



# Massachusetts Water Resources Authority

*Presentation to*

## **American Council of Engineering Companies of Massachusetts**

### *Approach to Climate Change and Development of System Resiliency*

**David W. Coppes**  
**Chief Operating Officer**

May 31, 2018





## 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



**Large Reservoir + More Precipitation =  
Plenty of High Quality Water**





# 2016: MWRA in position to help communities in need





## 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





## Significant Investment in Dams: Able to Handle Flooding

- 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





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







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

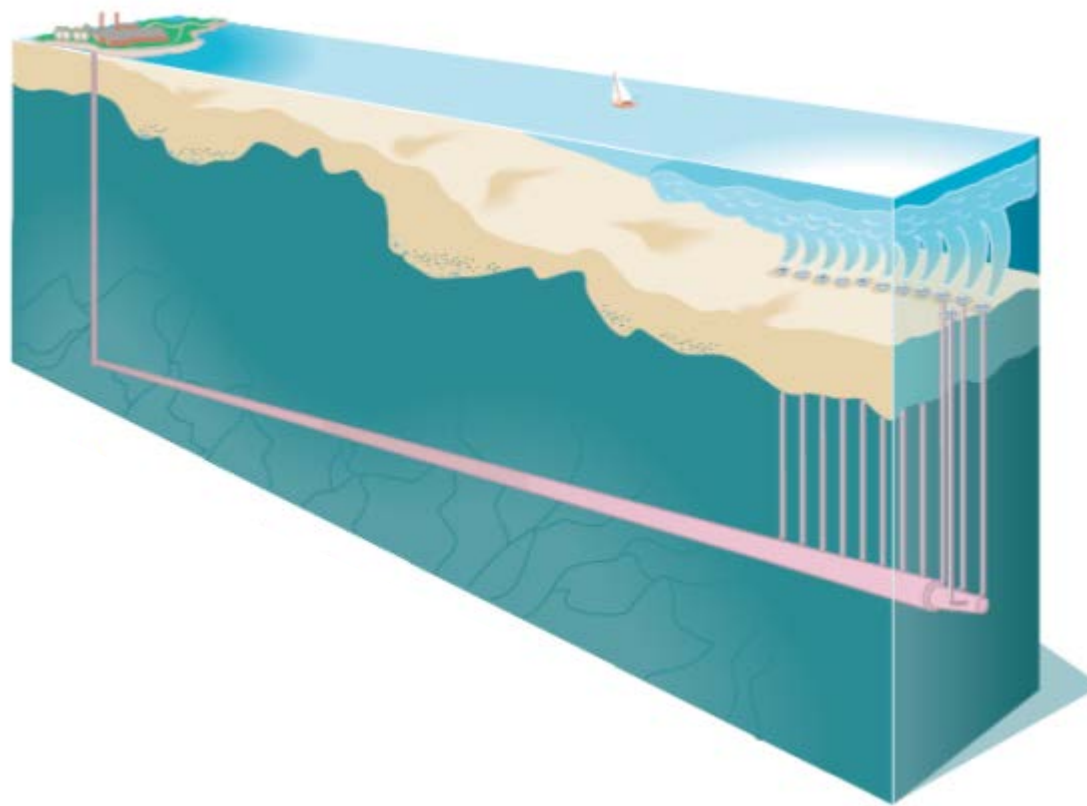
- Deer Island plant fully protected
  - 100-year flood
  - 1.9-foot sea level rise
  - Wave runup of 14 feet on east side and 2 feet on west side
- On-site power plant ensures uninterrupted power supply
- Nut Island headworks in Quincy similarly designed for sea level rise





# 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 outfall tunnel
- To maintain hydraulic capacity, tunnel diameter was up-sized from 24 feet to 24.25 feet





# Sea-Level Rise Is Already With Us: January and March 2018 Storm/Extreme High Tide Events





# Hurricane Sandy Impacts On NY/NJ Water Utilities: What WE want to avoid!

- 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





# 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.



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

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

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



# Impacted Areas in Chelsea: January and March 2018 Storm Events and Extreme High Tides



Eastern Avenue



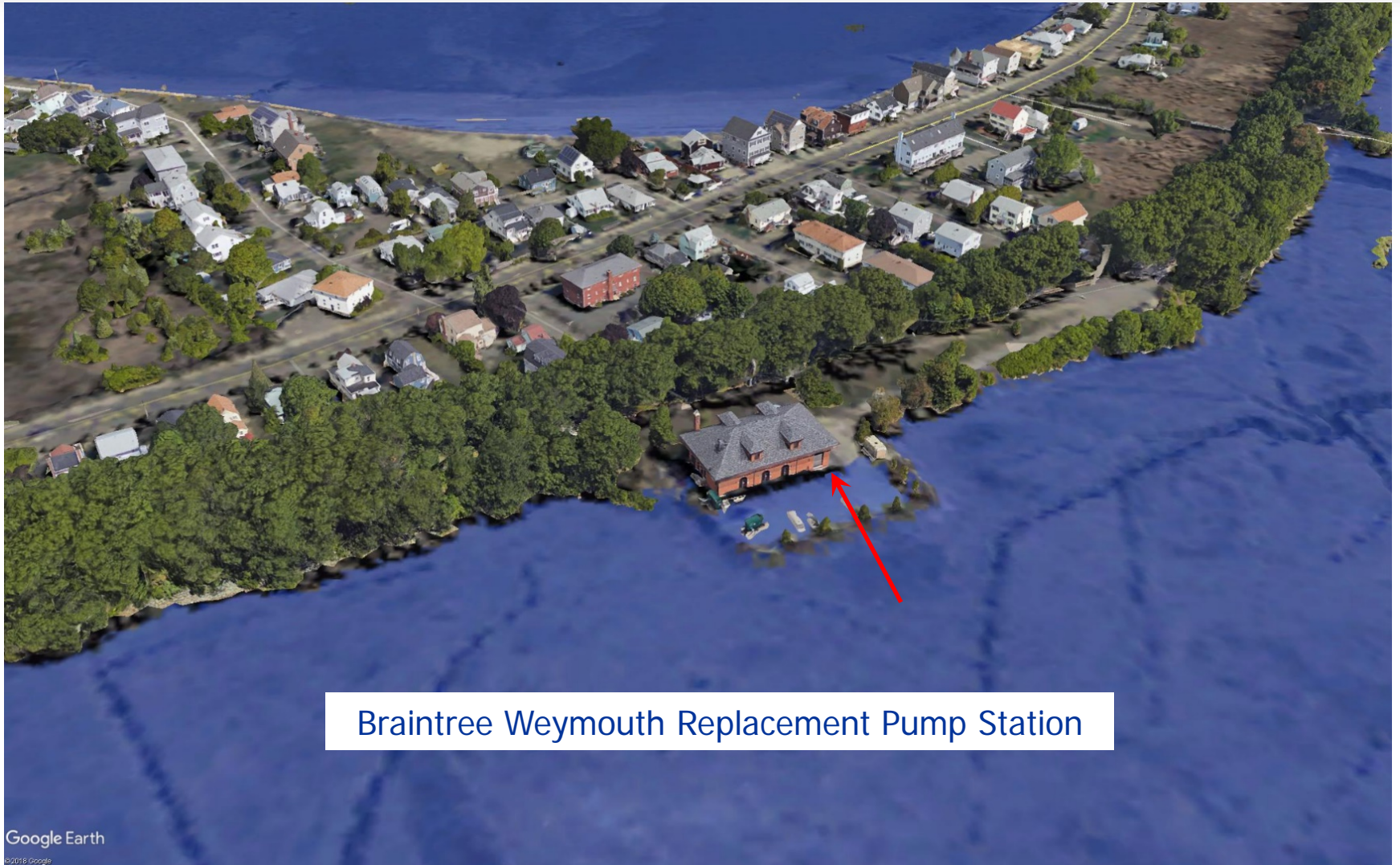
# Model Representation of Impacted Area



Chelsea Creek Headworks and Chelsea Screen House



# Model Representation of Impacted Area

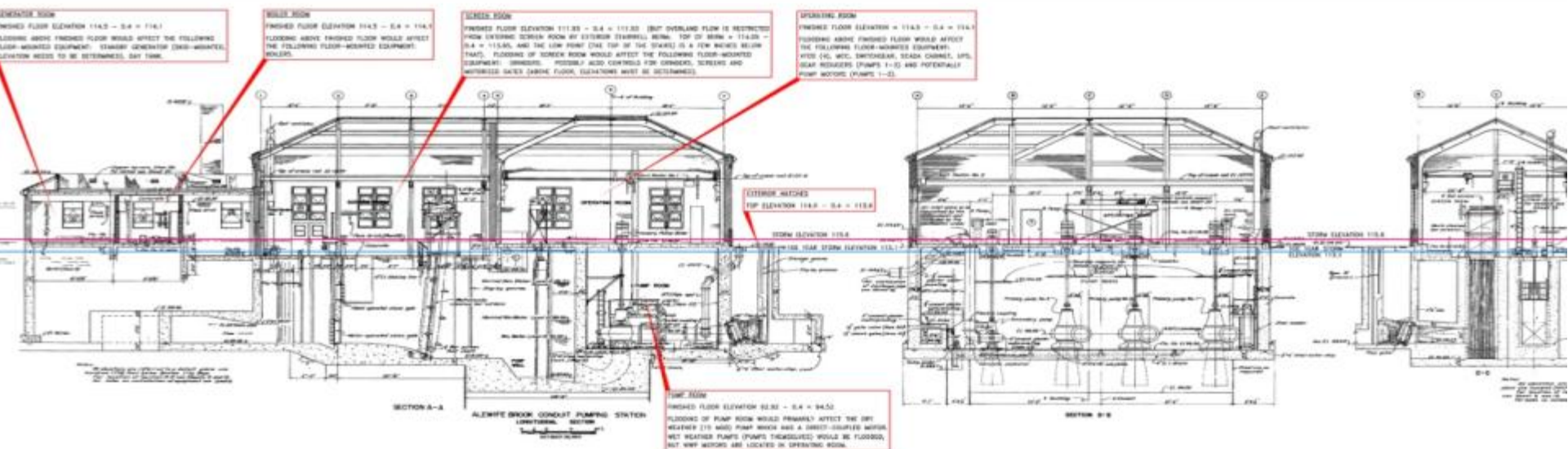


Braintree Weymouth Replacement Pump Station



# Going Forward

- Short-term
  - At-risk buildings fitted with temporary flood barriers.
- Long-term
  - Future rehabilitation contracts taking sea level rise into account.
  - Move important equipment to higher elevations.





# Flood Barrier Installation







# Example: Alewife Pumping Station Modifications Underway



Flood logs  
(exterior)

Flood logs  
(interior)

Watertight  
hatch

Flood logs  
(interior)



# Example: Alewife Pumping Station Modifications Underway



Raise elevation of critical equipment,  
both inside and outside of facility



## 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



# 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

*limit the damage and get back up and running as soon as possible*



# 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



# Renewable Energy at Deer Island

- Deer Island currently self-generates approximately 27% of its electricity needs and more than half of the Island's energy demand is provided by on-site, renewable generation – with more to come.





# Methane Utilization At Deer Island

- Deer Island utilizes 98% of the methane generated to power a steam turbine generator and backpressure turbine for plant heat and hot water
- Avoids purchase of about 5MG in fuel oil annually
- Approximately 33 MkWh/yr electricity production
- Over \$3.6M/yr electricity savings and revenue





# Hydroelectric Power

- Cosgrove, Oakdale, Loring Rd, Deer Island
- Over 8MW Capacity
- Approximately 23 MkWh/yr electricity production
- Over \$1.8M/yr savings and revenue







# Wind Power

- Deer Island, Charlestown (DeLauri Pump Station)
- 2.8 MW Capacity
- Over 5 MWh/yr electricity production
- Approximately \$575,000/yr savings and revenue





# Solar Power

- Deer Island, CWTP
- Over 1200 kW Capacity
- Over 1.4 MkWh/yr electricity production
- Approximately \$242,000/yr savings and revenue





## 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**