Flood Risk Management in Urban Areas: Concerning to Dhaka City

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Dhaka Water Supply & Sewerage Authority (DWASA)
A Brief on DWASA

1963: DWASA started its journey with the mandate to provide water supply, disposal of domestic and industrial sewerage, storm water drainage and solid waste management (EP Ordinance No. XIX, 1963). In spite of broad mandates DWASA mainly dealt with the water supply, treatment and disposal of sewerage since its inception.

1989: Storm Water Drainage was transferred to DWASA

1996: DWASA was reorganized to introduce Corporate management under WASA Act 1996 under which mandates for water supply, treatment and disposal of domestic and industrial sewage and storm water drainage were entrusted with DWASA. Till now Re-organization is only limited to the top management.
Brief on Dhaka City

Dhaka, the capital of Bangladesh is the center of all development activities of the whole country.

The Greater Dhaka city area (256 sq km) is bounded by the Balu River on the east, the Tongi Khal on the north, the Turag-Buriganga Rivers on the west and the on the south. Dhaka City Corporation (DCC) area, about 131 sq km, is the most densely populated (64,192 per sq km) and Population growth rate in is 4.65%

Usually average 2000 mm of rainfall a year in the city, 90% of which occurred during monsoon, June-October. Historic highest rainfall in Dhaka is 341 mm on 14 September, 2004,

Average temperature varies from about 20°C in December and January to about 30°C in April to September (maximum 38°C in April, 2014)
Geographical Location of Dhaka City
City Expansion (DMDP)

Present area: 256 sq km (350 sq km i/c DND)
Projected area in 2025: >1500 sq km

Present population: 10.9 mill
Projected population in 2025: >25 mill

More people and assets will be venerable to urban flood.

Water Supply, Sanitation and Drainage Problem will be the major issues.
Drainage System in Dhaka City

- Storm Sewer Line: 280 km
- Open Channel: 145 km
- Box Culvert: 10.5 km
- DCC tertiary Drains: anticipated about 1,200 km

3 Permanent Pumping Stations (P/S):
- Kallyanpur: 20 m$^3$/s
- Dholaikhal: 22 m$^3$/s
- Goranchatbari: 22 m$^3$/s

2 Permanent P/S is being constructed:
- Kamalapur: 15 m$^3$/s
- Rampura: 25 m$^3$/s

Temp Pumping Arrangement: 15 spot

Lakes:
- Gulshan, Banani, Dhanmondi, Uttara, Hatiljil, Cresent Lake,
Water Logging & Drainage Congestion in Dhaka City

Though Dhaka WASA is Mandated for drainage, Still a number of other Organizations are doing Drainage. They are: Dhaka City Corporation (DCC), BWDB, BIWTA, LGED, R & H and PWD.
### Urban Flood 2004
(September 13 to 16 )

<table>
<thead>
<tr>
<th>Date</th>
<th>Rainfall in September 2004 in mm</th>
<th>5 days Cumulative Rainfall in mm</th>
<th>Average Monthly Rainfall in September</th>
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<td>15th September</td>
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</table>
2004 Flood

- Eastern part suffered worst
- 40% of the city and habitats directly suffered
- Approximately 176,000 families and around 900,000 people were affected

- Causes
  - Inadequate drainage system
  - Insufficient pumping
  - Inadequate Interagency Cooperation
Tropical Rainfall Pattern

Frequent very high intensity rainfall

1-Day Maximum Rainfall
Natural drains-50 years back

Natural drains were intervened

Urbanization

Dhaka Drainage System
Impacts of Flood

- Damage to Water Supply, Sewerage, Drainage facilities and other Utilities
- Damage to City Roads
- Damage to dwelling houses
- Environmental Degradation
- Health and Sanitation Problem
- Disruption of Business and Commercial activities
- Damage to small & medium Industries
- Disruption of Communication
- Outbreak of water borne diseases
- Huge loss to economic activities
- Loss of livelihood of poor people
The World Bank Initiatives

Dhaka WASA is implementing a water Supply and Sanitation project with the financial support of the World Bank. The project has the following activities:

1) A Sewerage Master Plan for Dhaka city has already prepared.
2) A Drainage Master Plan for Dhaka city is being prepared (Draft final Report Submitted)
3) 2 large Pumping Stations are under construction.
4) 13 drainage canals has been rehabilitated.
5) Water supply to the Low Income Community.
Issues of Drainage Problems in Dhaka

Structural

- Increased Impervious Areas & Storm Runoff
- Encroachment of drainage canals, sedimentation.
- Land filling of low lying areas and ponds
- Inadequate Drainage Improvement
- Improper Road Drainage, Inlets and Manholes
- Clogging of Inlets by Solid Wastes
- Reduced Flow Capacity due to Sedimentation
- Blockage of Culverts and Drainage Outlets
- Improper Size of Road Crossing Culverts
Issues of Drainage Problems in Dhaka

Non-Structural

- Poor Public Awareness
- Inadequate Maintenance
- Fragmented Jurisdiction
- Inadequate Interagency Cooperation
- Non-integrated Urban Development Plan
- Inadequate Legislation and Enforcement
- Lack of Political Support
- Improper Solid Waste and Sewage Management
- Irregular Desludging of Septic Tanks
- Floodplain and Drainage Encroachment
- No Monitoring of Contractor’s Activities
- Lack of Training and Equipments
- Financial Constraints
Human intervention – a Major Challenge
Climate change is making weather less predictable, rains more uncertain and heavy storm rainfalls more likely. Heavy thunderstorm rains appear to have increased in frequency.

Urban areas may increase thunderstorm activity because the built-up surfaces attain higher temperatures than surrounding areas and create a local air circulation that produces an ‘urban heat island’.

Under changing climate the problem of urban flooding is likely to increase.
Large Scale Urbanization in Dhaka Area

- Rapidly growing mega-city
- Experienced major flooding in 1998 and 2004
- Eastern side of city most prone to flooding
Legislations & Policies

- Embankment and Drainage Act, 1952
- National Water Policy, 1999
- Water Supply and Sanitation Act, 1996
- Drainage Policy, 2006
- The Bangladesh Environment Conservation Act, 1995
- The Environment Court Act, 2000
- Open Space, Park and Natural Water Reservoir Conservation Act, 2000

Fragmented policies and Acts – needs integration
Institutional Setting – a major challenge

- Dhaka WASA
- Stormwater Drainage
- BWDB
- BIWTA
- Cantonment Board
- RAJUK
- DCC
- RHD
- DC office
- DoE
Organogram of DWASA
Climate Change Implications

The urban drainage infrastructure would be facing greater risk from more frequent and intense rainfall-runoff. The design and planning of drainage system needs to be reviewed. In Dhaka city about 12% increase of pump capacity and 7% increase of retarding ponds areas will be required by 2030. However, the change in the pattern and intensity of rainfall and runoff process in urban areas is yet to be fully understood. Collaboration between hydrological modellers and climate scientist is a prime requirement.

The urban areas will be more vulnerable to river floods
Urban Flood Mitigation Options

- Preservation of permeable areas,
- Preservation of natural water bodies,
- Injection into aquifer/groundwater recharge of rainfall runoff,
- Introducing permeable pavings,
- Construction of dry ponds etc.
- Optimizing minor and major urban drainage system (stormwater channels, culverts, pumps etc.) by modelling the drainage system
- Proper maintenance for preventing clogging of drainage facilities (cleaning, dredging, solid waste collection etc.)
- Detention and retention basins
- Rainwater harvesting
- Strict separation of sewage and stormwater drainage (discourage combined system)
- Protect potential contamination sources (sewage plants, landfills, patrol stations etc.) against floods
Integration of flood risks in urban planning

1. Delineation of risk zones
2. Definition of land-use for different risk zones
3. Implementation of land-use regulations through:
   • restrictive regulation (prohibitions, penalties, resettlement)
   • economic incentives (preferential taxation for desired land-uses, extra taxation for undesired land-use)
   • knowledge enhancement (communicating necessity for regulations, awareness campaigns)
   • public investment (purchase of property)

Source: WMO/GWP Associated Programme on Flood Management
Resilience measures

Improved flood drainage

Early warning system for urban floods

Risk mapping (Flood + Vulnerability mapping)

Building code / Land-use regulation based on risk mapping

Community awareness building

Follow up the Master Plan
Presently DWASA is in the process of finalizing a Drainage Master Plan for Dhaka city which addresses most the issues as discussed.

Based on the master plan immediate, medium-term and long-term measures (structural/non-structural) will be undertaken including some priority works.