



MWRA's Pragmatic Approach to Climate Change Adaptation

Stephen Estes-Smargiassi
Director of Planning

Wastewater Advisory Committee
March 7, 2014



Two Pronged Approach to a Long Term Concern

- **Adaptation:**
 - Understand the Potential Impacts
 - Mitigate Impacts
 - Create Resiliency
- **Mitigation:**
 - Reduce Greenhouse Gases
 - Contribute to the Common Good

 - Reduce Costs
 - Improve Environmental Footprint
 - Improve Public Perception



Our Mission in Short

- Adequate, Reliable Supply of High Quality Drinking Water
- Environmentally Responsible Collection, Treatment and Disposal of Wastewater

- **Drink with Confidence**
- **Flush with Pride**

- **All Accomplished Affordably**

- **Under All Circumstances**



Adaptation For Sea Level Rise In The Design of Deer Island WWTP





Adaptation For Sea Level Rise In The Design of Deer Island

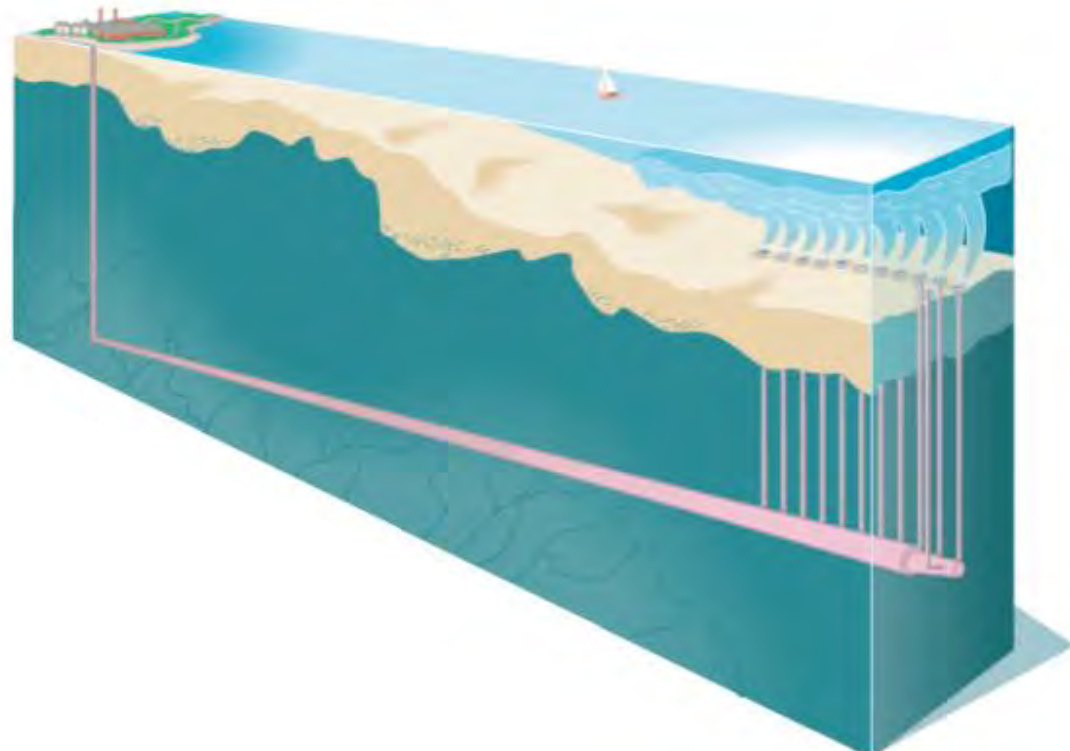
- Deer Island plant fully protected
 - 100-year flood
 - 1.9-foot sea level rise
 - Wave runup of 14 feet on east side and 2 feet on west side
- On-site power plant ensures uninterrupted power supply
- Nut Island Headworks in Quincy similarly designed for sea level rise





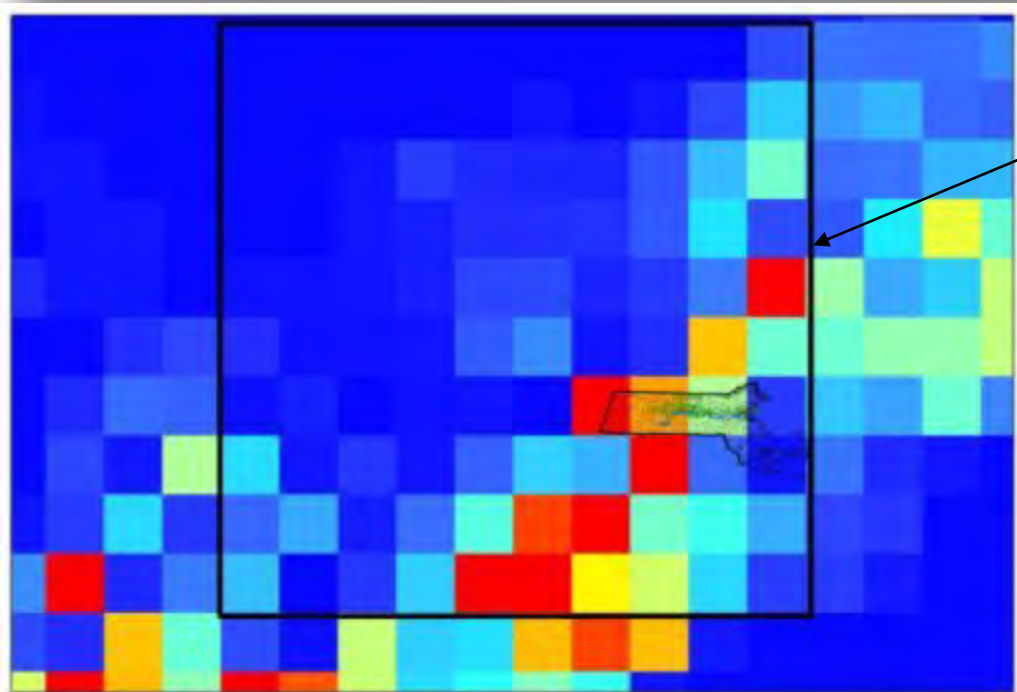
A Rising Sea Impacts The Hydraulics Of The Outfall Tunnel

- The effluent from the sewage treatment plant is discharged by gravity to the 9.5 mile
- To maintain hydraulic capacity,
 - Plant raised 1.9 feet in elevation
 - tunnel diameter was up-sized from 24 feet to 24.25 feet

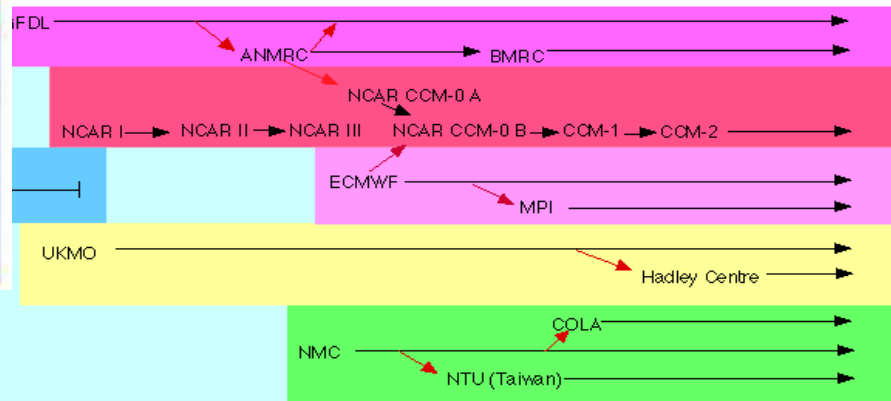




Over time, more models and finer resolution – make use of the additional detail

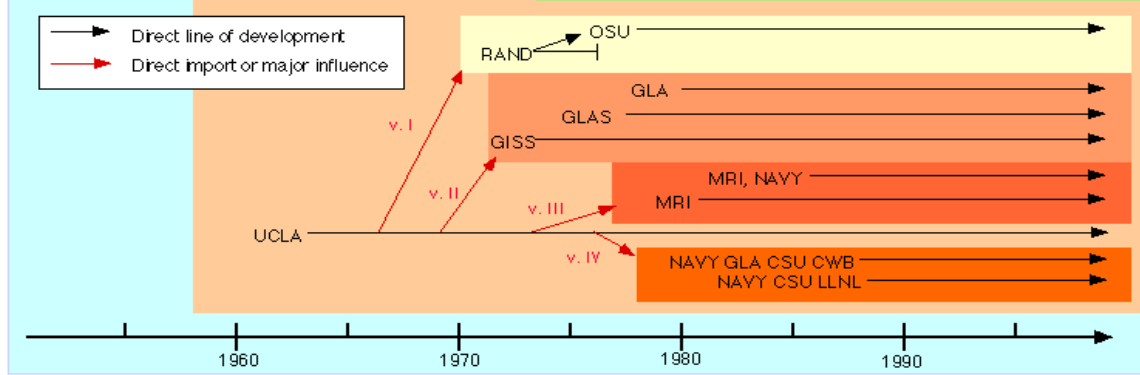


Old grid size



The GCM Family Tree

→ Direct line of development
→ Direct import or major influence



GCM computational cells color coded by predicted precipitation: Source: NCAR



Large Reservoir to Yield + More Precipitation = Plenty of High Quality Water





Drinking Water System Is In Good Shape

- Quabbin Reservoir, Belchertown
 - 65 miles west of Boston
 - Elevation 528 feet
- Wachusett Reservoir, Clinton
 - 35 miles west of Boston
 - Elevation 395 feet
- Water treatment plant is in Marlborough
- 85% of water delivered by gravity
- Lowest elevation of a water tank is 192 feet above sea level





Water System Not Threatened by More Intense Storms

- All MWRA dams, dikes, spillways and appurtenances are inspected routinely by licensed dam safety engineers and are in good condition.
- Since 2006, MWRA has spent over \$21 million on dam safety projects.
- Quabbin and Wachusett spillways have been improved to be able to discharge the probable maximum flood (1 in 1000 years).
- All drinking water pump stations and storage tanks above flooding elevation.



Examples of Dam Improvements Wachusett New Crest Gate

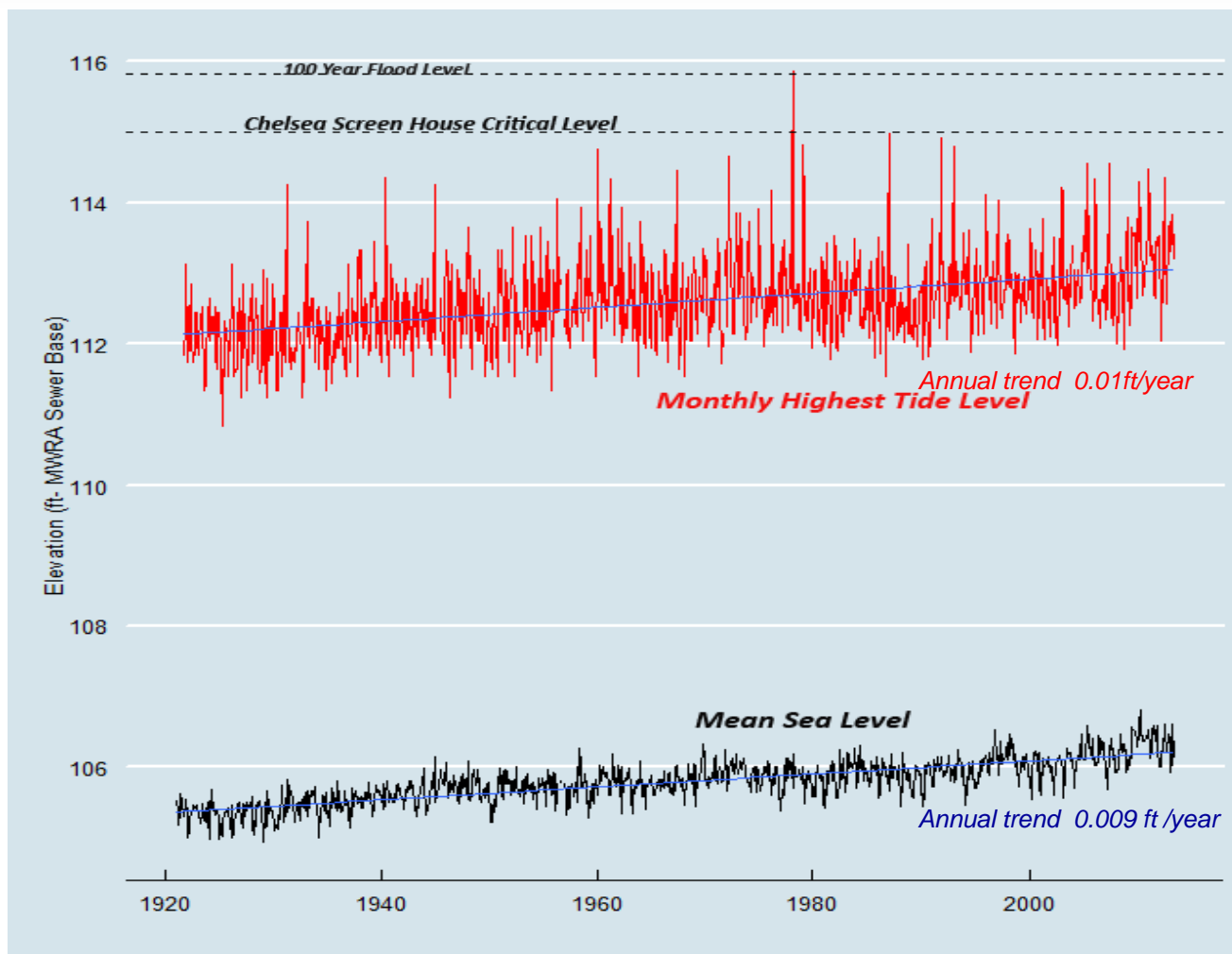


Installation of a crest gate greatly enhances discharge operations.



Sea-Level Rise Is Already With Us

Trend For Boston Inner Harbor, NOAA Tidal Gage #8443970 (1921 – 2013)



Data source :

http://tidesandcurrents.noaa.gov/data_menu.shtml?bdate=19210101&edate=20130511&wl_sensor_hist=W5&relative=&datum=6&unit=1&shift=g&stn=8443970+Boston%2C+MA&type=Historic+Tide+Data&format=View+Data



Sandy Not Like Previous Storms





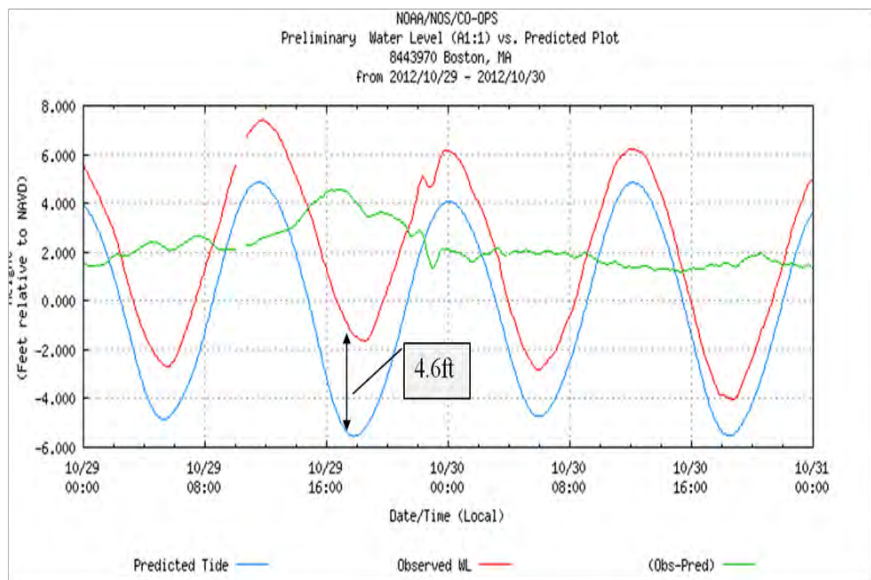
Sandy Track



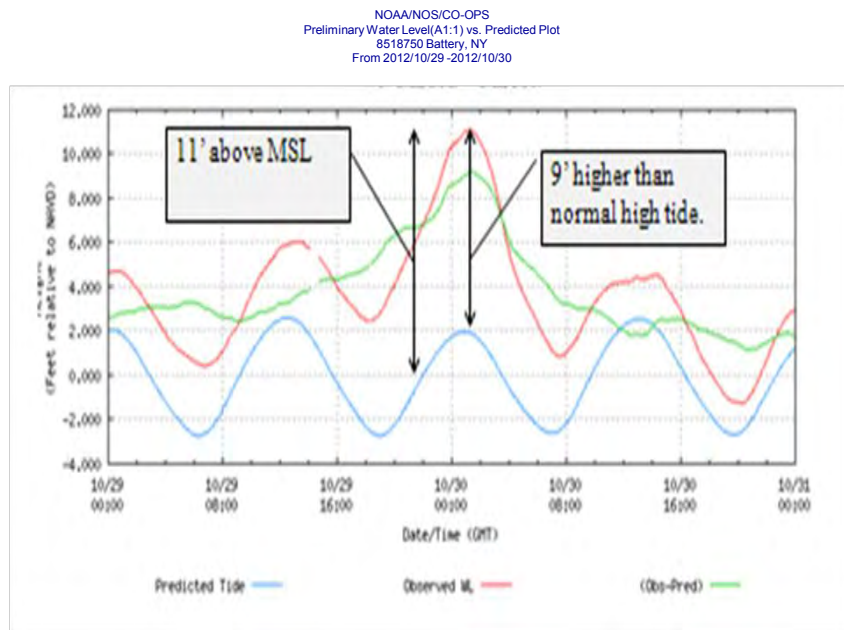


How Did Sandy Measure Up?

BOSTON

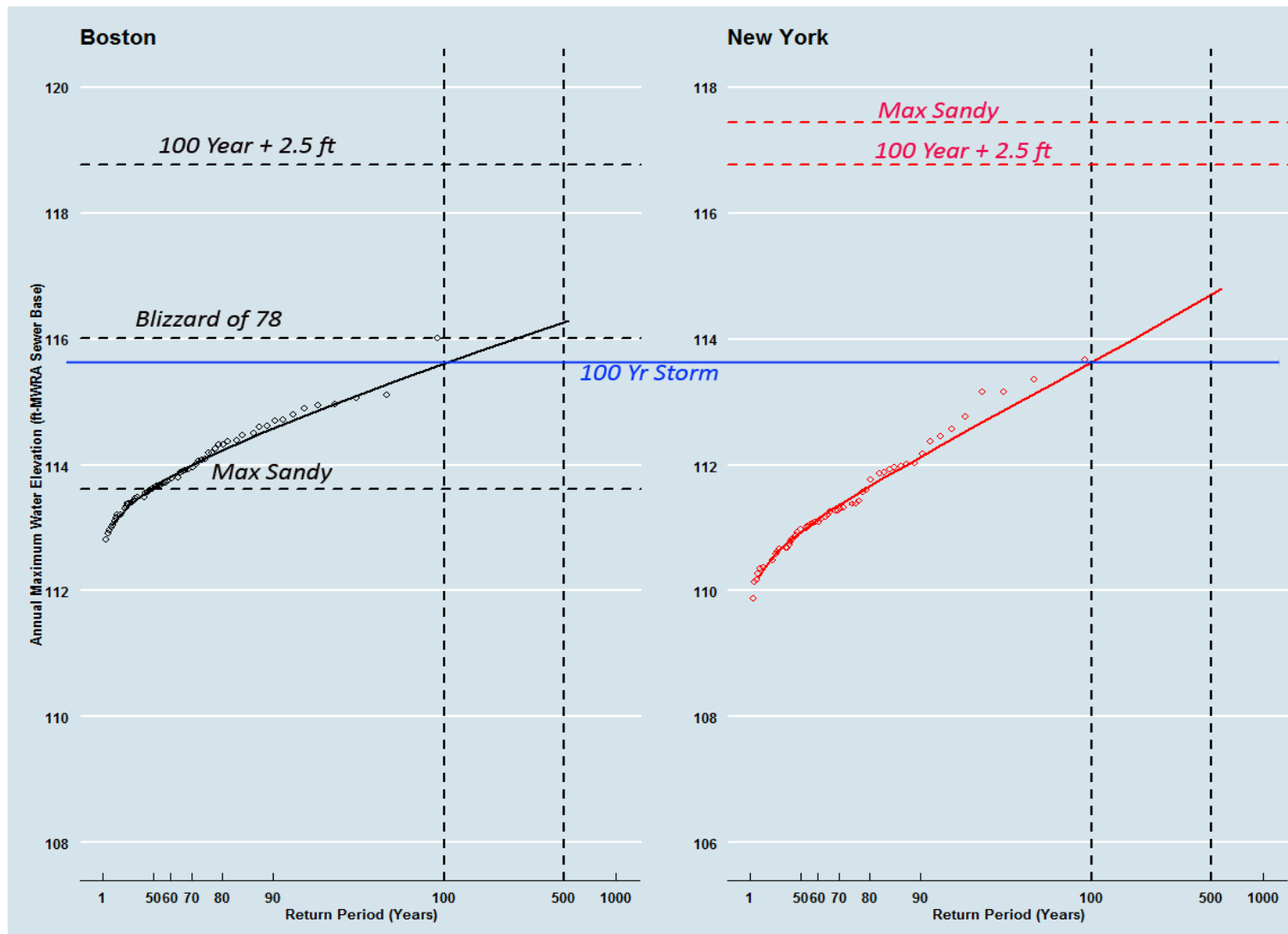


NEW YORK



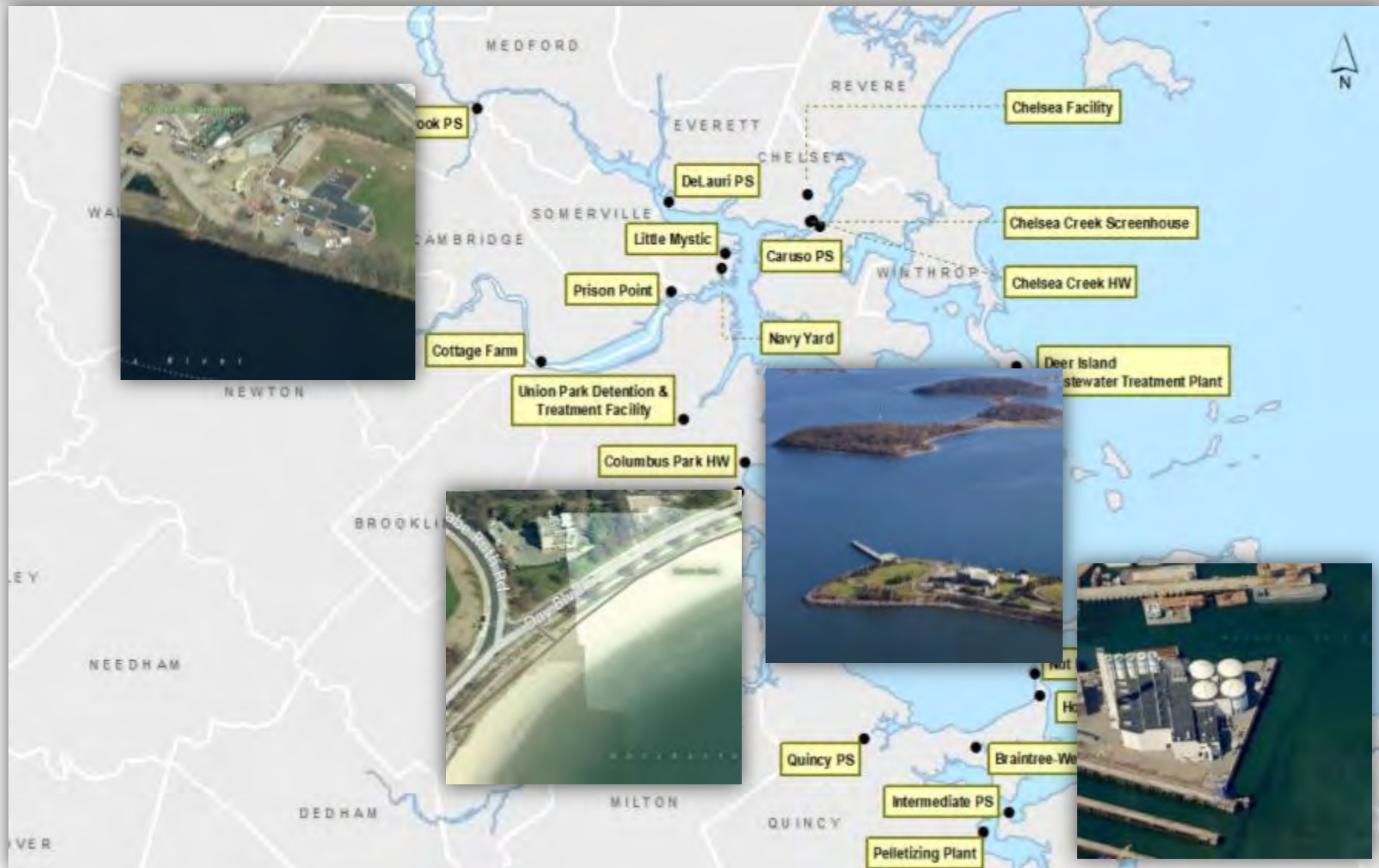


How Did Sandy Compare to Historical Storms?





21 Of MWRA Coastal Sewer Facilities Are Within 15 Feet Of Mean Sea Level





Areas Potentially Affected By Loss Of Coastal Pump Stations





Impact of Global Warming: 100 Year Storm and Sea Level Rise In Year 2100.



Data sources: Flooded area IPCC , ground elevations determined by LIDAR.



Hurricane Sandy Impacts On NY/NJ Water Utilities

- Many water utilities lost power due to lack of generators
- NYC water was safe to drink, but surrounding counties in NY and NJ had do not use advisories, or boil water notices
- Passaic Valley was forced to release billions of gallons of raw or partially treated sewage into New York Bay over several weeks





Benchmarks For Evaluating Facilities

- 100 year flood as determined by FEMA (current regulatory requirement).
- 100 year flood + 2.5ft (NYC DEP, BHA).

Additionally

- Hurricane flooding levels as determined by FEMA's SLOSH model (current evacuation planning recommendation) were reviewed.
- Wave action (for facilities adjacent to FEMA Hazard Zone VE) was reviewed.



How Do Facilities Measure Up?

		FACILITY					
		Ranking	Name	Town	Risk		
Very Unlikely to be Affected	Ranking	1	Chelsea Creek Screenhouse	Chelsea	Maximum		
		2	Braintree-Weymouth Pump Station	Quincy	High		
		3	South Boston CSO Tunnel Ventilation Building	Boston	High		
		4	Squantum Pump Station	Quincy	High		Minimal
		5	Pelletizing Plant	Quincy	High		Minimal
		6	Chelsea Creek Headworks	Chelsea	High		Minimal
Likely affected by a 100 year + 2.5 ft event	Ranking	7	Somerville Marginal CSO Facility	Somerville	Moderate		Minimal
		8	Alford St Facility	Boston	Moderate		Minimal
		9	Mystic River Gatehouse	Somerville	Moderate		Minimal
		10	South Boston CSO Pump Station	Boston	Moderate		Minimal
		11	Alewife Brook Pump Station	Somerville	Moderate		Minimal
		12	Charlestown Navy Yard Facility	Boston	Moderate		Low
Likely affected by a 100 year event	Ranking	13	Chelsea Facility	Chelsea	High		Low
		14	Chelsea Maintenance Facility	Chelsea	Moderate		Low
		15	Houghs Neck Pump Station	Quincy	Moderate		Moderate
		16	Quincy Pump Station	Quincy	Moderate		Moderate
		17	Union Park Detention & Treatment Facility	Cambridge	Moderate		Moderate
		18	Cottage Farm CSO Facility	Boston	Moderate		Moderate
Likely Affected by Hurricane Only	Ranking	19	Caruso Pump Station	Boston	Low		Moderate
		20	Wiggins Pump Station	Boston	Low		Moderate
		21	DeLauro Pump Station	Boston	Low		Moderate
		22	Columbus Park Headwork's	Boston	Low		Moderate
		23	Somerville Sampling Building	Somerville	Low		Moderate
		24	Prison Point CSO Facility	Cambridge	Low		Moderate
Very Unlikely to be Affected	Ranking	25	Hingham Pump Station	Hingham	Low		Moderate
		26	Ward Streef Headwork's	Boston	Minimal		Minimal
		27	Little Mystic Channel CSO Facility	Boston	Minimal		Minimal
		28	Intermediate Pump Station	Weymouth	Minimal		Minimal
		29	Deer Island	Winthrop	Minimal		Minimal
		30	Nut Island Headworks	Quincy	Minimal		Minimal

- Minimal – Facilities that are not expected to be affected by a 100 year event
- Maximum – Facilities that are expected to be affected by a 100 year event
- High – Facilities that are expected to be affected by a 100 year event plus 2.5ft
- Moderate – Facilities that are expected to be affected by a 100 year event plus 2.5ft
- Low – Facilities that are expected to be affected by a 100 year event plus 2.5ft
- Minimal – Facilities that are not expected to be affected by a 100 year event

Ranking	Risk
1	Maximum
2	High
3	High
4	High
5	High
6	High
7	Moderate
8	Moderate
9	Moderate
10	Moderate
11	Moderate
12	Moderate
13	High
14	Moderate
15	Moderate
16	Moderate
17	Moderate
18	Moderate
19	Low
20	Low
21	Low
22	Low
23	Low
24	Low
25	Low
26	Minimal
27	Minimal
28	Minimal
29	Minimal
30	Minimal

potential facility that plus 2.5ft



Facilities Impact Summary



- 6 Sewer Facilities Likely Affected by a 100 Year Event .
- 9 Sewer and 3 Administration Facilities Likely Affected by a 100 Year + 2.5 feet Event.
- 7 Sewer Facilities Likely Affected by Hurricane Only.
- 5 Sewer Facilities Very Unlikely to be Affected.
- **No Water Facility At Risk of Service Disruption.**



Chelsea Screenhouse - Vulnerabilities



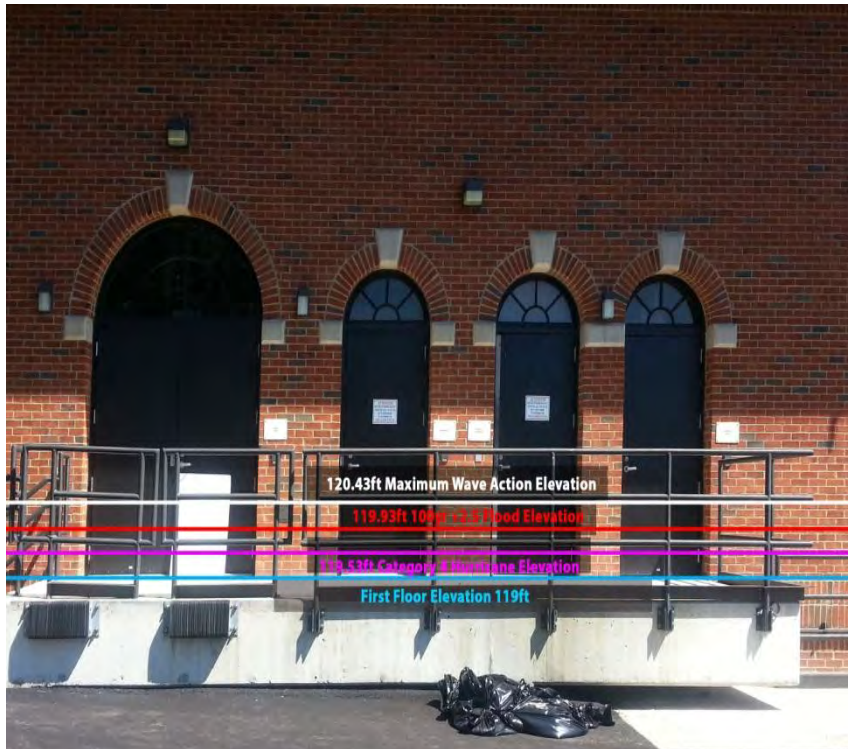
Southwest Facility View



Backup Generator



Braintree-Weymouth Replacement Pump Station



Exterior South Side View
First Floor



Interior South Side View
First Floor Switch Gear Room

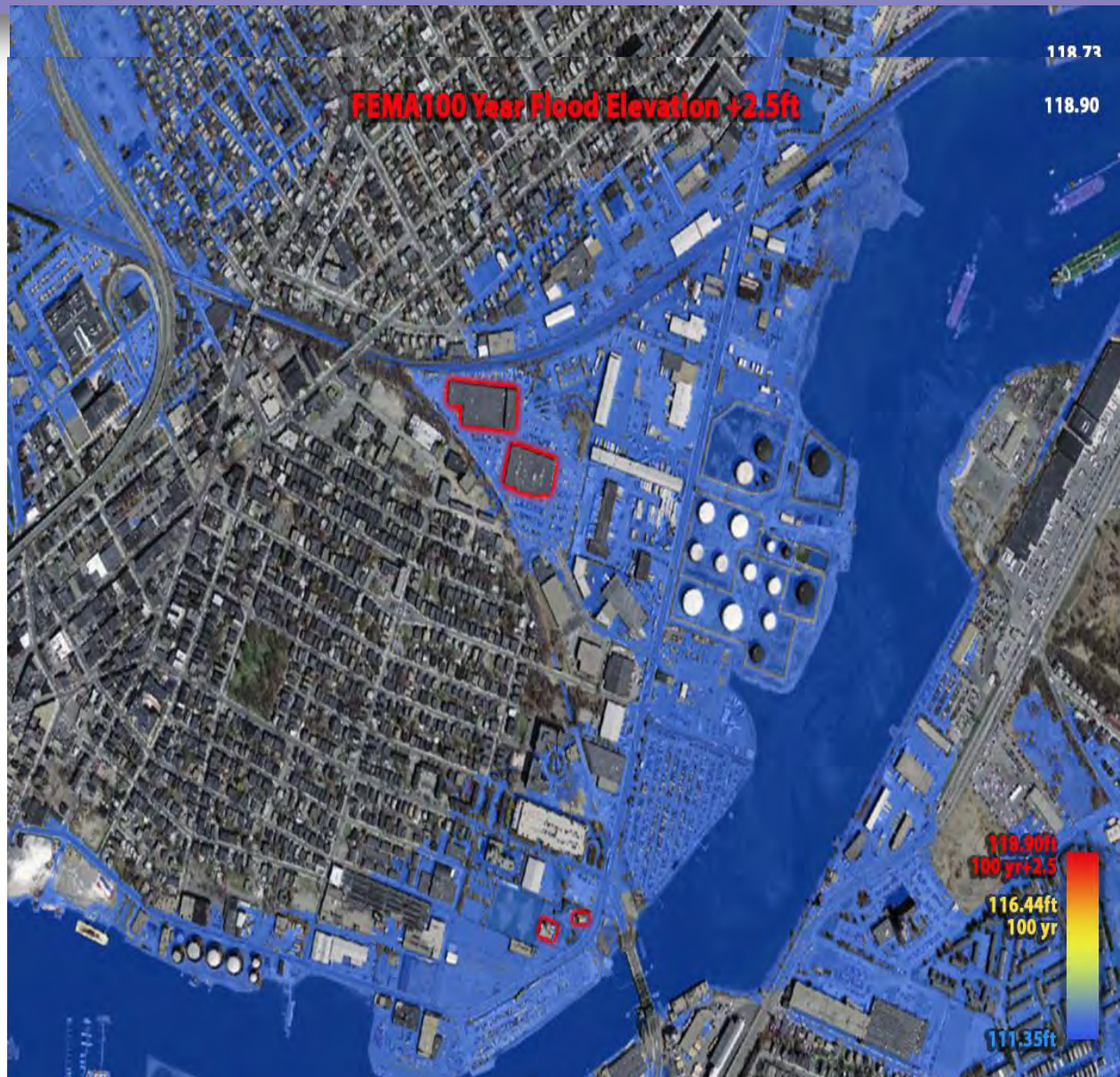


Braintree-Weymouth Replacement Pump Station High Tide





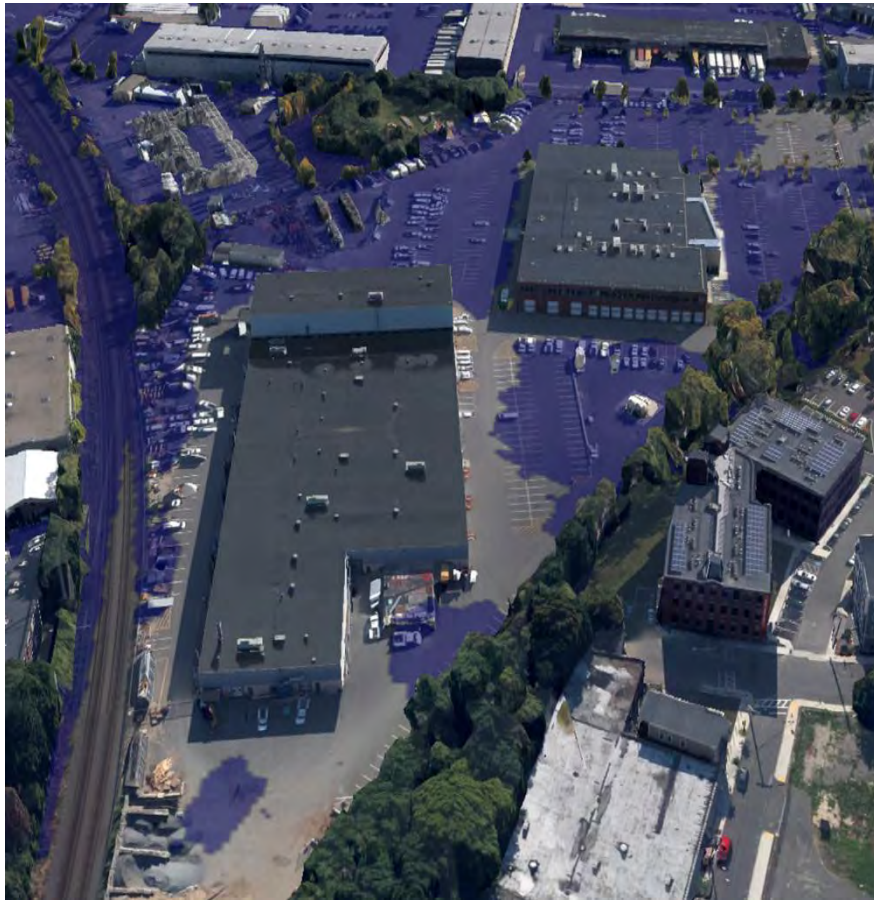
Chelsea Administration & Maintenance Facilities Flood Inundation



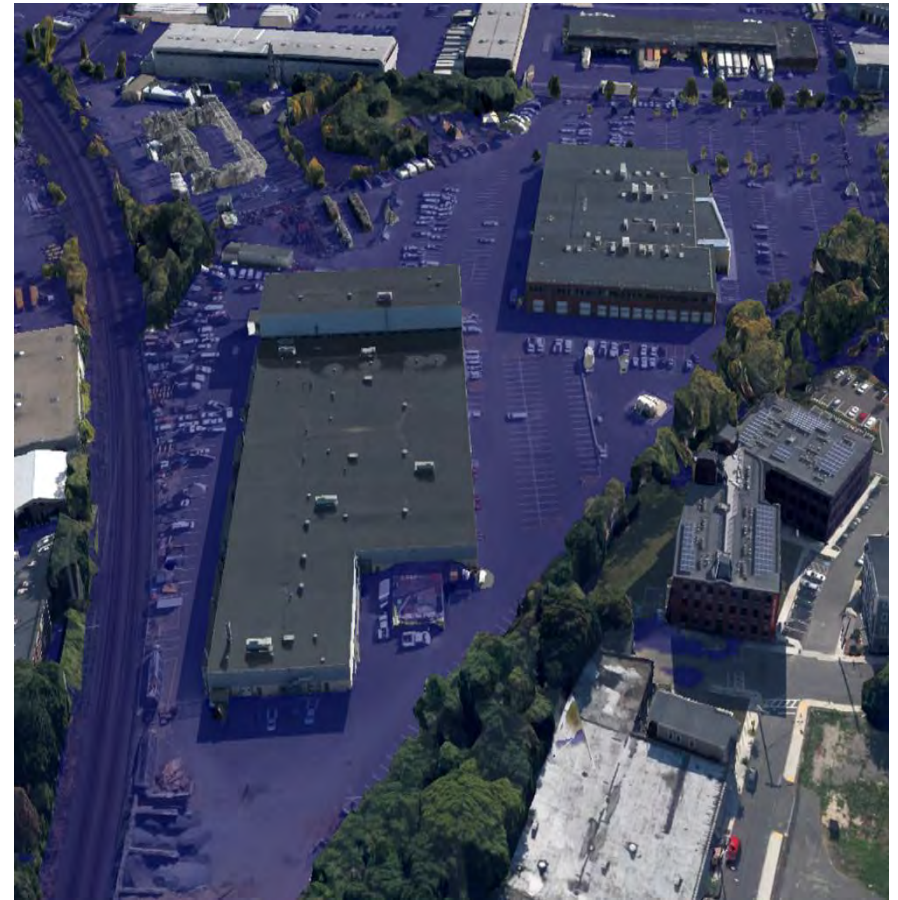


Chelsea Administration & Maintenance Facilities

FEMA 100 Year Flood Elevation



FEMA 100 Year Flood Elevation + 2.5ft





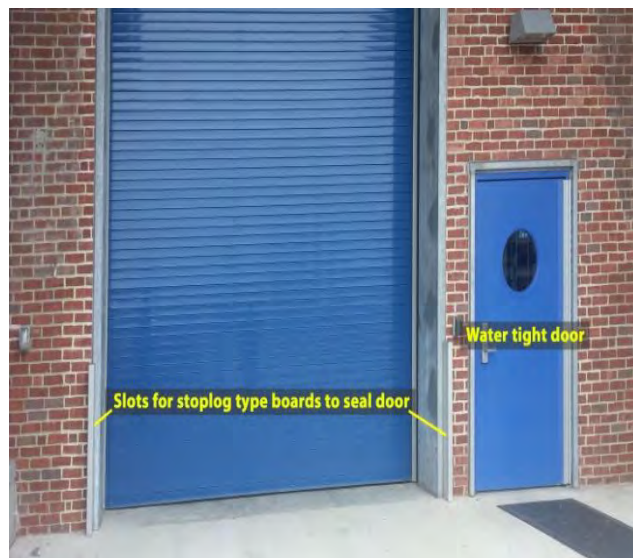
Past Practice

- Low-lying facilities are protected with sandbags and pumps.
- Mobile generators are deployed in advance of storms.
- Increased staffing



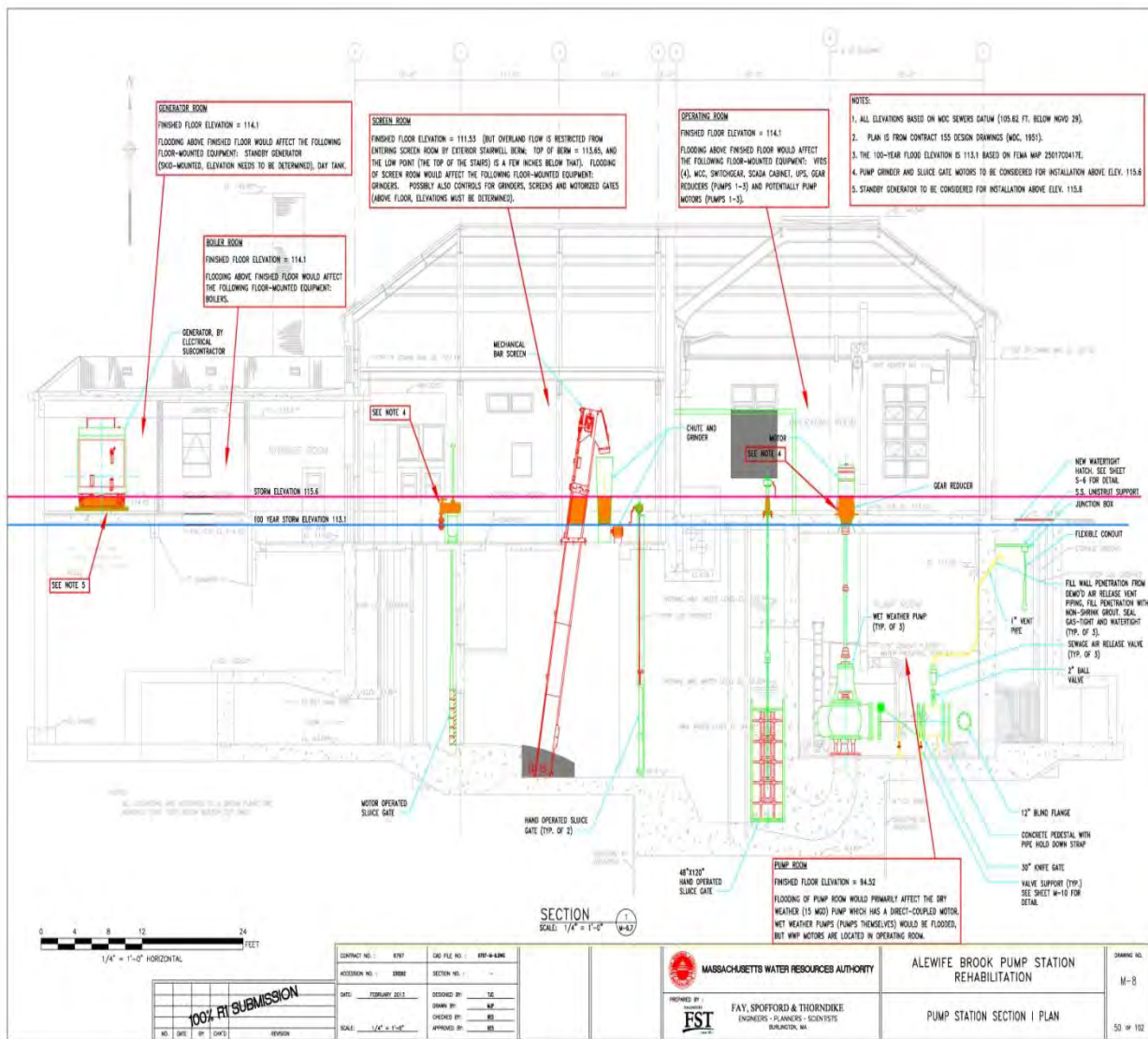


Evaluated Several Flood Barrier Options





Alewife Pumping Station Proposed Modifications





Planning to Avoid Inundation





Created SOPs To Redeploy Staff And Equipment To Higher Ground

- Staff and equipment redeployed to pre-determined locations in advance of storms.
- Back-up water and wastewater operations control center created at Carroll Treatment Plant in Marlborough.





Climate Change and The Planning Process

- MWRA Master Plan update process puts issues on the table for senior management and the Board of Directors to grapple with.
- Climate change is treated as an extra dimension in the assessment of infrastructure reinvestment.
- Climate change is also an input for the vulnerability analysis for extreme events (such as hurricane preparedness exercises) which identifies infrastructure fixes to provide extra resiliency.
- Think about all aspects whenever a facility is being evaluated or upgraded: use the investment cycle



MWRA Drivers for Energy Efficiency Focus

- Environmental agency
 - MWRA has been successfully meeting the goals established in Governor Patrick's Executive Order 484 (April 2007)
 - Goals include:
 - Overall Reduction of Energy Consumption
 - Increase Renewable On-site Energy Production
 - Purchase of Renewable Energy
- Cost Savings
- Operations
 - Equipment replacement
- Recognition and Reputation



Our Mission in Short

- Adequate, Reliable Supply of High Quality Drinking Water
- Environmentally Responsible Collection, Treatment and Disposal of Wastewater

- **Drink with Confidence**
- **Flush with Pride**

- **All Accomplished Affordably**

- **Under All Circumstances**

Questions or Comments?

- Stephen Estes-Smargiassi
- smargias@mwra.com
- 617-788-4303
- www.mwra.com

