Flood Mitigation and Management in Bangkok Metropolitan Area

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Flood Mitigation and Management in Bangkok Metropolitan Area

- **Flood risk area (35,000 Km.$^2$/22%)**
- **Irrigation Areas (16,000 Km. / 3 million people)**
  - Moderate to severe flood every 10 yrs. (B.E.2538, 2545, 2549, 2553)
- **Basin area (159,000 Km.$^2$/24 million people)**
  - Urban areas along the River (1,800 Km. / 12 million people)
  - Rural agricultural areas (17,000 Km. / 2 million people)
  - Irrigation Areas (16,000 Km. / 3 million people)

- **Flood frequency every 3-5 yrs.**
Flood in 2011

Discharge from the Chao Phraya River

Discharge from the Chao Phraya River, Bangkok Noi Canal, and Mahasawat Canal caused temporary dikes damage and flood in Bang Phlat, Bangkok noi and Thawi Watthana Districts.

Discharge from surrounding areas
- Eastern Bangkok; Discharge from Pathum Thani Province flew to Vibhavadi-Rangsit rd., Phahonyothin rd., Don Mueang and Sai Mai Districts.
- Western Bangkok; Discharge from Nonthaburi District flew over the dike along Mahasawat Canal to western Bangkok area.
Flood situation map of Bangkok on 16 November 2011

- Evacuation areas
- Intensive monitoring areas
- Monitoring areas
- Risk areas
• Heavy rainfall intensity (local flood)
• Overflow from river bank due to high discharge from the northern part
• Effect of high tides from the sea
• Land subsidence
• Low efficiency of drainage system
Caused of Flooding in Bangkok

Heavy rainfall

The average annual rainfall in BMA is 1,500 mm. 88% of annual rainfall extend during the southwest monsoon, May to October which the heaviest occurs in September and October. The high intensity rainfall cannot drained effectively and causes localized flooding in some low areas and main road. BMA drainage system capacity has been improved for 60 mm/hr of rainfall intensity.
Flood Mitigation and Management in Bangkok Metropolitan Area

**Maximum upstream discharge and maximum water level of the Chaophraya River in Bangkok in 1995-2011**

<table>
<thead>
<tr>
<th>Year</th>
<th>Sea water level (m.)</th>
<th>Discharge (cms.)</th>
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<tbody>
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<td>2538</td>
<td>0.94</td>
<td>2,538</td>
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<tr>
<td>2539</td>
<td>0.83</td>
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<tr>
<td>2540</td>
<td>0.85</td>
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<td>2541</td>
<td>0.77</td>
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<td>2542</td>
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<tr>
<td>2545</td>
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<tr>
<td>2552</td>
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<td>2553</td>
<td>1.17</td>
<td>2,537</td>
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<tr>
<td>2554</td>
<td>1.30</td>
<td>2,539</td>
</tr>
</tbody>
</table>

- **Sea water level**
- **Max. water level in Bangkok**
- **Max. upstream discharge**
Flood Protection Measures

Structural Measures
- Polder System
- Dikes
- Pumping Stations
- Drainage tunnels and pipes
- Canal improvement
- Retention area
- Flood control Center

Non Structural Measures
- Flood fighting
- Land use control
- Public information and education
2. Improvement of Drainage systems for rainfall
   • Drainage system has been designed for rainfall intensity 60 mm./hr.
   • Canals; 1,682 canals and 2,600 km.
   • Pipe systems 6,400 km.
     - Main roads have main drainage pipes length 1,640 km.
     - Normal roads have secondary drainage pipes length 4,760 km.
   • Pumping stations and water gates are 409 places. Total capacity is 1,638 cms.
   • 7 tunnels which total length is 19 km. and total capacity is 155.50 cms.
   • 25 storm water retention ponds in Bangkok area. Total volume is 12.88 million cm.
   • Flood control center
Drainage Tunnels

BMA has implemented the drainage tunnels in case of where the drainage system are insufficient. The tunnels will drain the exceed storm water through the tunnels lying 15-22 m. under ground surface and pump out to the river by high capacity pumps. Now there are 7 drainage tunnels which 19 km long and 155 cms. of pumping capacity.
Flood Control Center (FCC)

FCC was established in 1990, which utilize computer technology for systematic and management of operation of flood protection. The center is comprised of one master station which is located in DDS office and 69 remote terminal units (SCADA) scattered around Bangkok. The center has basic functions in monitoring and collect of hydrological data (rainfall and water level), facilities operation conditions, flood damage situation and water quality data by using an on-line system. The various data are processing and transmit to the facilities operators and flood fighting team.
C Band Radar

Movement of Rainfall from Radar

Pump & Gate operation

Flood Detector
Cleansing of sewers

Canal Dredging

Flood Fighters

Movable Pumps
Improvement of Bangkok Flood Protection
Flood Mitigation and Management in Bangkok Metropolitan Area

Short-term Plan (achieve within 3-6 months)

1. Dredging the main drainage canals 1.5 billion baht
   1.1 Bangkok budget for 460 canals, cost 417 million baht
   1.2 Budget from Government for 401 canals, cost 1.17 billion baht

2. Increase efficiency of drainage systems, initiate warning system, and setting the Flow Meter in the main canals, cost 684 million baht
1. Repair flood walls along the Chao Phraya River, Bangkok Noi canal, and Mahasawat.

2. Elevate flood walls along the River and the canals
   - Upstream, flood walls elevate from +3.00 m. to +3.50 m. above MSL.
   - Middle, flood walls elevate from +2.80 m. to +3.00 m. above MSL.
   - Downstream, flood walls elevate from +2.50 m. to +2.80 m. above MSL.

3. Elevate dike at eastern part of Bangkok under His Majesty’s initiative (King’s dike) from +1.50-+2.90 to be +3.00 m. above MSL.
The plan is constructing and elevating flood walls and dikes and develop drainage systems in order to increase efficiency of flood protection for the future. The plan has been set from 2013 to 2017 and costs 67.8 billion baht. The activities consist of:

1. Strengthening and elevating flood walls along the Chao Phraya River, Bangkok Noi canal, Mahasawat canal, and dikes at eastern part of Bangkok under His Majesty’s initiative (King’s Dike)
2. Develop canal capacities to improve drainage efficiency by using the canals.
3. Develop drainage systems to increase the flow discharge to the Gulf of Thailand (e.g., constructing 3 new drainage tunnels)
4. Develop retention ponds
5. Provide materials and equipments for flood protection
6. Develop flood control center by improve of database of information systems and warning systems
Bangkok Metropolitan Administration

Bamboo Type (Temporary)

Rock-Pile Embankment Type (Permanent)

Growing of Mangrove Tree

Coastal Erosion Protection

BMA construct the bamboo barrier and T-groins along the shoreline estimated 4.7 km and will grow mangrove tree to protect the shoreline and raise silt deposition on the coast. The schedule of construction project start from 2009 to 2016.

Thank you

For your Attention

“Sawasdee”