concepts for the Comprehensive Flood Management Plan
## e. Paranaque Spillway

### 1) Comparison of Spillway Types

Source: JICA Survey Team

| Case | Underground Spillway Type | | Open-cut Spillway Type | |
|---|---|---|---|---|
| | Case 1: Non-pressure Tunnel | Case 2: Siphon Type | Case 3: Open Channel Type | Case 4: Box Culvert Type |
| Figure |  |  |  |  |
| Concept | Tunnel connects existing rivers and/or channels with some tunnels under the road and/or hills. The most general type of the spillway. | Tunnel is planned deeper than fifty (50) m from the surface.*1 Siphon discharges excess water using the pressure difference caused by the water head. | Open channel type makes the construction cost relatively less. However, it comes with the issues of large compensation for land acquisition and number of the relocation of the existing facilities. | The top of the channel proposed in Case 3 is covered applying the box culvert structure. The top area can be utilized as a road, a park and so on. |
| Tentative Evaluation for Paranaque Spillway | Water head difference between Laguna de Bay and Manila Bay is so small that the earth covering thickness at the top of the tunnel with gravity flow of water is not sufficient. **Not adequate** | Siphon will do without pump drainage. **Adequate** | Compensation for land acquisition and relocation of houses are the big issues. Project cost can be high considering the amount of compensations. **less adequate but possible** | This case has the same issues with Case 3. In addition, the high construction cost and the high maintenance cost make this type almost infeasible. **Not adequate** |

*1: IRR of RA 10752 (yr. 2016) states that the government shall not be prevented from use of such private and government lands by surface owners or occupants, if such entry and use are made more than fifty (50) m from the surface.


# 3. Concepts for the Comprehensive Flood Management Plan
## e. Paranaque Spillway


### 2) Possible Spillway Route


Source: JICA Survey Team

| Route | Location | Length*1 | Depth |
|---|---|---|---|
| A | Bicutan – Paranaque | 7.8km | 50m |
| B | Bagumbayan – Paranaque | 7.6km | 50m |
| C | Sucat – Paranaque | 8.5km | 30m |
| D | Sucat – Zapote | 9.6km | 50m |
| E | Alabang – Zapote | 12.5km | 30m |

Source: JICA Survey Team

Note *1: Measured by Google Earth because of No Survey Data

"The government or any of its authorized representatives shall not be prevented from entry into and use of such private and government lands by surface owners or occupants, if such entry and use are made more than fifty (50) meters from the surface."
(from Section 11 in "Implementing Rules and Regulations of Republic Act No. 10752" in 2016)

## 3. Concepts for the Comprehensive Flood Management Plan
## e. Paranaque Spillway

### 2) Comparison (Summary) of Possible Spillway Route

| Route | A | B | C | D | E |
|---|---|---|---|---|---|
| Inlet | Bicutan | Bagumbayan | Sucat | Sucat | Alabang |
| Outlet | Paranaque | Paranaque | Paranaque | Zapote | Zapote |
| Route Map |  |  |  |  |  |
| Depth | 50 m | 50 m | 30 m | 50 m | 30 m |
| Length | 7.8 km | 7.6 km | 8.5 km | 9.6 km | 12.5 km |
| Cost*1 | 38.0 Bil.Php | 37.1 Bil.Php | 41.2 Bil.Php | 44.7 Bil.Php | 57.9 Bil.Php |
| Problem & Issue | •Negative Influence for LPPCHEA<br>•Insufficient Capacity of Outlet River | •Negative Influence for LPPCHEA<br>•Access Road to Inlet Site | •Negative Influence for LPPCHEA<br>•Sectional Surface Rights | •Relatively High Cost | •Highest Cost<br>•Sectional Surface Rights (Partially) |
| Evaluation | Possible | Not Good/ Some Problems | Not Good/ Some Problems | Possible | Difficult/ Impossible |

Source: JICA Survey Team
Note*1: The cost is estimated roughly and to be revised.



## 3. Concepts for the Comprehensive Flood Management Plan
## e. Paranaque Spillway

### 3) Calculated Discharge of Spillway

Design Discharge = 200 m3/s
Water Level at Laguna Lake = 14.0 m
Water Level at Manila Bay = 10.5 m
Spillway Length = 10,000 m

10% Reduction of Spillway

| Diameter (m) | Area (m2) | Invert (m) | 10% Reduction Area (m2) | Conversion Diameter (m) | Roughness Coefficient | Inlet fe | Outlet fo | Velocity *1 v (m/s) | Total Loss ht (m) | Calculated Discharge (m3/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 15.00 | 176.715 | 5.00 | 157.749 | 14.172 | 0.015 | 0.50 | 1.00 | 2.626 | 3.499 | 414.221 |
| 14.00 | 153.938 | 5.00 | 137.150 | 13.215 | 0.015 | 0.50 | 1.00 | 2.524 | 3.499 | 346.119 |
| 13.00 | 132.732 | 5.00 | 117.947 | 12.255 | 0.015 | 0.50 | 1.00 | 2.417 | 3.499 | 285.022 |
| 12.00 | 113.097 | 5.00 | 100.135 | 11.291 | 0.015 | 0.50 | 1.00 | 2.304 | 3.499 | 230.700 |
| 11.00 | 95.033 | 5.00 | 83.706 | 10.324 | 0.015 | 0.50 | 1.00 | 2.185 | 3.499 | 182.901 |
| 10.00 | 78.540 | 5.00 | 68.648 | 9.349 | 0.015 | 0.50 | 1.00 | 2.059 | 3.499 | 141.345 |

Water Level at Laguna Lake = 12.5 m
Water Level at Manila Bay = 10.5 m

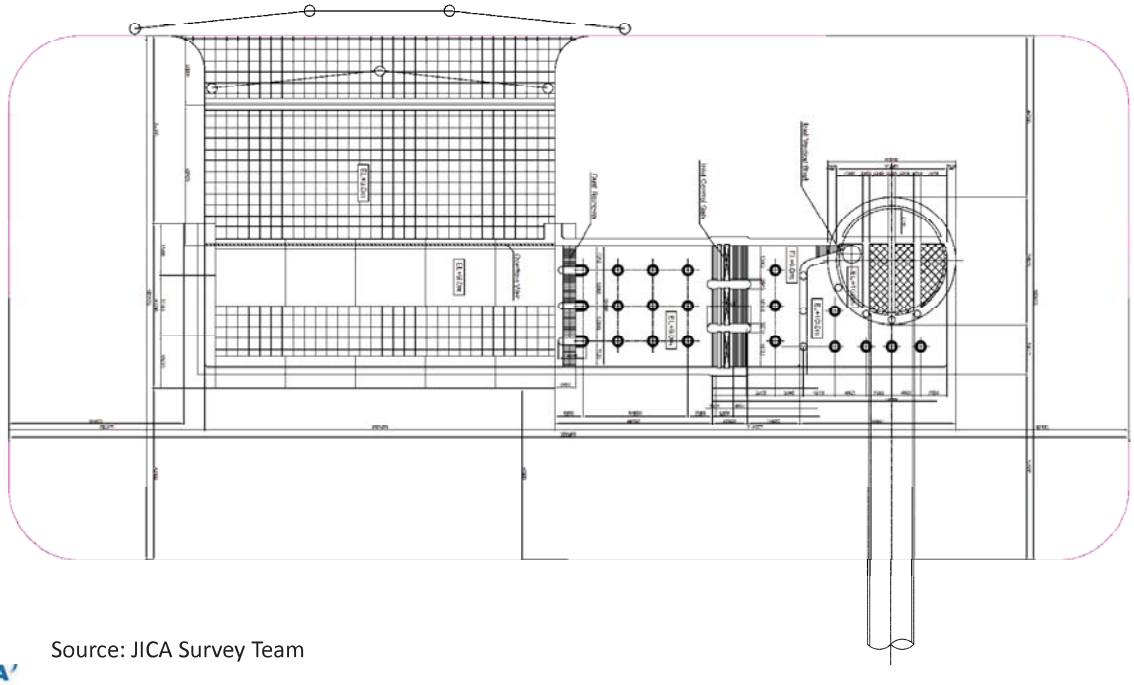
10% Reduction of Spillway

| Diameter (m) | Area (m2) | Invert (m) | 10% Reduction Area (m2) | Conversion Diameter (m) | Roughness Coefficient | Inlet fe | Outlet fo | Velocity *1 v (m/s) | Total Loss ht (m) | Calculated Discharge (m3/s) |
|---|---|---|---|---|---|---|---|---|---|---|
| 15.00 | 176.715 | 5.00 | 157.749 | 14.172 | 0.015 | 0.50 | 1.00 | 1.963 | 2.000 | 309.639 |
| 14.00 | 153.938 | 5.00 | 137.150 | 13.215 | 0.015 | 0.50 | 1.00 | 1.886 | 2.000 | 258.732 |
| 13.00 | 132.732 | 5.00 | 117.947 | 12.255 | 0.015 | 0.50 | 1.00 | 1.806 | 2.000 | 213.060 |
| 12.00 | 113.097 | 5.00 | 100.135 | 11.291 | 0.015 | 0.50 | 1.00 | 1.722 | 2.000 | 172.453 |
| 11.00 | 95.033 | 5.00 | 83.706 | 10.324 | 0.015 | 0.50 | 1.00 | 1.633 | 2.000 | 136.722 |
| 10.00 | 78.540 | 5.00 | 68.648 | 9.349 | 0.015 | 0.50 | 1.00 | 1.539 | 2.000 | 105.659 |

Source: JICA Survey Team

## 3. Concepts for the Comprehensive Flood Management Plan
### e. Paranaque Spillway

4) Plan Drawing (Draft)
i) Inlet Plan

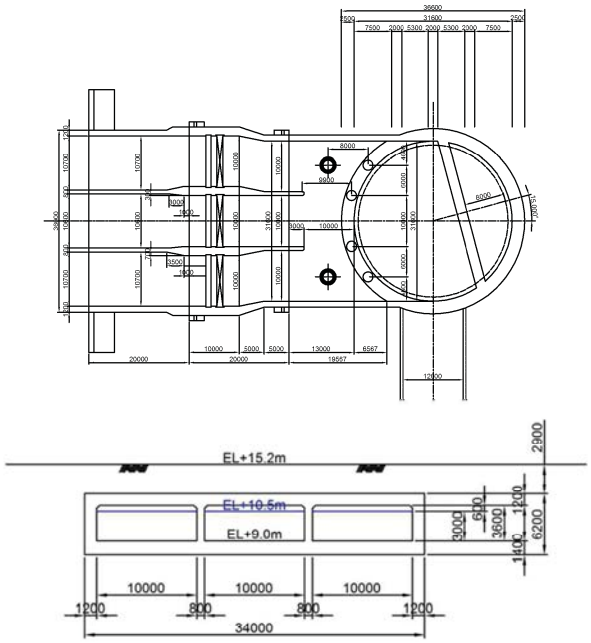


Source: JICA Survey Team

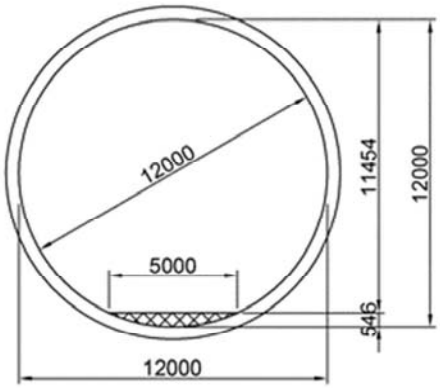


## 3. Concepts for the Comprehensive Flood Management Plan
### e. Paranaque Spillway

4) Plan Drawing (Draft)
ii) Outlet Plan



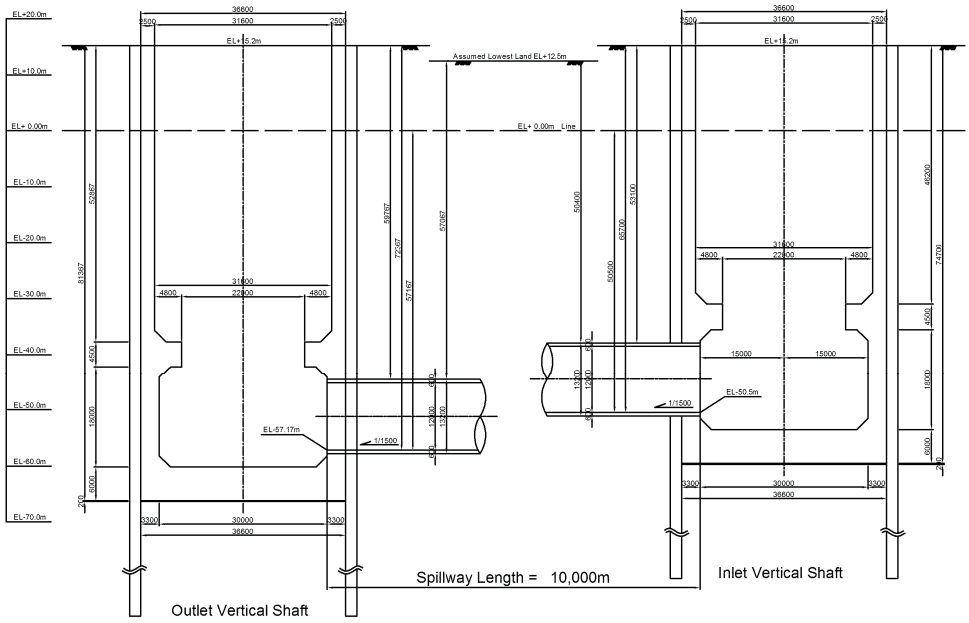

iii) Tunnel Cross Section




Source: JICA Survey Team

## 3. Concepts for the Comprehensive Flood Management Plan
### e. Paranaque Spillway

4) Plan Drawing (Draft)
iv) Cross Section of Vertical Shaft (Inlet & Outlet)

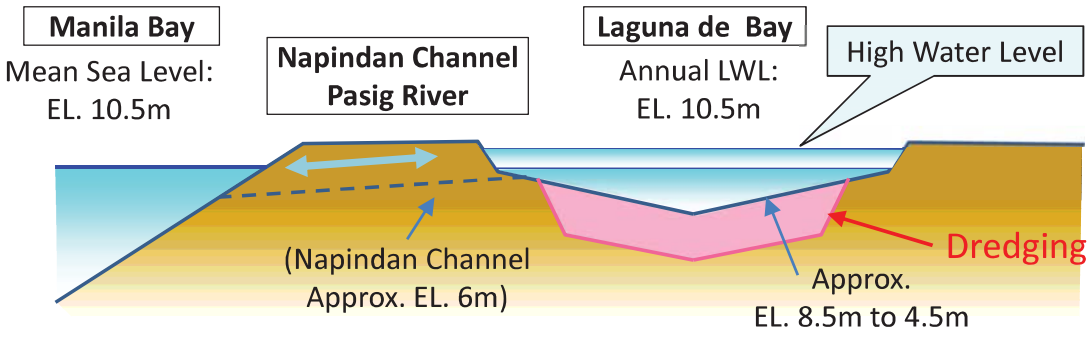



Source: JICA Survey Team



## 3. Concepts for the Comprehensive Flood Management Plan
### f. Structural Measures

1) Dredging of Laguna de Bay

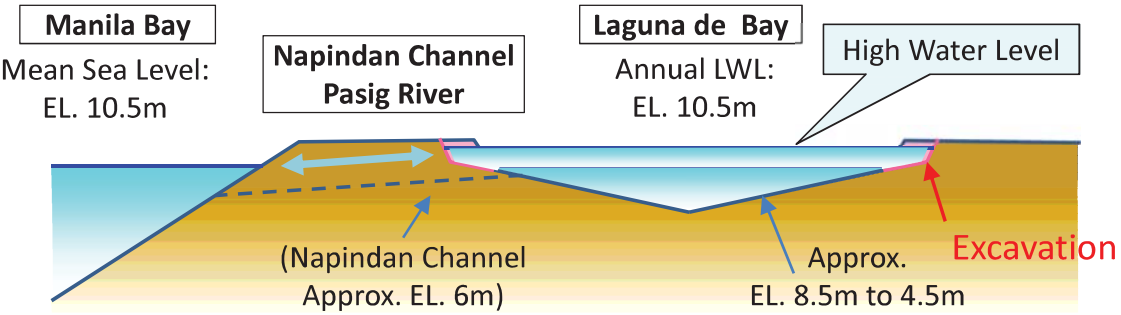



Source: JICA Survey Team

- ✓ Since the lake is in a bowl shape, dredged area may be covered with sedimentation.
- ✓ After balancing the water level between Manila Bay and Laguna de Bay, the effect of the dredging will be minimized.
- ✓ <u>Not Adequate</u>

## 3. Concepts for the Comprehensive Flood Management Plan
## f. Structural Measures

### 2) Excavation of Lakeshore Area of Laguna de Bay (around Lake)



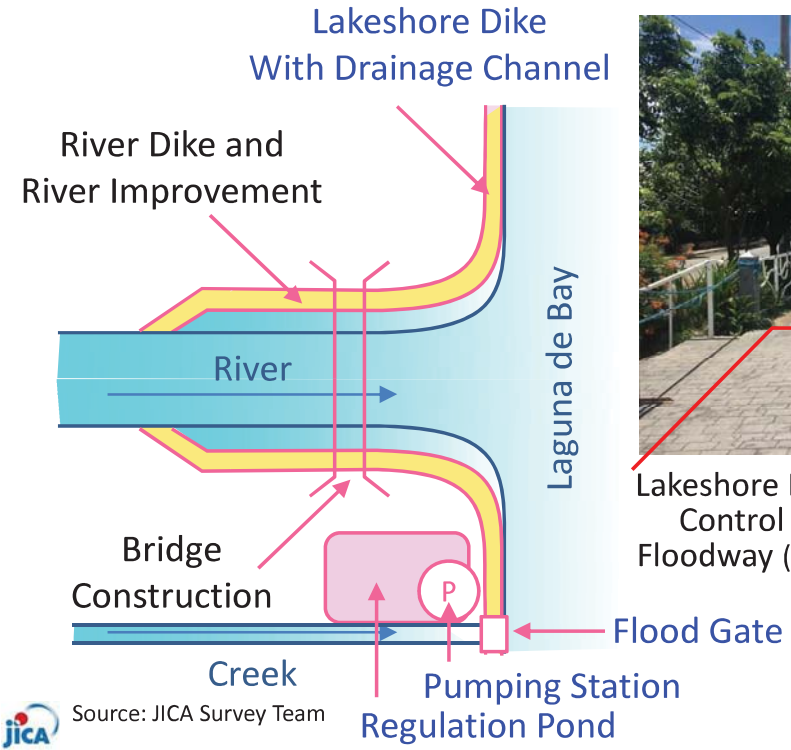

Source: JICA Survey Team

- ✓ Volume for flood water storage increases.
- ✓ Large areas of the land acquisition will be required.
- ✓ <u>Not Adequate</u>



## 3. Concepts for the Comprehensive Flood Management Plan
## f. Structural Measures

### 3) Concept of Lakeshore Diking System





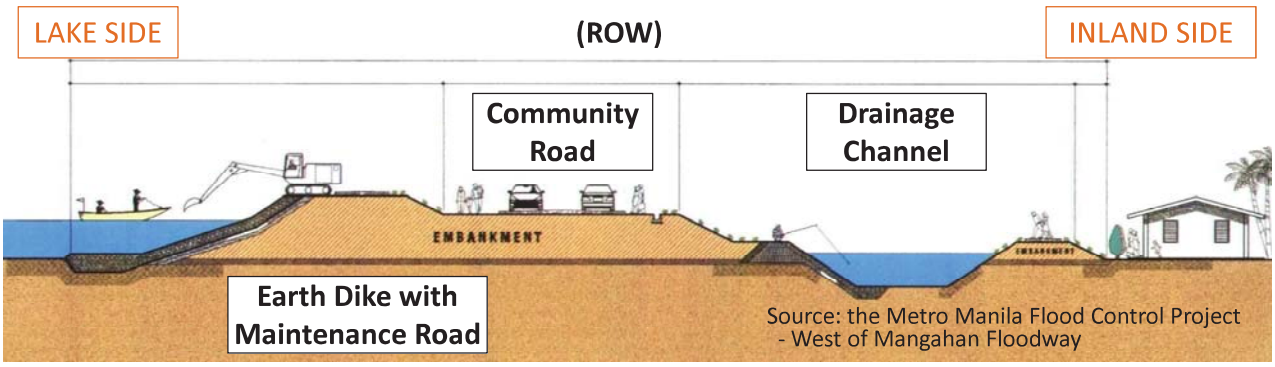
Lakeshore Dike at the Metro Manila Flood Control Project - West of Mangahan Floodway (after the additional Improvement)

Source: JICA Survey Team

## 3. Concepts for the Comprehensive Flood Management Plan
## f. Structural Measures

### 4) Construction of Lakeshore Dike (with drainage channel)

**Typical Cross Section of the Lakeshore Dike**




- ✓ The Lakeshore dike is proposed with a community road and a drainage channel referring to the structures in "the Metro Manila Flood Control Project - West of Mangahan Floodway."
- ✓ Community road has two lanes with shoulders.
- ✓ Drainage channel width and height are dependent on the Inflow.
- ✓ Proposing dike alignment at EL. 12m to EL. 12.5m to avoid residential areas



## 3. Concepts for the Comprehensive Flood Management Plan
## f. Structural Measures

### 5) Construction of Discharge Facility for Inland Flood

**Pumping Station and Floodgate**



Source: the Metro Manila Flood Control Project - West of Mangahan Floodway

- ✓ Water from the creeks crossed by the Lakeshore dike is collected by the drainage channel along the dike and discharged into Laguna de Bay at the pumping station with flood gates.
- ✓ Discharge capacity of single pump and type of the pumps are referred to the ones of the existing pumps considering the maintenance.

## 3. Concepts for the Comprehensive Flood Management Plan
## g. Non-structural Measures, 1) Lake Management

**i) Lack of Lake Management**

- RA No. 4850 (1966) and PD No. 813 state that Laguna Lake below El. 12.50m is public land for management by LLDA.
- El. 12.50m is the average of annual maximum lake water level and not the real lakeshore elevation.
- Lake management below the real lakeshore elevation is lacking.

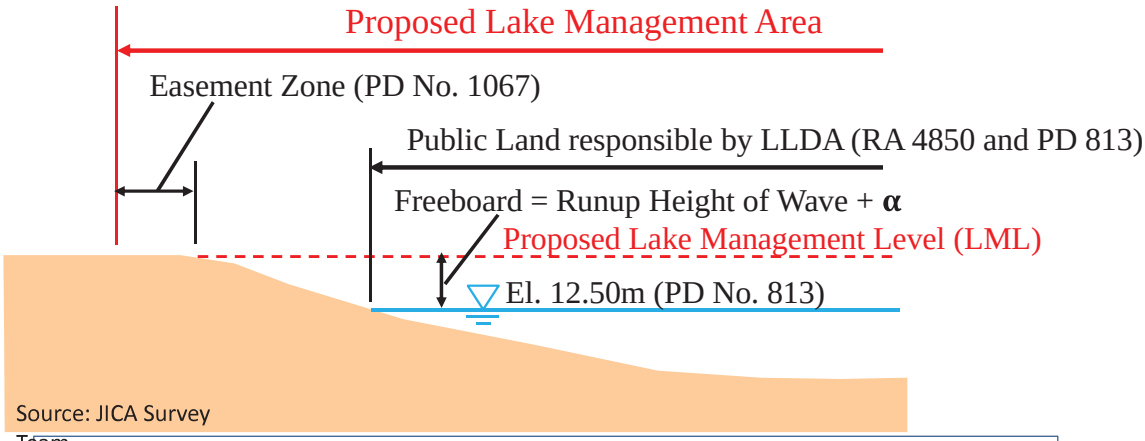
**ii) Proposal of Establishing Lake Management System**

- Set the lakeshore bank elevation : El. 12.50m + Wave runup height + $\alpha$

  (Example: Wave runup height + $\alpha$ = 0.70m ( half of freeboard 1.20m of the West Manggahan Dike) . Then, Lakeshore bank elevation = El. 13.20m (about 10-year return period of lake water level)
- Set Easement zones from the Lakeshore bank (3m for urban area, 20m for agricultural area etc.).
- Manage between the Easement zone to the other side of the Lake.
- Lake Management is to be conducted by LLDA under cooperation by LGUs and the related agencies (DPWH, DENR, DA etc.).



## 3. Concepts for the Comprehensive Flood Management Plan
## g. Non-structural Measures, 1) Lake Management




Source: JICA Survey Team

Notes:
- Lake water level of El. 12.50m is average annual maximum lake level elevation (based on the RA No. 4850 and PD No. 813)
- Easement zone: 3 m for urban area and 20 m for agricultural area (based on the PD No. 1067: Water Code)
- Freeboard example: 0.7m (about half of the freeboard of the West Manggahan Dike of 1.20m)

Figure 3.d.1 Proposed Lake Management Area for the Laguna de Bay

## 3. Concepts for the Comprehensive Flood Management Plan
## g. Non-structural Measures, 2) DRRM Coordination Issue

**i) Needs of Comprehensive Coordination of DRRM for the Entire Laguna Lake Basin**

- The LGUs covering the Laguna Lake Basin belong to Region IV-A and NCR.
- Coordination between Region IV-A and NCR is rather difficult.
- Each related agency and LGU has different targets and plans related to DRRM.
- It is necessary to establish coordination system for DRRM for the entire Laguna Lake Basin for facing same direction of strengthening DRRM.

**ii) Proposal of Comprehensive Coordination by NDRRMC for the Entire Laguna Lake Basin**

- Coordination and monitoring progress of DRRM by NDRRMC is proposed (same as the proposal of the WB Master Plan in 2012).
- Based on the Master Plan for DRRM, DRRM is to be implemented for the entire Laguna de Bay Basin with well-balanced manner.
- Proposed to establish a Sub-committee under NDRRMC for the Laguna Lake Basin (better for Sub-committee for the Pasig-Marikina and Laguna Lake Basin) .



## 3. Concepts for the Comprehensive Flood Management Plan
## g. Non-structural Measures, 3) Land Use Management

**i) Importance of Land Use Management along the Laguna Lakeshore**

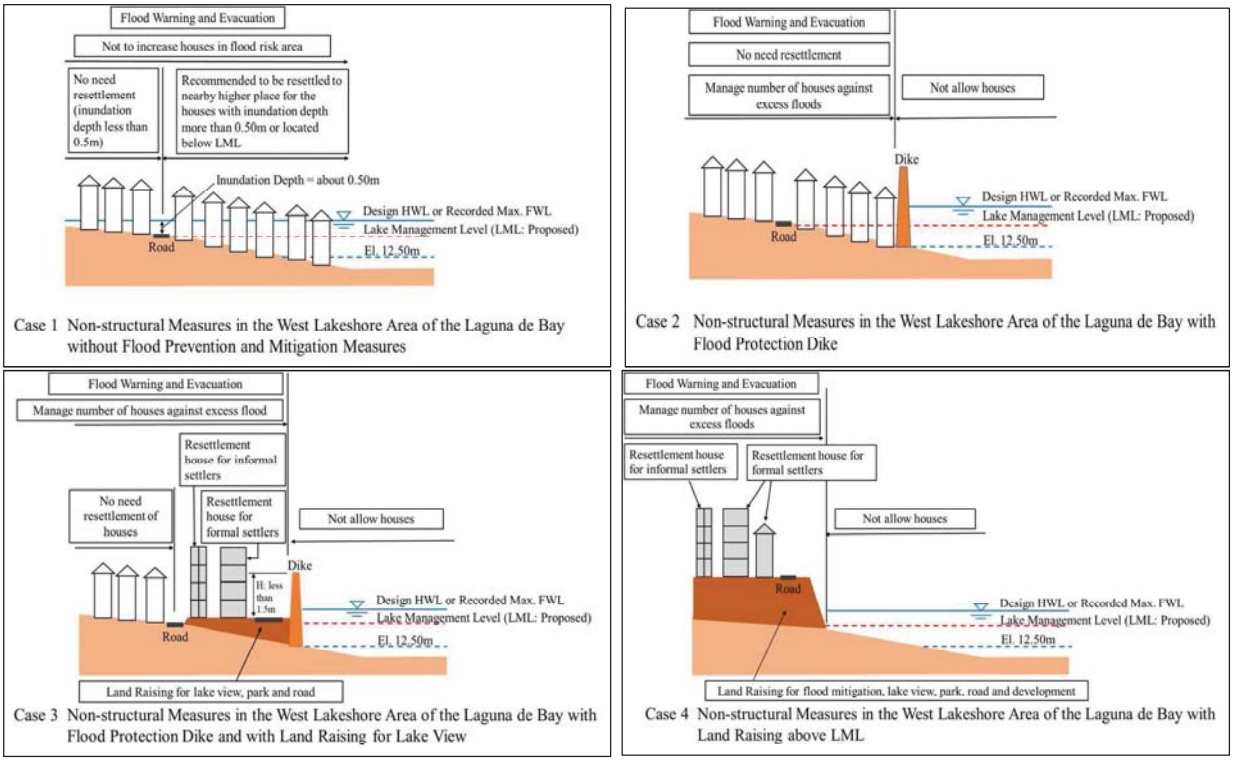
- Many houses exist in the low-lying areas with flood depth of more than 0.5m and with flood duration of 4 months by the 2009 and 2012 Floods.
- It is necessary not to allow houses in the above low-lying areas. However, it takes long time for resettle people in the low-lying areas to nearby higher safer places.

**ii) Proposal of Land Use Management in the Low-lying Lakeshore Area in Combination with Flood Warning and Evacuation System**

- Land Use Management in the low-lying lakeshore areas in combination of flood warning and evacuation for various cases are proposed.
- LGUs have desire to improve and develop the lakeshore area by considering the precious values of the Laguna de Bay such as beautiful scenery, natural environment and livelihood of fishermen*).

  *) Based on the interview by the Survey Team to OCD Region IV-A, Santa Rosa City, San Pedro Municipality and Biñan Municipality until October 13, 2017
- It is also necessary to consider the view points of LGUs for formulating flood control plan for the Lakeshore area.

## 3. Concepts for the Comprehensive Flood Management Plan
## g. Non-structural Measures, 3) Land Use Management

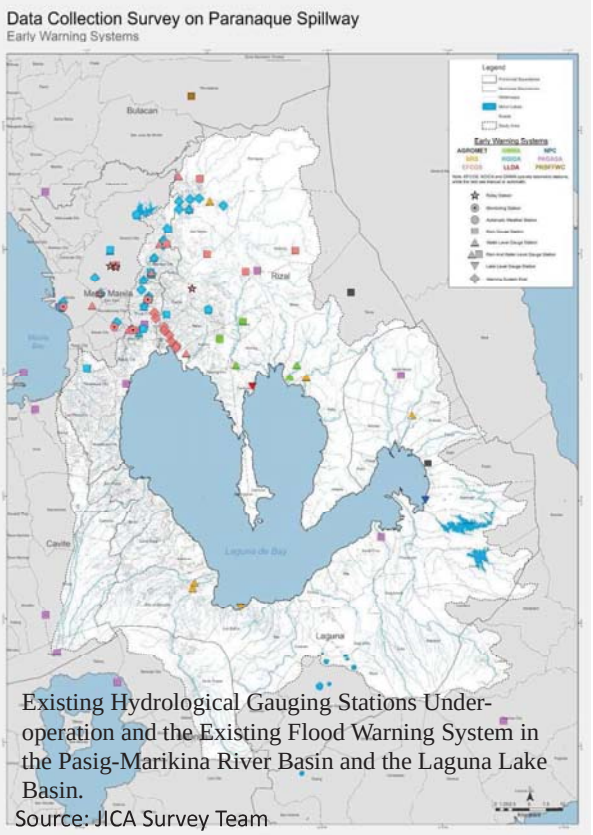



Source: JICA Survey Team

Figure 3.d.2 Non-structural Measures for the Western Lakeshore Area of the Laguna de Bay



## 3. Concepts for the Comprehensive Flood Management Plan
## g. Non-structural Measures, 4) Flood Warning System




Existing Hydrological Gauging Stations Under-operation and the Existing Flood Warning System in the Pasig-Marikina River Basin and the Laguna Lake Basin.

Source: JICA Survey Team

**i) Insufficient Flood Warning System**

- PAGASA's radar rain gauge at Tagaytay (C-band radar with observation radius of about 120km) covers the Laguna Lake Basin. There is no plan for installing X-band radar with observation radius of about 50 to 80km in the Basin.
- There is only pilot community-based flood warning system of GMMA Ready Project covering the Tanay River Basin
- Some LGUs install telemetric or manual gauging stations (rainfall and water level) for flood warning. Example: Santa Rosa City and San Pedro City.

**ii) Proposal of Flood Warning System**

- WB MP in 2012 proposed improvement of hydrological observation of PAGASA with telemetric system and radar rain gauge covering the Laguna Lake Basin focusing on flash floods of the inflow rivers. This relates to flood warning system.
- Or, it may be considered expansion of EFCOS especially in the western area of the Laguna de Bay within the range of MMDA.
- It is proposed to install hydrological gauging stations (telemetric or manual) by each LGUs around the Laguna de Bay for warning and evacuation.

# 4. Project Implementation Schedule

- Total of 30 years for the project implementation with **target year of 2050** is proposed.
- Stepwise-implementation schedule is proposed.
  - ✓ Urgent Project, Mid-Term Project, Long-Term Project (**10 years each**)



Republic of the Philippines
Department of Public Works and Highways
Manila

**Title/Description: SECOND STEERING COMMITTEE MEETING FOR THE DATA COLLECTION SURVEY ON PARAÑAQUE SPILLWAY IN METRO MANILA**

**Minutes of Meeting**

| **Date:** | **Started** | **Adjourned** | **Venue** |
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| November 3, 2017 | 2:00 P.M. | 4:30 P.M. | Operations Room, 2nd Floor, DPWH Central Office, Port Area, Manila |

| **Attendees:** | **Topics:** |
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| Please see attached marked "**ANNEX 1**" | 1. Topographical Characteristics<br>2. Administrative Jurisdiction and Land use<br>3. Major Flood Control Projects around Laguna de Bay<br>4. Geological Characteristics<br>5. Composition of the Flood Management at Laguna de Bay |

| **Topic** | **Session Highlights and Discussion** | **Person Responsible** |
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| | The Meeting was chaired by Undersecretary Emil K. Sadain, Unified Project Management Office (UPMO) Operations, and Chairman of the Steering Committee, DPWH and was called to order at 2:16 P.M. The Progress Report together with the Comprehensive Flood Management Plan was explained/reported by Mr. Takahiro Mishina, Leader of the Japan International Cooperation Agency (JICA) Survey Team. The highlights of the discussions are summarized below: | |
| 1. Topographical Characteristics | • Dr. Glen Tabios of UP National Hydraulic Research Center (UP-NHRC) pointed out that there is a previous study which assessed the rising of the water level of Laguna Lake due to Typhoons Ondoy and Habagat. The study included the option of dredging the Napindan Channel which would increase its flow capacity by around 150 $m^3/s$ which is almost the target conveyance capacity of the proposed Parañaque Spillway which is 200 $m^3/s$. | JICA Study Team |

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| | • He also presented the option for the diversion of flood water that can be discharged to the Pasig-Marikina-Napindan River. He further suggested to divert the flood water of Wawa River directly to the Pacific Ocean through Pakil which will take only 20 hours to lower the level of water compared to months. Another option is to store floodwater at the upland areas of Marikina and directly discharge it towards the Pacific Ocean.<br>➢ Mr. Mishina took note of his comments and explained that the survey is based on the request of the Philippine Government to determine if the proposed Parañaque Spillway using the underground tunnel is feasible.<br>• Dr. Tabios informed of the opposition encountered by the Putatan water treatment plant in Muntinlupa from the fisherfolks using the lake for livelihood and environmental concerns for salt water intrusion.<br>➢ Mr. Mishina assured him that the environmental concerns are being taken into consideration under the Study.<br>• Assistant Regional Director for Technical Services Sofio B. Quintana of Department of Environment and Natural Resources (DENR) reminded and requested that all environmental concerns should also be considered in the survey as well as the potential impacts to the 175 hectare- Las Pinas-Parañaque Critical Habitat and Ecotourism Area (LPPCHEA) that is located in the proposed outlet of the spillway.<br>➢ Mr. Mishina assured him that the environmental concerns are being taken into consideration as the direction of the outlets are being planned to avoid direct flow to the LPPCHEA. | |
| 2. Administrative Jurisdiction and Land use | • Assistant General Manager Generoso M. Dungo of Laguna Lake Development Authority (LLDA) raised the issue on planning and management due to the potential conflict of the proposed Parañaque Spillway with their Public-Private Partnership (PPP) project with the Philippine Reclamation Authority (PRA). He informed the body that a proponent have submitted a proposal for a PPP project very similar to the DPWH/JICA Parañaque Spillway project with | JICA Study Team |

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| | similar alignments. He addressed the question to Usec. Sadain as LLDA is keen on pursuing the offer of the PRA for a PPP project.<br>➢ Usec. Sadain informed the AGM that Secretary Mark A. Villar is keen on solving the flooding problem of communities around the Laguna de Bay. There were previous attempts to integrate the flooding and road improvement projects in the Laguna Lakeshore Expressway Dike Project (LLEDP) but there are issues that are still to be resolved. One of the issue is the real purpose of the project, whether it is a road network or a flood management project. Since both JICA and Asian Development Bank (ADB) wanted to assist the government on flood management and road network aspect, delineation of responsibility is required to complement both projects.<br>• Project Manager Dolores M. Hipolito of the UPMO Flood Control Management Cluster (FCMC) also clarified that protocol requires the PRA to obtain a letter of no objection/clearance from the DPWH that the area is not affected by the Department's project.<br>➢ Mr. Mishina and Project Manager Leonila R. Mercado of UPMO-FCMC replied that they would coordinate with LLDA regarding the matter. | |
| 3. Major Flood Control Projects around Laguna de Bay | • Usec. Sadain mentioned the Department of Transportation's (DoTr) Metro Manila Mega subway project and its alignment and further suggested the JICA Survey Team to consider the potential impacts particularly for the two alignments of the spillway, which are:<br>o Route A: Bicutan-Parañaque<br>o Route D: Sucat-Zapote<br>➢ Mr. Mishina made an assurance that these are being considered. | |
| 4. Geological Characteristics | • Dr. Rhommel N. Grutas of the Philippine Institute of Volcanology and Seismology (PHIVOLCS) inquired on how the Parañaque Spillway will consider the following impacts:<br>o Impact of the West Valley Fault on the design of the spillway as the fault line | JICA Study Team |

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| | traverse perpendicular to the alignments being considered;<br>○ Impact of ground shaking, and<br>○ Impact of possible tsunami brought by movements of the Manila Trench<br>➢ Mr. Mishina replied that these concerns are all considered in their analysis and the details will be included in the Detailed Engineering Design for the West Valley Fault as well as the Manila Trench. | |
| 5. Composition of the Flood Management at Laguna de Bay | • PM Hipolito cited some corrections in the presentations:<br>○ Change "1972" to "1947" for the rainfall data simulation;<br>○ The need for explanation or correction on slide number 34 for the routes with 30m depth from the Routes with 50m depth<br>➢ Mr. Mishina explained the Routes with 30m depths are aligned with the road network, thus, no need for RROW while for 50m depth application of RROW is no longer applicable.<br>• Engr. Jun Paul U. Mistica of LLDA requested confirmation on the 30 year period of implementation of the Parañaque Spillway. He cited the Mega Sub-way of DOTr that will be completed in less than 10 years.<br>• Usec. Sadain asked Mr. Mishina on the projected period for FS including the DED.<br>➢ Mr. Mishina said that construction period will take 10 years while for FS with DED will take 3 years.<br>• Usec. Sadain also mentioned that the Mega Sub-way was prepared during the past administration and there was a pressure for the immediate implementation of the project. The project has five (5) segments but only three (3) segments will be completed by 2022.<br>• Mr. Takafumi Nakui, DPWH-JICA Flood Management Expert, inquired on the operation & maintenance requirements of the spillway.<br>➢ Mr. Mishina replied that the team has already collected data/information needed in the analysis of the proposed spillway and they are | |

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| | now analyzing/examining the statistics including the appropriate organization structure and EIRR of the spillway project.<br>• With no more matters to discuss, the meeting was adjourned at 4:30 P.M. | |

| **Review and Confirmation:** | | |
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| Prepared by: | Approved by: | Noted: |
| **TAKAHIRO MISHINA** | **PATRICK B. GATAN, CESO III** | **EMIL K. SADAIN, CESO II** |
| Project Team Leader<br>JICA Survey Team | Project Director<br>UPMO - FCMC | Undersecretary for UPMO Operations |
| Position | Position | Position |

## ANNEX 1 ATTENDANCE SHEET

| Date: | Started: | Adjourned: | Venue: |
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| November 3,2017 | 2:00 PM | 4:30 PM | 2nd Floor Operations Room, Office of the Secretary, DPWH Head Office, Bonifacio Drive, Port Area Manila |

**ATTENDANCE SHEET**

| Name | Office | Contact Number | Signature |
|---|---|---|---|
| 1.Usec. Emil K. Sadain | DPWH-UPMO Operations | | |
| 2.Rhommel Grutas | PHILVOCS | | |
| 3.Geordge Noel T. Gomez | MMDA | | |
| 4.Jonathan T. Gomez | MMDA | | |
| 5.Generoso M. Dungo | LLDA | | |
| 6.Loren Martinez | LLDA | | |
| 7.Adelina Santos Borja | LLDA | | |
| 8.Jocelyn Siapao | LLDA | | |
| 9.Crispin Muna | LLDA | | |
| 10.Jun Paul U. Mistica | LLDA | | |
| 11.George Rubio | LGU-Las Piñas | | |
| 12.Michael Aguila | LGU-Las Piñas | | |
| 13.Ma. Teresa R. Quiogue | LGU-Parañaque | | |
| 14.Glen Q. Tabios | UP-NHRC | | |
| 15.Marco Augosto Cabueños | DILG | | |
| 16.Juan Jovian Ingeniero | DILG-NCR | | |
| 17.Sofio B. Quintana | DENR-NCR | | |
| 18.Melquiades H. Sto. Domingo | DPWH-Reg.IV-A | | |
| 19.Tiburcio L. Canlas | DPWH-NCR | | |
| 20.Rafael Valenzuela | DPWH-NCR-Sub-DEO | | |
| 21.Rodelio O. Batac | DPWH-NCR-Sub-DEO | | |
| 22.Lea N. Delfinado | DPWH-BOD | | |
| 23.Dolores M. Hipolito | DPWH-UPMO-FCMC | | |

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| 24.Constante A. Llanes Jr.. | DPWH-PS | | |
| 25.Michael T. Alpasan | DPWH-UPMO-FCMC | | |
| 26.Leonila R. Mercado | DPWH-UPMO-FCMC | | |
| 27.Cathy Palanca | JICA | | |
| 28.Ayumi OHSHIMA | JICA | | |
| 29.Takafumii NAKUI | JICA Expert | | |
| 30.Takahiro MISHINA | CTI-JICA Survey Team | | |
| 31.Emi SUGINO | CTI-JICA Survey Team | | |
| 32.Tadahiro FUKUDA | NK-JICA Survey Team | | |
| 33.Eji MOKI | CTI-JICA Survey Team | | |
| 34.Makoto KUDO | CTI-JICA Survey Team | | |
| 35.Michihiro ABE | NK-JICA Survey Team | | |
| 36.Yushiharu INABE | NK-JICA Survey Team | | |
| 37.Tatsuji ITO | CTI-JICA Survey Team | | |
| 38.Masanori SUZUKI | CTI-JICA Survey Team | | |
| 39.Takeshi MURAKAMI | NK-JICA Survey Team | | |
| 40.Geraldine Santos | JICA Survey Team | | |
| 41.Eleazar Rupido | JICA Survey Team | | |
| 42.Riza S. Nanas | JICA Survey Team | | |