Approach to Climate Change and Development of System Resiliency

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Chief Operating Officer

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MWRA Service Area

- MWRA provides wholesale water and wastewater services to over 2.5 million customers in 61 communities
- On average, MWRA delivers about 200 million gallons per day to its water customers
- MWRA collects and treats an average of 350 million gallons of wastewater per day, with a peak capacity of 1.2 billion gallons
• **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?

<table>
<thead>
<tr>
<th>Ranking</th>
<th>Facility Name</th>
<th>Town</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chelsea Creek Screenhouse</td>
<td>Chelsea</td>
<td>Maximum</td>
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<tr>
<td>2</td>
<td>Braintree-Weymouth Pump Station</td>
<td>Quincy</td>
<td>High</td>
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<tr>
<td>3</td>
<td>South Boston C3O Tunnel Ventilation Building</td>
<td>Boston</td>
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<td>4</td>
<td>Squanto Pump Station</td>
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<tr>
<td>5</td>
<td>Peletizing Plant</td>
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<tr>
<td>6</td>
<td>Chelsea Creek Headworks</td>
<td>Chelsea</td>
<td>High</td>
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<tr>
<td>7</td>
<td>Somerville Margin CSO Facility</td>
<td>Somerville</td>
<td>Moderate</td>
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<tr>
<td>8</td>
<td>Alford St Facility</td>
<td>Boston</td>
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<tr>
<td>9</td>
<td>Mystic River Gatehouse</td>
<td>Somerville</td>
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<tr>
<td>10</td>
<td>South Boston C3O Pump Station</td>
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<td>Alewife Brook Pump Station</td>
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<td>Charlestown Navy Yard Facility</td>
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<td>13</td>
<td>Chelsea Facility</td>
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<td>14</td>
<td>Chelsea Maintenance Facility</td>
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<td>Houghs Neck Pump Station</td>
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<td>16</td>
<td>Quincy Pump Station</td>
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<td>Union Park Detention &amp; Treatment Facility</td>
<td>Cambridge</td>
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<td>Cottage Farm CSO Facility</td>
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<td>Caruso Pump Station</td>
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<td>Hingham Pump Station</td>
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<td>Ward Street Headworks</td>
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<td>Little Mystic Channel CSO Facility</td>
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<td>28</td>
<td>Intermediate Pump Station</td>
<td>Weymouth</td>
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<td>29</td>
<td>Deer Island</td>
<td>Winthrop</td>
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<tr>
<td>30</td>
<td>Nut Island Headworks</td>
<td>Quincy</td>
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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
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.
Example: Alewife Pumping Station
Modifications Underway

- Flood logs (exterior)
- Flood logs (interior)
- Watertight hatch
- Flood logs (interior)
Raise elevation of critical equipment, both inside and outside of facility.
Two Pronged Approach to a Long Term Concern

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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 MkWh/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