BANGLADESH WATER DEVELOPMENT BOARD
New Member of Sentinel Asia

Presented by

A M Mustofa Sorwar
Superintending Engineer

Central GIS Directorate
Bangladesh Water Development Board (BWDB)
Bangladesh Water Development Board (BWDB) became a member of Sentinel Asia (May 2023)
After two consecutive catastrophic floods in 1954 & 1955, **Krug Mission** was appointed in 1957 with UNDP support.

As per Krug Mission recommendations **EPWAPDA (East Pakistan Water & Power Development Authority)** was established in 1959.

After the independence of Bangladesh (1971), Water Wing was separated from Power Wing and BWDB was born under Presidential Order in 1972.

Reformed under BWDB Act 2000, since then BWDB managed by Governing Council (GC) with thirteen Members headed by the Minister, Ministry of Water Resources.
Vision of BWDB

Vision

• Sustainable development of water resources in Bangladesh through participatory water management,
• Protection of people's lives and property through water related disaster management
• Improvement of socio-economic condition of the people by ensuring food security through development of irrigation system.
Mission of BWDB

Mission

• Flood control under strategic planning,
• Development of drainage and irrigation systems
• Food security & alleviation of poverty
• Prevention of river erosion,
• Addressing salinity intrusion problem
• Land reclamation
• Management of water related disasters
• Addressing the adverse effects of climate change in line with integrated coastal management;
• Increasing public engagement through people’s participation in integrated water resource management.
Organogram of BWDB

Focal Point of Sentinel Asia

ADG (Planning, Design & Research)
- CE (Design)
- CE (Hydrology)
- CE (Planning)

ADG (East Region)
- CE (Central Zone, Dhaka)
- CE (Eastern Zone, Cumilla)
- CE (South-Eastern Zone, Chattogram)
- CE (North-Eastern Zone, Sylhet)

ADG (West Region)
- CE (North Zone, Rangpur)
- CE (North-Western Zone, Rajshahi)
- CE (Western Zone, Faridpur)
- CE (Southern Zone, Barisal)

ADG (Admin)
- CE (South-Western Zone, Khulna)

ADG (Accounts & Finance)

ADG: Additional Director General
CE: Chief Engineer
SE: Superintending Engineer
BWDB: A unique multidisciplinary organization

- Planning
- Design
- Hydrology
- Implementation, O&M
- Monitoring

Technical
- Planning
- Design
- Hydrology
- Implementation, O&M
- Monitoring

Socio-economic and Env.
- Sociology
- Economy
- Environment
- Agriculture
- Fisheries
- Forestry
- Geologist
- Soil Science

Admin and Finance
- Administration
- Finance
- Accounts

Support Services
- IWM
- CEGIS
- RRI
Overview of water related disasters in Bangladesh

• Most of the disasters are water related such as **Floods**, Tropical **Cyclones**, Storm Surge, **River Bank Erosion**, Drought, **Salinity Intrusion** etc.


• River bank erosion is an endemic and recurrent natural hazard in Bangladesh.

**Floods:** four types:

i. Flash Flood  
ii. Rain-fed Flood  
iii. River Flood  
iv. Flood due to Cyclonic Storm Surges

**Cyclones:** Hit the coastal regions of Bangladesh almost every year, in early summer (April-May) or late rainy season (October-November).

**River Bank Erosion:** Ganges, Brahmaputra and Meghna are sluggish and meander or braid. These rivers undergo massive riverbank erosion.
Social condition of Bangladesh

Population

• One of the most densely populated countries in the world with 1305 living per square Kilometre.

• Bangladesh population has reached 169.8 million in 2022.
A riverine country with about 405 rivers

- Total river length: 24,000 km
- Annual Ave. Rainfall: 1200mm in NW to 5500mm in NE
- Trans-boundary rivers: 57 nos. (54 from India and 3 from Myanmar)
- Lower riparian to all trans-boundary Rivers

Cherapunji (in INDIA) - World's highest rainfall
Catchment Area of Major Rivers

About 93% catchments area lying outside Bangladesh

Flow
- The Ganges: 1,000 ~ 80,000 cumec
- The Brahmaputra: 2,400 ~ 102,000 cumec
- The Meghna: 500 ~ 30,000 cumec

Annual Sediment Transport
- The Ganges: 286 Mtons
- The Brahmaputra: 600 Mtons
- The Meghna: 1 Mtons

Catchment of main three rivers only 7% lies within Bangladesh

Total estimated sediment load 1.00 ~ 1.10 BMT
Physical Setting of Bangladesh

About 1350 BCM flow generated Annually
93% flow passes through Bangladesh
80% in five months of monsoon

GBM catchment=1.7million km²

Farakka Barrage Commissioned 1974

Too much water
Floods in Bangladesh

• Large area on the floodplains in the major rivers of Bangladesh is flooded during the wet season.

• Every year about 20% of the cultivable area is inundated more than one meter about 4 to 6 months period

• Situation deteriorates during floods of higher magnitude
  • Casualties in 1998 floods
    • Over 60% area inundated
    • Over 30 million people affected
    • Over 4300 km of roads damaged
    • Food grain loss 2.2 million tons
    • 270 thousands fish farms washed away
    • More than 3000 industries were affected

• Flooding reduces economical activities and enhances poverty

1998 Flood (Source: SWMC)
Salinity Problem:
Climate Change Scenario

Source: IWM
Addressing All These Problems:
Two types of interventions Taken by BWDB

• *Structural Measures*

• *Non-Structural Measures*
**Structural Interventions**

- **Flood Control, Drainage and Irrigation projects**
- **Coastal embankment, submergible embankment in Haor area**
- **Dredging/re-excavation to increase conveyance**
- **Riverbank Protection**
- **Accelerated Land Reclamation**
- **Prevention from Salinity Intrusion**
- **Surface water retention**
### Non-structural Interventions

<table>
<thead>
<tr>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disaster Management: Flood forecasting and warning</td>
</tr>
<tr>
<td>Disaster Management: Flood Extent mapping using RS</td>
</tr>
<tr>
<td>Hydrological data collection and survey</td>
</tr>
<tr>
<td>Erosion Prediction (planned)</td>
</tr>
<tr>
<td>Capacity Development</td>
</tr>
<tr>
<td>Mathematical Modelling</td>
</tr>
<tr>
<td>Participatory water management</td>
</tr>
</tbody>
</table>
Interventions of BWDB

Flood Control, Drainage and Irrigation
Riverbank Protection
River Dredging
Land Reclamation
Salinity Management
Flood forecasting
Hydrological data collection and study
Integrated Water Resources Management
Structural Measure:
Chandpur Irrigation Project (CIP)
Structural Measure: Rubber Dam
<table>
<thead>
<tr>
<th><strong>Major Structural Interventions: till date</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of projects implemented</strong></td>
<td>938 Nos.</td>
</tr>
<tr>
<td><strong>Area covered by irrigation, flood control and drainage facilities</strong></td>
<td>65.16 lakh hectares</td>
</tr>
<tr>
<td><strong>Area covered by irrigation facilities (139 irrigation projects implemented)</strong></td>
<td>16.49 lakh hectares</td>
</tr>
<tr>
<td><strong>Barrages (Tista, Manu, Buri Teesta and Tangon)</strong></td>
<td>4 nos.</td>
</tr>
<tr>
<td><strong>Land creation/reclamation</strong></td>
<td>1086.62 square km.</td>
</tr>
<tr>
<td><strong>District town protected from river erosion</strong></td>
<td>31 nos.</td>
</tr>
<tr>
<td><strong>Bank protection works to prevent river bank erosion</strong></td>
<td>1457.24 km.</td>
</tr>
<tr>
<td><strong>Spur construction</strong></td>
<td>251</td>
</tr>
<tr>
<td><strong>Construction of flood wall</strong></td>
<td>19.224 km.</td>
</tr>
<tr>
<td><strong>Length of completed embankment</strong></td>
<td>16528 km.</td>
</tr>
<tr>
<td>a) <strong>Coastal embankment (139 polders)</strong></td>
<td>5816 km.</td>
</tr>
<tr>
<td>b) <strong>Submersible embankment (through 99 haor/haor sub-projects)</strong></td>
<td>2728 km.</td>
</tr>
<tr>
<td>c) <strong>Other flood control embankments</strong></td>
<td>7984 km.</td>
</tr>
<tr>
<td><strong>Irrigation canal dikes</strong></td>
<td>3613 km.</td>
</tr>
<tr>
<td><strong>Length of irrigation canal</strong></td>
<td>5355 km.</td>
</tr>
<tr>
<td><strong>Length of drainage canal</strong></td>
<td>4502 km.</td>
</tr>
<tr>
<td><strong>Hydraulic structure</strong></td>
<td>15769 nos.</td>
</tr>
<tr>
<td><strong>Number of Pump Houses</strong></td>
<td>23 nos.</td>
</tr>
<tr>
<td><strong>Closure</strong></td>
<td>1428 nos.</td>
</tr>
<tr>
<td><strong>Bridge/Culvert</strong></td>
<td>5776 nos.</td>
</tr>
<tr>
<td><strong>Rubber Dam (Pekua, Mahamaya, Palakata, Kahua, Baggujara)</strong></td>
<td>5 nos.</td>
</tr>
<tr>
<td><strong>River reclamation</strong></td>
<td>3081 km.</td>
</tr>
<tr>
<td><strong>River dredging</strong></td>
<td>1294 km.</td>
</tr>
</tbody>
</table>
## Data Collection:
### BWDB Measurement Stations

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Type of Data</th>
<th>No. of Stations</th>
<th>Frequency of Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Water Level</td>
<td>357</td>
<td>Daily 7 times (tidal) Daily 5 times (non-tidal)</td>
</tr>
<tr>
<td>2</td>
<td>Discharge</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non tidal</td>
<td>123</td>
<td>Daily/Weekly/Fortnightly</td>
</tr>
<tr>
<td></td>
<td>Tidal</td>
<td>06</td>
<td>Fortnightly</td>
</tr>
<tr>
<td></td>
<td>Semi tidal</td>
<td>07</td>
<td>Dry season</td>
</tr>
<tr>
<td>3</td>
<td>Surface Water Quality</td>
<td>83</td>
<td>Monthly</td>
</tr>
<tr>
<td>4</td>
<td>Salinity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Static</td>
<td>100</td>
<td>Daily/Weekly/Fortnightly</td>
</tr>
<tr>
<td></td>
<td>Dynamic</td>
<td>66</td>
<td>Once in a year</td>
</tr>
<tr>
<td>5</td>
<td>Sediment</td>
<td>20</td>
<td>Weekly/Fortnightly</td>
</tr>
<tr>
<td>6</td>
<td>Rainfall</td>
<td>274</td>
<td>Daily</td>
</tr>
<tr>
<td>7</td>
<td>Metrological</td>
<td>2</td>
<td>Daily</td>
</tr>
<tr>
<td>8</td>
<td>Evaporation</td>
<td>39</td>
<td>Daily</td>
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### Discharge Stations of Bangladesh

### Water Level Stations of Bangladesh
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CENTRAL GIS DIRECTORATE
BWDB Focal Point for Sentinel Asia
### Hardware and Software

#### GIS Software
- ArcGIS Desktop (Advanced) 10.6.1 (Perpetual License)
- ArcGIS Pro (Standard) 2.6 (Perpetual License)
- ArcGIS Desktop (Standard) 10.6.1 (Perpetual License)
- ArcGIS Enterprise Server 10.6.1 (Perpetual License)
- QGIS 3.28 (Free and Open Source Software)
- Geoserver 2.18.5 (Free and Open Source Software)

#### Geospatial Imagery Analysis Software
- ENVI 5.5.2 (Perpetual License)

#### Hydraulic and/or Hydrological Modelling Software
- HEC-RAS 6.0 (Free but closed source)
- HEC-HMS 4.8 (Free but closed source)
- MIKE 11 or MIKE Hydro River (Perpetual License)
- MIKE 21c (Perpetual License)
**Hardware and Software**

- **Physical Server** (Location: Pani Bhaban Data Center)
  - Server 1 (Web server, database server, application server)
  - Server 2 (Application server)
  - Server 3 (Application server, File Server)

- **Virtual Server** (Will be physical very soon)
  - Application Server
  - Database Server
  - File Server

Software:
- LIS/SPMMIS
- GIS
- SIMS
- ArcGIS Desktop PC
Hardware and Software
Field Survey Equipment

RTK Base Setup

Phantom 4 RTK with DRTK-2
Drone Survey

Drone survey of Polder 18-19 in Paikgacha, Khulna, Bangladesh
Functions of Central GIS Directorate

1. **Database & Inventory**
   - Project Data (Completed, Current, Up-coming)
   - Haor and Wetlands
   - Coastal Embankments and Polders

2. **Disaster Impact Assessment**
   - Damage assessment due to flood and natural disaster

3. **Morphological Study from Remotely Sensed (RS) Imagery**
   - Identify the erosion prone areas and vulnerability mapping
   - Advise BWDB to undertake dredging and re-excavation activities

4. **GIS Apps and Mathematical Models**
   - Provide advice on preparation of Term of Reference (ToR) for Consultancy Services
   - Receive and store GIS applications and Mathematical Models and update according to BWDB needs
   - Disseminate through Web-GIS
- **GIS Database**: PostgreSQL 13 with PostGIS Extension Enterprise Database
- **Data Center Database**: Oracle 19c with Oracle Spatial
Disaster Impact Assessment

- Damage assessment due to flood and natural disaster
- Flood event, June 2022: Sylhet Division

Flood Extent Map of Sylhet Division

Legend
- Sylhet Division Boundary
- Flooded Area

<table>
<thead>
<tr>
<th>District</th>
<th>Flooded Area (km²)</th>
<th>Area (km²)</th>
<th>Flood Extent (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sylhet</td>
<td>1936.8</td>
<td>3416.11</td>
<td>57%</td>
</tr>
<tr>
<td>Sunamganj</td>
<td>2519.01</td>
<td>3699.21</td>
<td>69%</td>
</tr>
<tr>
<td>Moulvibazar</td>
<td>750.18</td>
<td>2677.49</td>
<td>28%</td>
</tr>
<tr>
<td>Hobiganj</td>
<td>1261.43</td>
<td>2581.99</td>
<td>49%</td>
</tr>
</tbody>
</table>

Data Source:
Central GIS Directorate, BWDB

- This map shows the detected flood water areas in Sylhet Division, Bangladesh on 18 June, 2022.
- Note that the detected water may also include water in cultivated areas and regularly flooded monsoon Haor area.

Disclaimer: The accuracy of this map is not validated.
Disaster Impact Assessment

- Flood event, June 2022: Sylhet Division
Damage assessment due to flood and natural disaster

• Case study for post-flood damage of Cyclone Yaas on 26th May 2021
Morphological Study from Remotely Sensed (RS) imagery

- Identify the erosion prone areas and vulnerability mapping
- Advise BWDB to undertake dredging and re-excavation activities
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Morphological Study from Remotely Sensed (RS) imagery

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Quantification of Bank Line Shifting at Panguchi River
Morphological Study from Remotely Sensed (RS) imagery

- Identify the erosion prone areas and vulnerability mapping
- Advise BWDB to undertake dredging and re-excavation activities
• Catchment Delineation from Digital Elevation Model (DEM)
Hydrological Study

- Rainfall Map
• Haor and Polder
GIS Apps and Mathematical Models

- Receive and store GIS applications and Mathematical Models
GIS Apps and Mathematical Models

- Receive and store GIS applications and Mathematical Models
GIS Apps and Mathematical Models

- Disseminate online based output maps of mathematical models
GIS Apps and Mathematical Models

Disseminate through Web-GIS

Visit https://gis.bwdb.gov.bd/arcgis/home/
ArcGIS Enterprise Portal
of Central GIS Directorate, BWDB

A Preliminary initiative to Host Modern GIS Applications in BWDB by
Central GIS Directorate

Bangladesh Water Development Board
Publication Year:: 2022-2023
Cyclone MOCHA in Bangladesh on 14 May, 2023, Processed by MBRSC: DAN, Sentinel Asia

Tropical Cyclone MOCHA made its landfall on 14 May, in Myanmar, and Bangladesh. Flooded areas can be observed on Sentinel images on the 18 of May 2023.

Description

Tropical Cyclone MOCHA, equivalent to a Category 4 hurricane (on the Saffir-Simpson scale), has made its landfall on May 14, then moved through the Bay of Bengal, to Myanmar and Bangladesh, affecting around half a million Bangladeshis living in coastal areas of south-eastern Bangladesh.

Data Source

Pre-disaster image: Sentinel1A_S1A_IW_SLC_15DV acquired on 06 May 2023 at 7:11:55:57
Post-disaster image: Sentinel1A_S1A_IW_SLC_15DV acquired on 18 May 2023 at 7:11:56:23

Note: The resulted outputs had not been verified with ground truth observation.
Cyclone MOCHA in Bangladesh on 14 May, 2023, Processed by GIC. AIT. PDAN. Sentinel Asia

This map shows the detected water areas in Banskhali Sub-district, Chittagong District and Chakaria, Kutubdia, Maheshkhali and Cox Bazar II Sub-districts, Cox’s Bazar District, Chittagong Province, Bangladesh, on May 15, 2023, due to heavy rains and strong winds from Cyclone Mocha.

- **NUMBER OF DEATHS**: 0
- **EVACUATED PEOPLE**: 414,170
- **EVACUATED LIVESTOCK**: 23,027

Satellite Image: ALOS-2 PALSAR-2, Post-disaster: 15 May 2023

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GIS Data: Building and Road © OSM (2023) - Administrative Boundary © GAOM (2023)

Map product made by GIC-AIT (v1.0).

Disclaimer: The accuracy of this product is not validated.
Visit https://gis.bwdb.gov.bd for more info
Thank You