Tools for Flood Risk Management & Increased Resiliency

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Background

• Climate Change Induced Flooding is Increasing

• How to Decrease Risk and Increase Resiliency?

• Tools:
  - Identify the Problem
    • Visualization
  - Assess the Problem
    • Audits
  - Prepare for Storm
    • Dashboards
  - Implement Solutions
    • Active Control
Identify the Problem:
Modeling and Data Visualizations
Tool #1: TIDEGateway

- Geospatial Analysis Tool
  - Climate change resiliency planning
    - Sea level rise scenarios
    - Storm surge scenarios
    - Upland storm event scenarios
  - Ecological restoration planning
    - Where is restoration feasible... Without increased flood risk?
Select flood condition and optional sea level rise to visualize impacts.

Coastal Storm Surge:
- MHHW
- 2-yr flood
- 10-yr flood
- 25-yr flood
- 50-yr flood
- 100-yr flood

Sea Level Rise (ft):
Select a sea level rise condition in feet above Mean Higher High Water (MHHW)
- MHHW
- +1
- +2
- +3
- +4
- +5
- +6

I want to...
EASTHAM-02 IMPACT ANALYSIS
Surge 10yr; SLR 0
Total Flood: 20.92 ac
Flooded Wetland: 16.31 ac
Structures: 2
EASTHAM-02 IMPACT ANALYSIS
Surge 10yr; SLR 1
Total Flood: 23.71 ac
Flooded Wetland: 16.56 ac
Structures: 3
EASTHAM-02 IMPACT ANALYSIS
Surge 10yr; SLR 3
Total Flood: 25.84 ac
Flooded Wetland: 16.63 ac
Structures: 6
EASTHAM-02 IMPACT ANALYSIS
Surge 10yr; SLR 3
Total Flood: 25.84 ac
Flooded Wetland: 16.63 ac
Structures: 6
Identify the Problem: Takeaways

- **Scenario Driven Modeling Results**
  - Understanding the risk

- **Findings Shareable Via Web (Secure or Public)**

- **Interact and Visualize Scenarios**
  - Visualizing the risk
Assess the Problem:
Hyper-Localized Resiliency Audits
Tool #2: Resiliency Audits

• **Purpose:**
  – Identify potential flood risk and flood vulnerabilities

• **Modeling:**
  – Estimate localized flooding elevations under different rainfall, tidal and surge conditions

• **Site Audit:**
  – Field assessment to identify measures which may mitigate risk

Superstorm Sandy business recovery program managed by NYC EDC
Assessing Exterior Vulnerabilities

Superstorm Sandy
High Water Mark
Assessing Interior Vulnerabilities

Seepage
Data-Driven Reports & Recommendations

Flood Resiliency Audit Form
Sample Company Audited: XX/XX/20XX

2. Vulnerability: In an expansion of the definition of a structure, it is considered to have vulnerabilities.

- Steel door at northern building interior

3. Potential Sources:
- Inundation:
  - Flood risk for each flood event is calculated.
  - The most effective flood protection method is floodproofing.
  - Annualized risk is calculated for any major vulnerabilities.

Refer to the attached photos for visual confirmation.
Assess the Problem: Takeaways

- **Location Specific Resiliency Assessments**
  - Engage, inform, & empower owners

- **Data Collection via. Web-Based Forms**

- **Auto Generated Reports**
  - Modeling Results & Expected Risk
  - Identified Vulnerabilities
  - Recommendations & Fact Sheets
Prepare & Increase Resilience: Resiliency Dashboards
Tool #3: Flood Resiliency Dashboards

Link to Site-Specific Resiliency Dashboards

Site Locations
Resiliency Dashboards

Forested Flood Inundation & System Statuses

Forecasted Site Inundation Depth
“UNKNOWN” status indicates data is unavailable or forecasted precipitation and tide are below modeled thresholds.

Current Flood Advisory System Statuses
“OFFLINE” indicates that one or more datastream has been offline in the past 48 hours which might impact computation of site-specific flood information.

Color-coded locations by estimated flood inundation depth

Color-coded locations by estimated flood risk

Radar

How Much Rain is in the Forecast?
This chart shows the expected probability and quantity of rainfall in the next 48 hours (source: weather.gov).

Radar and Precipitation Forecast
Resiliency Network Dashboards

What's My Expected Flood Depth?
This table shows the maximum predicted level and timing of flooding over the next 48 hours as referenced to the lowest point on the property "Site Zone" and just below the first floor of the building "Building Zone" (Null value if data unavailable or forecast tide and precipitation are below modeled thresholds).

Building Zone (ft)
03/05/2018 14:20
0.0

Site Zone (ft)
03/05/2018 14:20
0.0

What's My Expected Flood Elevation?
This chart shows a continuous time-series of the potential flood elevation at the property as it relates to the elevation of the "Site Zone" and "Building Zone."

Estimated Flood Inundation Depth
Flood Elevation Graph
Estimated Flood Risk Indicator
Resiliency Network Dashboards

Current and Predicted Tides

Links to Reports

Emergency Resources

What are the Current and Predicted Tide Levels?

This chart displays the forecast storm tide levels. The storm tide includes two components: 1) Astronomical tide (i.e., caused by the moon), and 2) Storm Surge (http://hudson.dl.stevens-tech.edu/SFAS/)

Current: 4.33 ft NAVD88
Predicted: 4.66 ft NAVD88

Resources

Below is a listing of resources to help increase future preparedness and resiliency:

Flood Resiliency Audit
- Resiliency Audit
- Flood Proofing Fact Sheets

Emergency Resources
- City Wide Emergency Notification Sites
  - CorpNet
  - Know Your Zone
  - Corporate Emergency Access System
  - Ready New York for Business
  - NYCOEM Twitter
- Department of Small Business Services
  - Call SBS Emergency Response Services at (212) 618-8810
- Other Resources
  - SBA Business Preparedness
  - Insurance Institute for Business and Home Safety
Prepare for Storm: Takeaways

• Real-time estimates of flooding risk (including timing)

• Actions can be taken to prepare for storm & increase resiliency

• Empowers owners & heightens overall community awareness
Implementing Solutions: Active Management & Control
Tool #4: Active Controls

- **Case Study: Curtiss Pond, Minnesota**
- **Goal**
  - Increase Efficiency of Pond through retrofit with Continuous Monitoring and Control
- **Benefits**
  - Minimize Flooding & Reduce Site Risk
  - Intelligent Infiltration
  - Minimal Maintenance
  - Remote Monitoring & Programming
Site Overview

- Control Panel
- Access to Infiltration Gallery
- Existing Manhole
- Pond
Site Overview
Electrical Panel
Manhole with Equipment

- Overflow Weir
- Level Sensor
- Actuator
How Does it Work?

Opti

- Cloud-native platform that uses sensor data, forecast information, & modeling to actively control and/or maintain/monitor water infrastructure.
Traditional Infrastructure

- Stormwater runoff is managed with passive infrastructure designed for a single purpose and design storm

- Performance and maintenance needs of stormwater infrastructure are manually calculated or unknown

*Image Courtesy of OptiRTC*
Continuous Monitoring & Adaptive Control

$Q_{\text{out}} = 0$

Stormwater Infrastructure

*Image Courtesy of OptiRTC*
Control Dashboard Visualization

Pond drained before Storm (~10,000-CF Drained)

Pre-Storm

Forecast Rain of Over 1 Inch
Control Dashboard Visualization

Overflow Capacity Reached

8' depth reached! (Max = ~10')

Capacity regained

Post-Storm
Dearborn Homes: Chicago Housing Authority Sponsored by MWRD
Dearborn Homes – Spring 2018
Retrofit with real time control

Underground storage

Modified Restrictor
Solution Implementation: Takeaways

• Optimize Performance of Traditional Infrastructure

• Minimize Potential Flooding and Site Risk

• Remote Monitoring & Programming