Urban Flood Risk:
Stormwater + Floodplain = Flood Risk Management
Why Urban Flood Risk?

- Past Experiences
- Future Projections of Rainfall Events
- Urban Flood Risk is Connected to Riverine and Tidal/Storm Surge Flood Risks
- Lack of Lead Agency or Comprehensive Program
- Lack of Data and Integrated Models to Predict and Guide Planning and Engineering
- Disconnection between Stormwater Management and Floodplain Management Programs
Design storms are the events that engineers use to design drainage infrastructure, bridges, culverts, roads, etc.

The chart shows how rainfall amounts are projected to increase across the relevant design storms.

Today’s 100-year rain event (8 inches)
CLIMATE READY DC

Storm Surge

Sea Level Rise

- **2020s:** 2.4 inches
- **2050s:** 1.4 feet
- **2080s:** 3.4 feet

Source: USACE North Atlantic Coast Comprehensive Study map overlaid on GIS map base created by Kleinfelder, 2015.
Challenges in Managing DC Urban Flood Risk

Too many agencies, missions, programs…
Flood Inundation Mapping Tool

Depth: 18.09 – 20.09 ft
Lat: 38.90232192511065
Lon: -77.06095314813106

Nearest geolocated address:
3111 K St NW 20007
Washington
District of Columbia
Remove this marker.
2012 Bloomingdale Flooding

- Photo source unknown
  - 1st St NW

- Photo source unknown
  - Rhode Island & T St NW

- Photo courtesy of Greg Roberts
  - Rhode Island & 1st St NW

- Photo source unknown
  - Rhode Island Metro

- Photo courtesy of myfox.com
  - Rhode Island & T St NW

- Photo courtesy of myfox.com
  - Flagler St NW

- Photo source unknown
  - Rhode Island Between 1st & 2nd St NW

- Photo courtesy of huffingtonpost.com
  - 1st & V St NW
Mayor’s Task Force
Overview

4 storms caused major flooding: July 10, 18, 19 and Sept 2, 2012

Mayor formed Task Force in Aug 2012

Task Force report delivered end of Dec 2012

Over 25 Recommendations:

- Public Outreach
- Regulatory
- Code Changes
- Operations & Maintenance

Engineering Measures
- McMillan Stormwater Storage
- First Street Tunnel
- Northeast Boundary Tunnel (NEBT)
Mayor’s Task Force
Recommended Plan

1. SHORT-TERM (NOT ILLUSTRATED)
   - Construction of green infrastructure projects
   - Installation of storm drains and a five-foot-wide storm sewer
   - Backwater valve and rain barrel program

2. MEDIUM-TERM
   **IRVING STREET GREEN INFRASTRUCTURE PROJECT**
   - Construction of bioretention facilities along Irving Street NW
   - 0.4 million gallons. Completed

   **MCMILLAN STORMWATER STORAGE PROJECT**
   - Repurpose McMillan Sand Filtration cells as stormwater storage
   - In-line storage in a sewer that runs along First Street NW
   - 3.6 million gallons. Completed

   **FIRST STREET TUNNEL PROJECT**
   - Construction of a new tunnel under First Street NW
   - Construction of diversion facilities to divert flows to tunnel
   - 9 million gallons, Completion in Spring 2016

3. LONG-TERM
   **NORTHEAST BOUNDARY TUNNEL PROJECT**
   - A large, deep sewer tunnel that will increase the capacity of the sewer system to current design standards and control combined sewer overflow discharges to the Anacostia River
2006 Federal Triangle Flooding
2006 Federal Triangle Flooding

Constitution Avenue

Old Post Office Annex

12th Street Tunnel

National Archives
Federal Triangle Stormwater Study Working Group
What is the scope of the Stormwater Study?

In-depth analysis of the hydrologic conditions and sewer system capacity of the Federal Triangle watershed to predict flood risk areas. Information was collected on existing stormwater infrastructure in the study area. Five storm events of different intensities, (15 year, 50 year, 100 year, 200 year, and 500 year) were modeled to predict areas at risk of flooding.

Computer model of the surrounding area and the sewer system of the Federal Triangle drainage basin was created and calibrated using observed site conditions resulting from the 2006 flood. The calibrated model was then used to understand the performance of the stormwater sewer system in the study area under varying storm conditions.

Estimates of the direct costs and benefits for each of the alternatives listed below.

Identification and analysis of the viability of six structural alternative approaches to mitigate interior drainage flooding, specifically for a 50 year, 100 year, and 200 year storm event, on an area-wide basis.

1. Capturing stormwater in the upstream watershed through low impact development (LID), such as green roofs and bioswales.
2. Stormwater storage upstream of the study area in the watershed.
3. Utilizing the 48 inch gravity condensate line at Constitution Avenue.
4. Providing stormwater storage beneath the National Mall.
5. Providing a pumping station on the National Mall.
6. Constructing a new sewer tunnel to the Main and O Street Pumping Station Complex.
Since 2006 Federal Triangle Flooding

National Archives

Federal Triangle Metro Station

National Gallery of Art

Proposed Ideas

Levees along the Potomac prevent the Potomac from over flowing and flooding the National Mall and Tidal Basin.

Retention areas created at natural low points around the monuments capture and store rainwater run-off during a storm.

After the storm passes water can slowly be fed through underground pipes, filtered naturally by wetlands and into the Potomac.

Turbines powered by the moving water generate electricity helping keep emergency lights on during and after the storm.
Closing Gap between Stormwater Management and Floodplain Management

- **Comprehensive Flood Risk Management Program**
  - Centralize flood risk management program
  - Define, map, and regulate flood risk management areas

- **Municipal Separate Storm Sewer System (MS4) Permit (DRAFT)**
  - Review development in floodplain within MS4 to ensure that the site is reasonably protected from flooding and that the construction minimizes the impact of water quality of receiving water bodies caused by a flood event
  - Review development within MS4 to assess effects on flood storage or carrying potential of encroachment, alteration or improvement to any water bodies
  - Continue co-leading and supporting the Silver Jackets interagency flood risk management coordination team to ensure that the flood management projects are effectively operated and maintained in MS4 and to build public awareness of the impact of flooding on the water quality of receiving water bodies
  - Collaborate with stakeholders in developing and implementing flood management projects in areas of known flood hazard, including implementing green infrastructure along with other control measures and coordinating with neighboring jurisdictions to explore a watershed-wide approach in stormwater and flood management within MS4
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