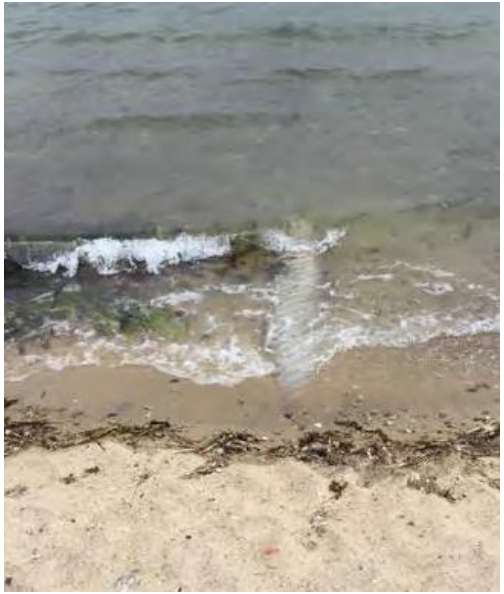
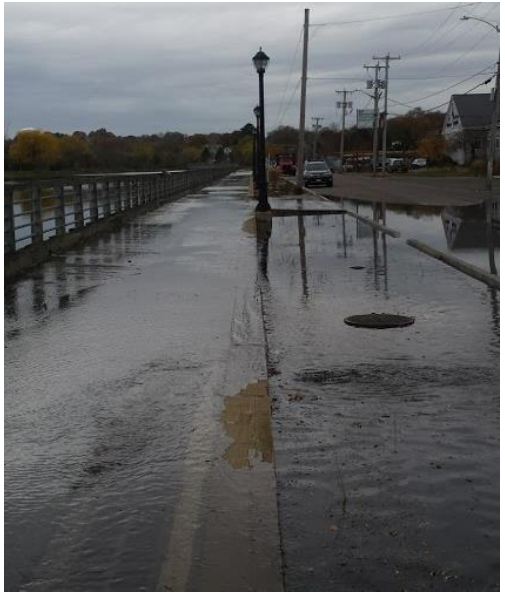
Climate Change Impacts on Stormwater Infrastructure





Cristina Kennedy, Coastal Habitat & Water Quality Specialist
MA Office of Coastal Zone Management
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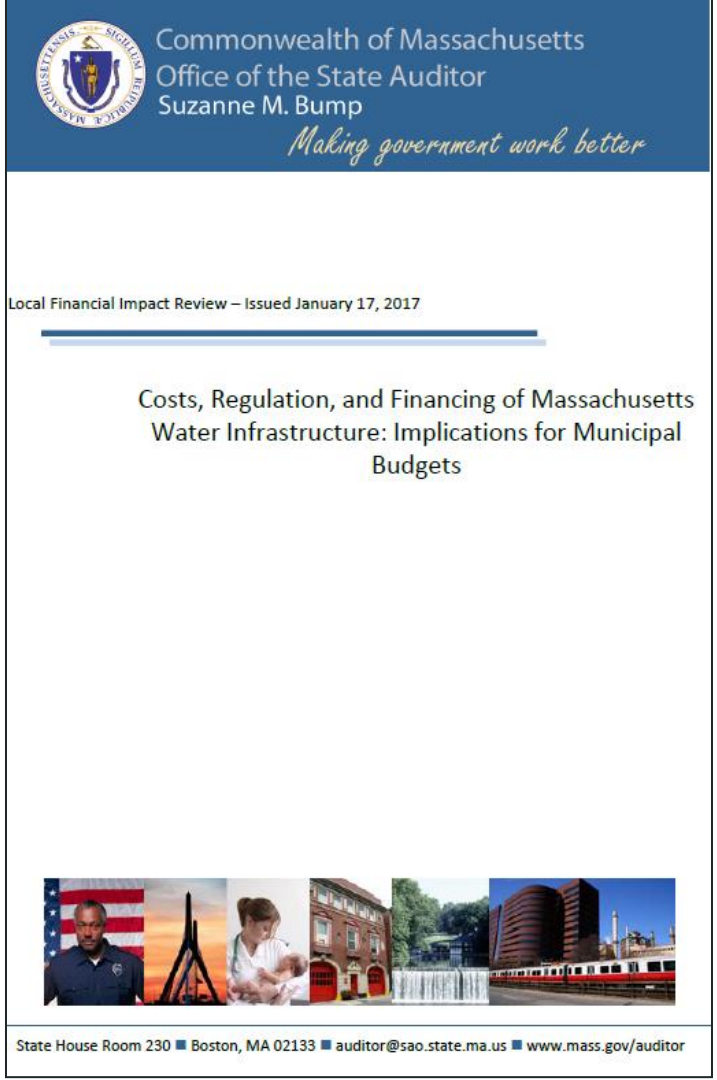
MA Water Resources Commission
January 11, 2018

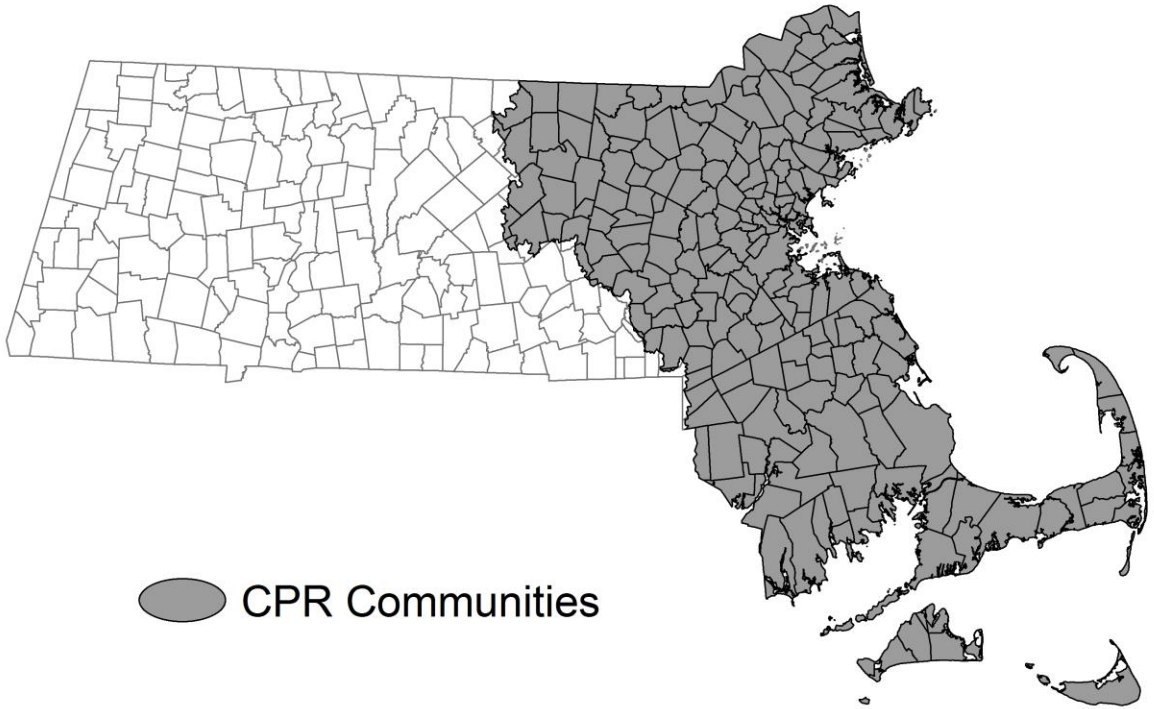
MA State Auditor's Report 2017

- $1.58 billion on SW in next 20 years
- Need to incentivize green infrastructure
- Communities were not focused on vulnerabilities to climate change
- Communities reported a low rate of adoption of innovative technologies that reduce cost and increase efficiency

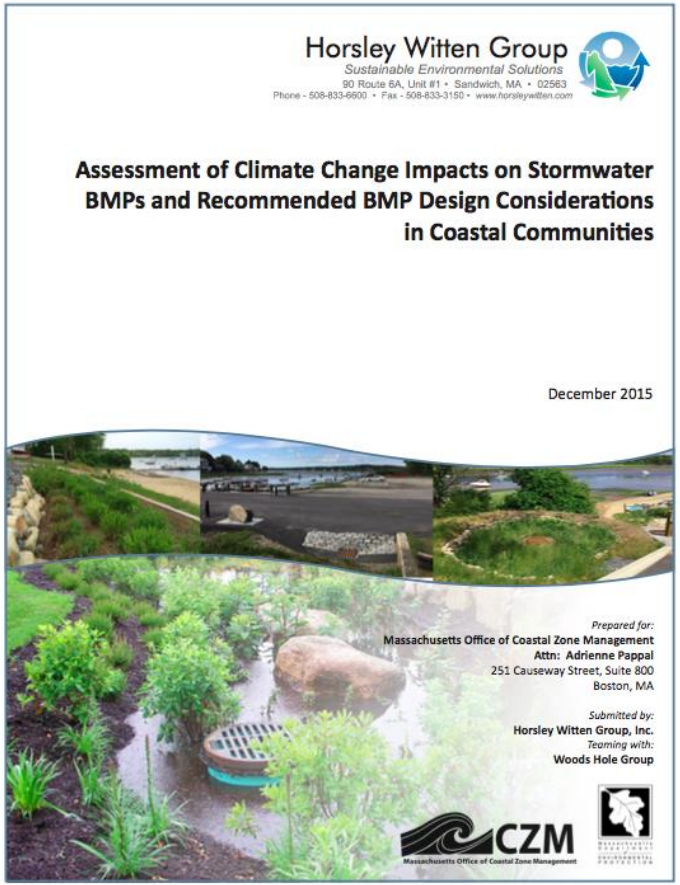


Coastal Pollutant Remediation (CPR) Grant Program

- Coastal Habitat and Water Quality
- Assessment, Design and Construction of SW BMPs
- Role of climate change for coastal BMPs?



https://www.mass.gov/service-details/coastal-pollutant-remediation-cpr-grant-program

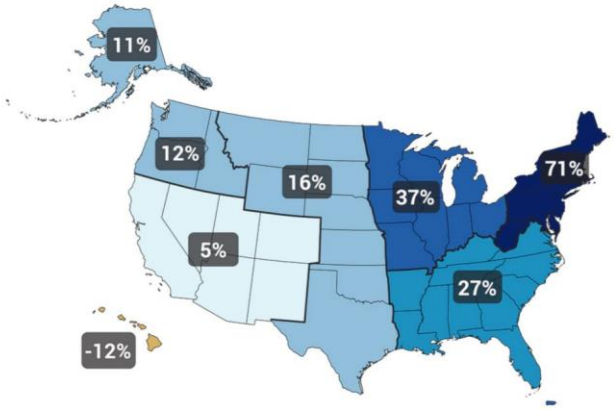


Assessment of Climate Change Impacts on Stormwater BMPs and Recommended BMP Design Considerations in Coastal Communities

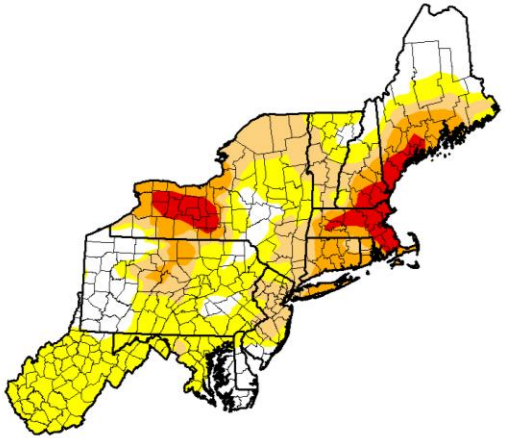
Report available at: https://www.mass.gov/service-details/report-on-climate-change-impacts-to-coastal-stormwater-treatment-systems

Climate Change Impacts

Precipitation and Drought

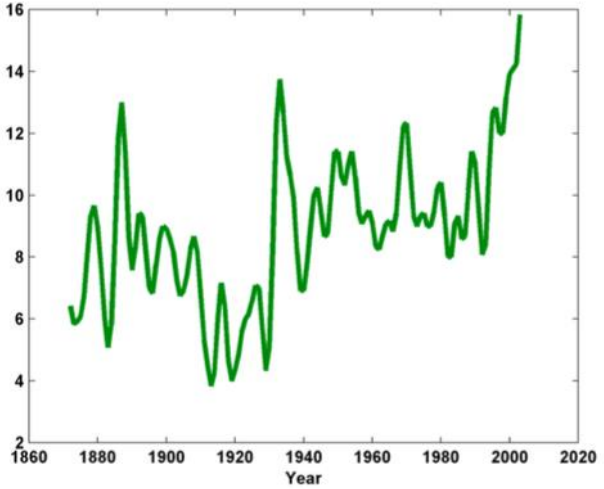


1958-2012
Heavy downpours % increase
Karl *et al*. 2009



September 2016
NE drought conditions
US Drought Monitor

Hurricanes

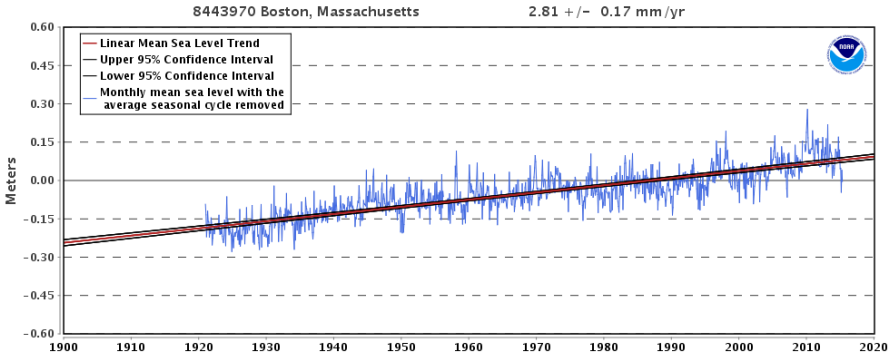


Annual number of hurricanes

Emanuel 2005

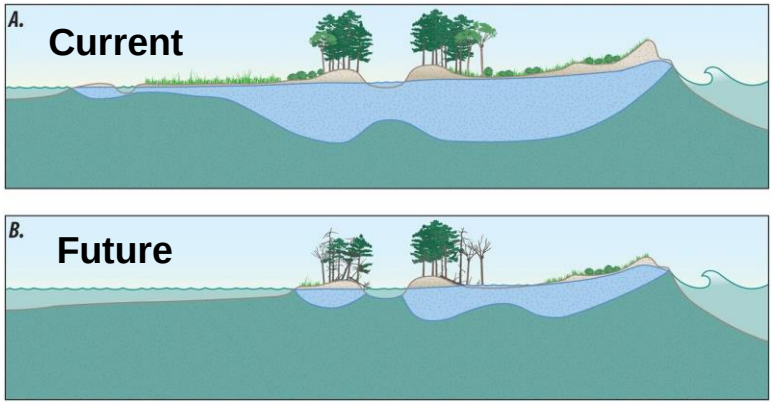
Climate Change Impacts

Sea Level Rise



Boston Mean Sea Level (meters) 1900-2013

Groundwater Elevation



Masterson *et al.* 2014

Field Assessments

- 26 BMPs evaluated in spring 2015

- Both green and grey infrastructure

BMP Vulnerabilities to Climate Change

Rising sea level and submerged outfalls

Rising groundwater and shrinking separation distances

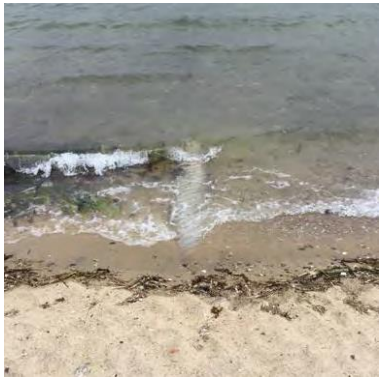
Physical impact of storm surge inundation

Increased flooding and drought

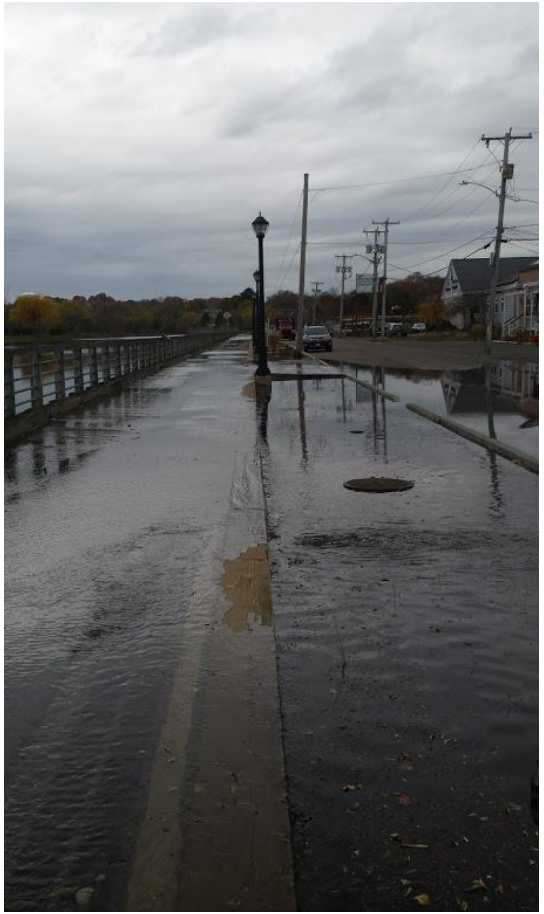
Chronic wind, sand and salt exposure

Clogged inlet

Invasives species



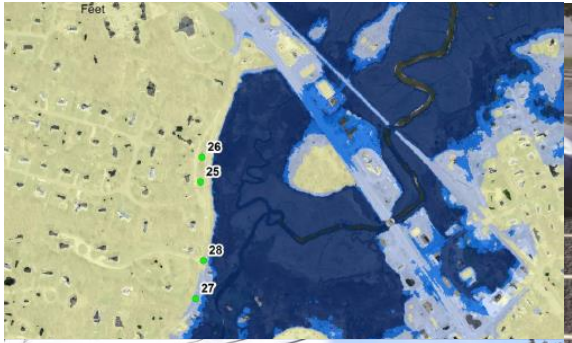
Submerged outfall



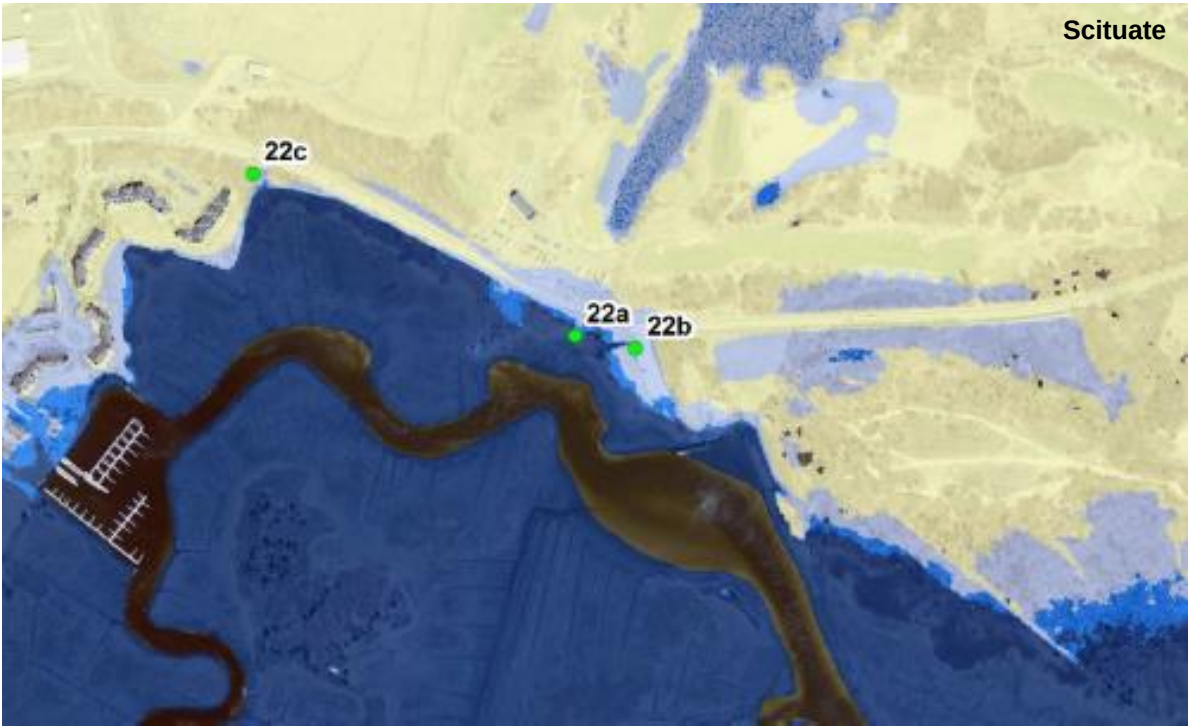
Flooded rain garden

Design Recommendations

- Using a 50-year planning horizon
- Proper siting of practices
- Selecting appropriate practices and materials
- Ensuring redundancy and flexibility in design
- Choosing “green” over “grey”
- The importance of maintenance



Using a 50-year planning horizon



100 Year Storm Flood Risk Projections

LiDAR Elevations (Feet)

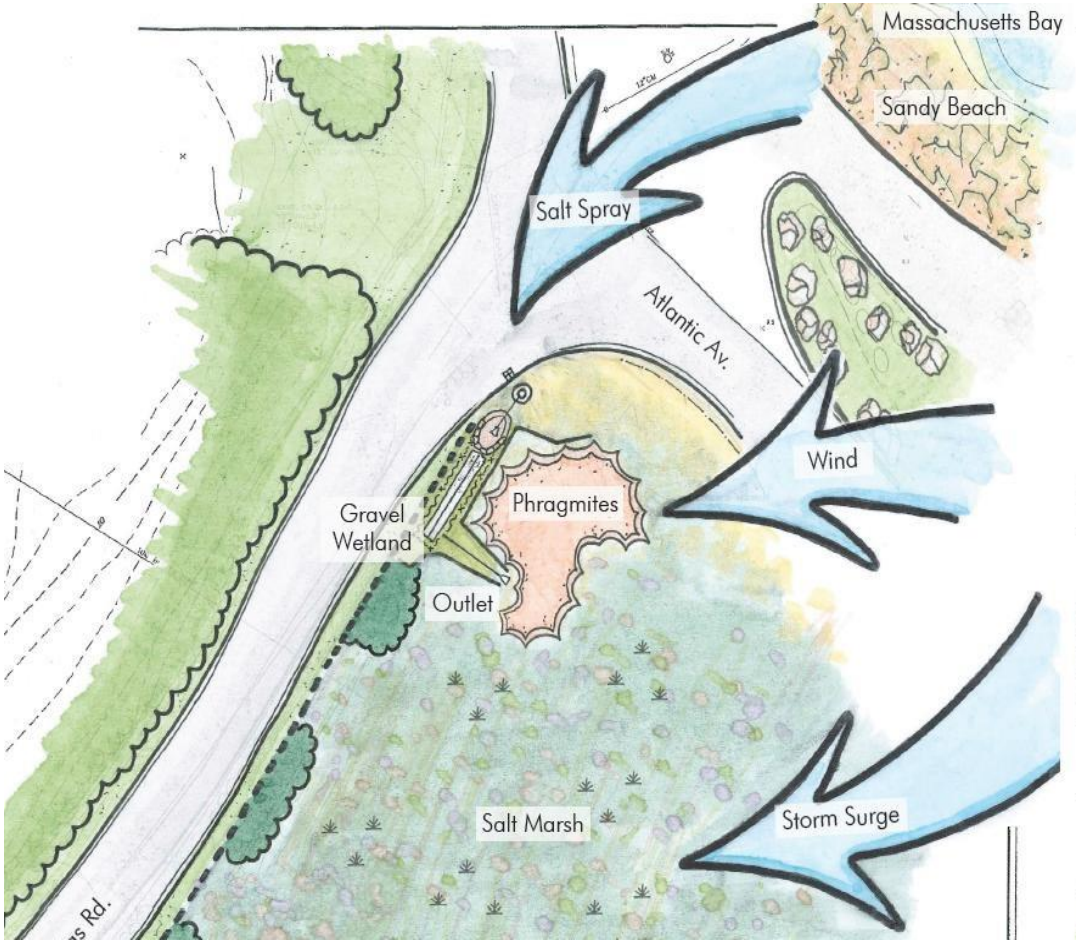
- **< 8.2: flooded in the present**
- **< 8.2 – 9.3: flooded by 2030**
- **< 9.3 – 12.8: flooded by 2070**
- **> 12.8 Dry**

Projections based on model results from Bosma *et al.* 2015

Proper siting of practices

Sites 8 & 9, Cohasset

Selecting appropriate materials



Site 1, Cohasset

Selecting appropriate practices

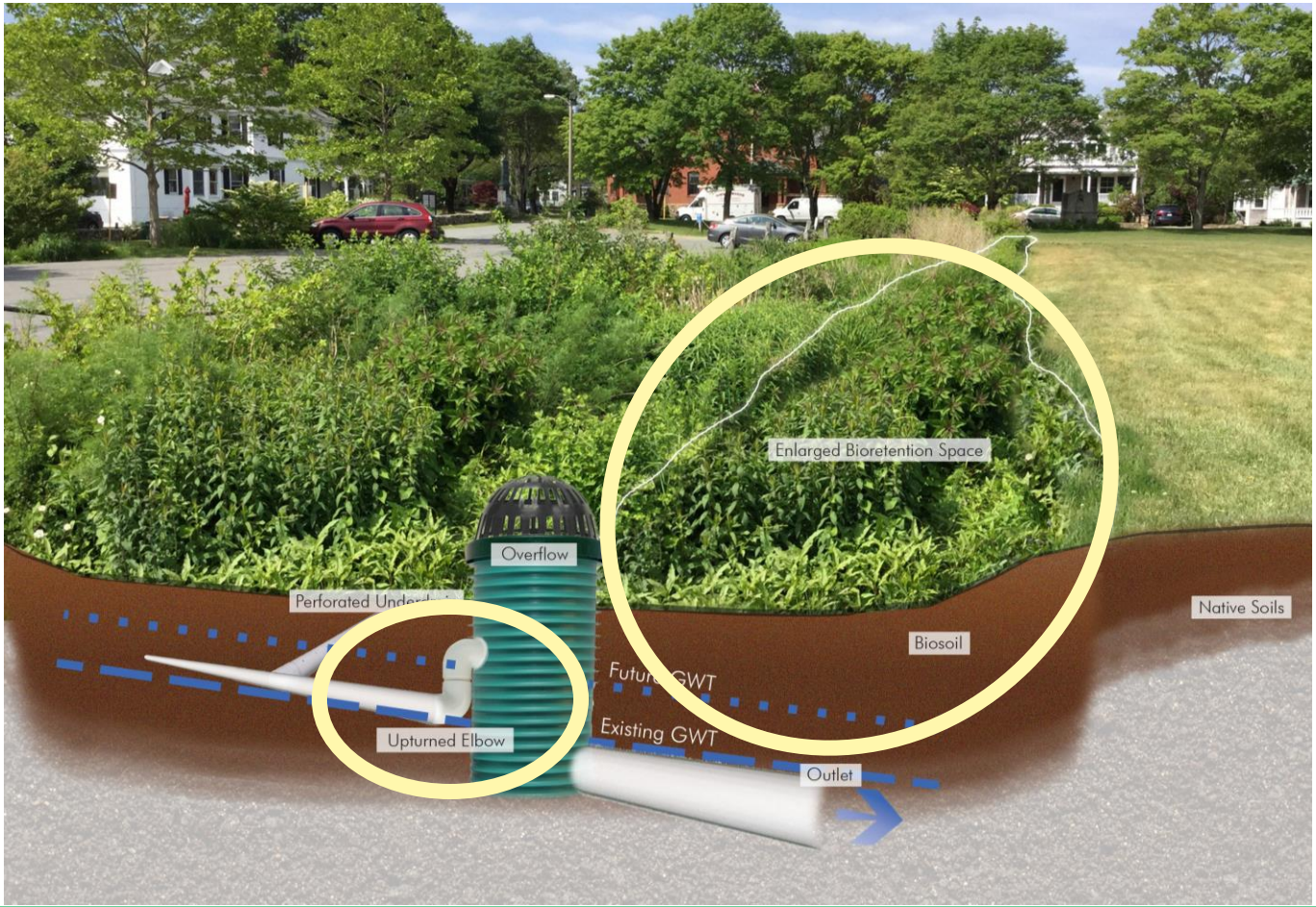
Underground infiltration chambers

Image Source: Cultech

Choosing “green” over “grey”

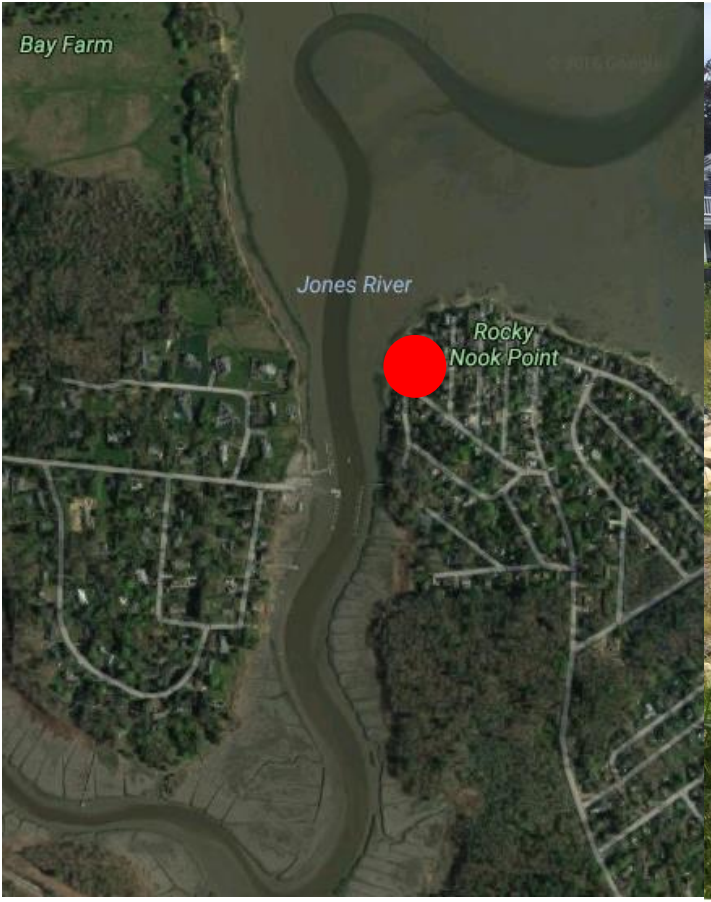
Site 32, Bourne

Ensuring redundancy and flexibility in design



Site 31, Marion

The even greater importance of maintenance



Site 34, Kingston

Conclusions

Common sense, practical guidelines

The future is now

Guidance in sw management

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Tools for Implementation

BMP Selection

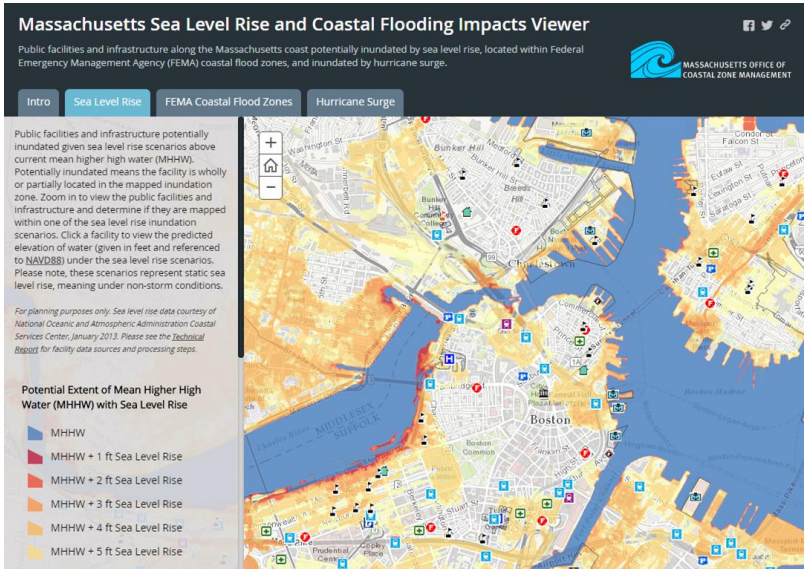
- BSWC Stormwater Best Management Practices: Guidance Documents (urban focus)
- http://www.bwsc.org/ABOUT_BWSC/systems/stormwater_mgt/Stormwater%20BMP%20Guidance_2013.pdf
- EPA and MassBays Green Infrastructure Handbook: http://www.mass.gov/eea/docs/mbp/publications/massbays-green-infrastructure-handbook.pdf

Landscaping Tips

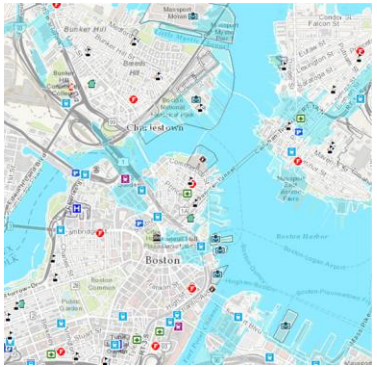
- http://www.mass.gov/eea/agencies/czm/program-areas/stormsmart-coasts/coastal-landscaping/tips.html
- http://ag.umass.edu/landscape/fact-sheets

BMP Coastal Siting

- CZM Sea Level Rise Viewer: http://www.mass.gov/eea/agencies/czm/program-areas/stormsmart-coasts/flooding-impacts-viewer/
- CZM's MORIS: http://www.mass.gov/eea/agencies/czm/program-areas/mapping-and-data-management/moris/
- NOAA's Digital Coast: https://coast.noaa.gov/digitalcoast/topics/coastal-storms.html



CZM Sea Level Rise Viewer



FEMA Flood Zones

Hurricane Surge

References

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