Utilizing Floodplain Management to Enhance Resiliency in Baltimore City

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Overview

- Climate Change
- Hazards
- DP3 Development
- Floodplain
- Our Projects
- Preparedness
Quick Review of Hazards

Coastal Storms
- more severe

Floods
- more extensive

Severe Thunderstorms
- more severe

Wind
- increase intensity

Winter Storms
- less snow, more flooding

Extreme Heat/Drought
- more severe and intense

Sea Level Rise
- increased threat

Air Quality
- lower quality and increase risk
Precipitation Variability

Percentage Change in Very Heavy Precipitation

Percentage Change

- 0-10
- 10-20
- 20-30
- 30-40
- 40-50
- >60

Examples:

- 7%
- 12%
- 19%
- 21%
- 26%
- 36%
- 45%
- 74%
Coastal Storms

There has been a substantial increase in hurricane activity in the Atlantic since the 1970’s.

Recent Tropical Storms/Hurricanes impacting Baltimore:
- 2013 Hurricane Sandy
- 2011 Tropical Storm Lee
- 2011 Hurricane Irene
- 2006 Tropical Storm Ernesto
- 2003 Hurricane Isabel
• Baltimore is expected to experience 1.5 to 3 feet (conservative numbers) of additional sea level rise in the next 50 years.

• We are expected to go from 17 tidal flooding events per year to 227 tidal flooding events per year by 2045
Baltimore’s Unique Approach

All Hazard Mitigation Plan
(Current and Historical Hazards)

+  =  Resilience

Climate Adaptation Plan
(Adapt to new and predicted climate conditions)
Risk Assessment

Hazard Identification
- Hazard Identification
- Review Historical Impacts
- Conduct an Asset Inventory

Vulnerability Assessment
- Determine likelihood
- Determine economic, social, legal & environmental consequence

Impacts Assessment
- HAZUS Modeling
- Integrate projected climate conditions
- Identify weaknesses

Plan Development
- Vision, Goals, Strategies, Actions
- Prioritization
- Integration
- Plan for implementation & monitoring
Community Engagement

Small Staff Trainings and Community Meetings

Large Town Halls and Interactive Community Meetings
Disaster Preparedness Plan

Adopted unanimously in October, 2013

STORMWATER

IN-16 Enhance and expand stormwater infrastructure and systems

Future changes in precipitation frequency and intensity may require reconsideration of the design of existing stormwater infrastructure systems. Increase resiliency and disaster prevention measures related to stormwater systems by enhancing drainage systems in stream corridors and improving and repairing stormwater conveyance pipes and outfalls.

1. Implement the requirements of Baltimore’s MS4 (separate stormwater and sewer system) permit (5).

The City of Baltimore operates under a Municipal Separate Stormwater and Sewer System (MS4) permit, which protects water quality and requires that Baltimore prevents pollution as much as possible. It is critical that the requirements of these permits are fully met.

2. Prioritize storm drain upgrades and replacement in areas with reoccurring flooding (5).

While proximity to a floodplain or floodway can increase vulnerability to flooding, certain measures can reduce this vulnerability. Inadequate or older pipes, which cannot accommodate the excessive amounts of stormwater, should be upgraded so as to handle extreme rainfall and storm surge events.

3. Install backflow-prevention devices or other appropriate technology along waterfront to reduce flood risk (M-4).

Backflow-prevention devices are used to ensure that water does not flow back through drainage infrastructure. Through the installation of backflow-prevention devices, the City can improve the performance of the drainage network and prevent risk of flooding impact along the waterfront.

4. Preserve and protect natural drainage corridors (5).

It is important to utilize natural drainage corridors and green infrastructure to capture more stormwater runoff and enhance the ability of the existing infrastructure to cope with environmental changes.
National Flood Insurance Program (NFIP)
The U.S. Congress established the NFIP on August 1, 1968, with the passage of the National Flood Insurance Act of 1968. This program:

• Aims to reduce the impact of flooding on private and public structures.
• Provides affordable insurance by encouraging communities to adopt and enforce floodplain management regulations.
• Utilizes floodplain management regulations to reduce the socio-economic impacts of flooding
Types of Flooding in Baltimore

Tidal (Coastal)
Flooding issues related to coastal storms, hurricanes, tropical storms, and storm surge.

Non-Tidal (Riverine)
Flooding issues related to heavy precipitation events. Flash flooding is major concern.
DP3 Flood-Related Goals & Strategies

**Goal 6** - Become a Community Rating System (CRS) classified community

**IN-17**: Modify urban landscaping requirements and increase permeable surfaces to reduce stormwater runoff

**BL-2**: Enhance City building codes that regulate building within a floodplain or near waterfront

**BL-3**: Strengthen City zoning floodplain and construction codes to integrate anticipated changes in climate

**BL-7**: Retrofit existing buildings in the designated Flood Area to increase resiliency

**NS-1**: Utilize green corridors and parks to help protect surrounding communities from the impacts of hazard events

**PS-9**: Improve awareness and education about the importance of flood insurance and preparation for citizens
Floodplain Modeling

Modeling that looks at the 100-year and 500-year storm with Sea Level Rise

As you can see, our entire waterfront is almost completely inundated.
Floodplain Regulation

Understanding Height and Freeboard

Base Flood Elevation (BFE)
(predicted height water will rise during 100-year flood)

2 ft Freeboard

Design Flood Elevation (DFE)
(the BFE plus the 2 foot freeboard)

Land Surface
Floodplain Regulation

• The City of Baltimore regulates to the height and extent of the 500-year flood in tidal areas

In non-tidal areas, the City regulates to the height of the 100-year flood and to the extent of the 500-year flood
Floodplain Regulation

Understanding Extent of Regulated Floodplain

Baltimore Regulates both the 100-year and 500-year floodplain

Light Blue - Flood Resilience Area (FRA) 500 year Floodplain

Dark Blue - 100 year Floodplain
Flood Resilience Area

Higher of Base Flood Elevation or Stillwater 500

(g) **Flood Resilience Area.**

(1) The Flood Resilience Area comprises those lands within a tidal floodplain that:
   (i) due to hurricanes, tropical storms, and the rising Bay are subject to a 0.2% chance of flooding in any given year; and
   (ii) lie in areas where detailed study data are available.

(2) The Flood Resilience Area appears:
   (i) on the Flood Insurance Rate Map, as that part of the tidal floodplain that is designated Zone X (“areas of 0.2% annual chance flood”); and
   (ii) in the Flood Insurance Study’s Table 4 {“Transect Data”}, under the column heading “0.2% annual chance”.

<table>
<thead>
<tr>
<th>Flood Source</th>
<th>Transect</th>
<th>Coordinates</th>
<th>Significant Wave Height $H_b$ (ft)</th>
<th>Peak Wave Period $T_p$ (sec)</th>
<th>1% Annual Chance</th>
<th>2% Annual Chance</th>
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Flood Design Class of Buildings and Structures

Flood Design Class | Minimum Elevation, Relative to Base Flood Elevation (BFE) or Design Flood Elevation (DFE)
---|---
I (Ag, storage, temp) | DFE
II (Non-III, IV) | BFE + 1 ft or DFE, whichever is higher
III (300 people +) | BFE + 1 ft or DFE, whichever is higher
IV (Critical Facilities) | BFE + 2 ft or DFE, or 500-year flood elevation, whichever is higher
Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements.

By regulating to these higher standards, the City of Baltimore helps support safe and smart development.

Moreover, meeting and exceeding the NFIP standards allows the City of Baltimore to help policy holders receive discounts on their insurance rates.
The Program for Public Information (PPI) is a coordinated flood hazard outreach effort to improve communication with stakeholders, and provide information on:

- flood hazard,
- flood safety,
- flood insurance and ways to protect property, and
- natural floodplain functions

The PPI was developed to identify strategies to targeted audiences and efficiently use resources and improve communications.
Stormwater Management

Resiliency & Restoration

• Stream Restoration
• Stormwater Capture Systems
• Impervious Surface Removal
• Erosion Control
• DAMS
• Wastewater Treatment Plants
• Blue Alley Projects
• Replace and upgrade pipes
• GGI
Large mitigation options

**Flood doors and/or gates**

**Flood walls/barriers**
Upcoming projects

**Historic Considerations**
- Inventory of all historic structures in SFHA
- Develop a guide/toolkit for retrofitting
- Provide mitigation options to developers

**Floodplain trainings and design manual**
- Urban area focus
- Our housing typology
- Staff and developer trainings
Preparedness: Make a Plan, Build a Kit, Help Each Other
Questions?

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