



MWRA's Pragmatic Approach to Climate Change

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Wastewater Advisory Committee

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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

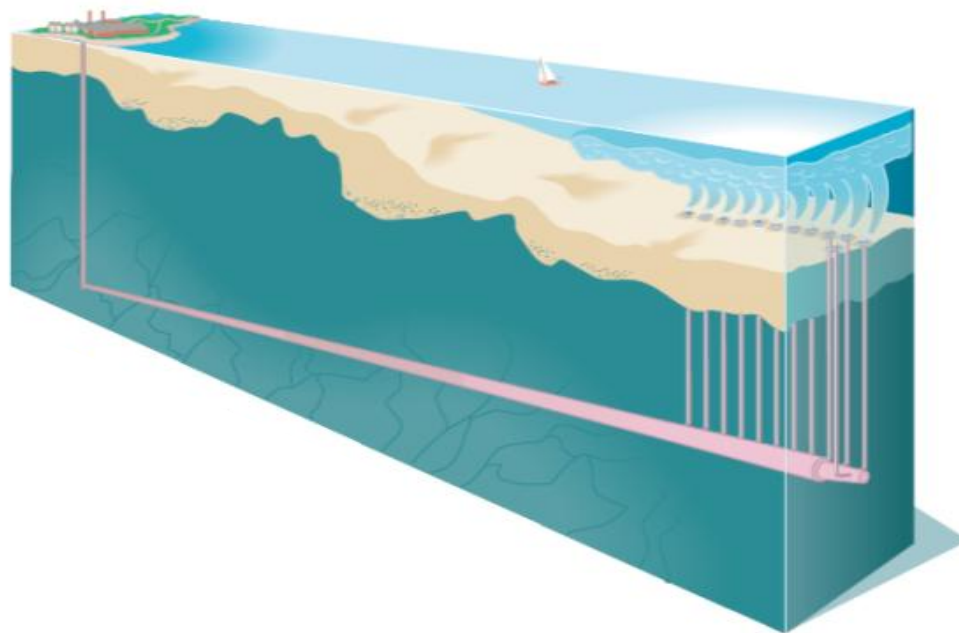
- Deer Island plant fully protected
 - 100-year flood
 - 1.9-foot sea level rise
 - Wave runup of 14 feet on east side and 2 feet on west side
- On-site power plant ensures uninterrupted power supply
- Nut Island headworks in Quincy similarly designed for sea level rise





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 process tank elevation raised 1.9 feet and tunnel diameter was up-sized from 24 feet to 24.25 feet





Benchmarks For Evaluating Facilities

- Pragmatic Approach – Don't Miss Opportunities to Adapt
- Consistent with Other Agencies
- **100 year flood + 2.5 ft**

- Science continues to advance
- Pace of CO2 increases unclear
- MWRA will Regularly Review and Update our Benchmark
- Current Benchmark Likely Good until 2070's



Sea Level Rise Vulnerability of Every Facility Examined

- Be Pragmatic – Don't Miss Any Opportunities to Adapt
- Long Term – Use Periodic Facility Rehab Process for Major Upgrades
- Meanwhile – Use Maintenance Crews to Improve Flood Proofing





Chelsea Screenhouse - Vulnerabilities



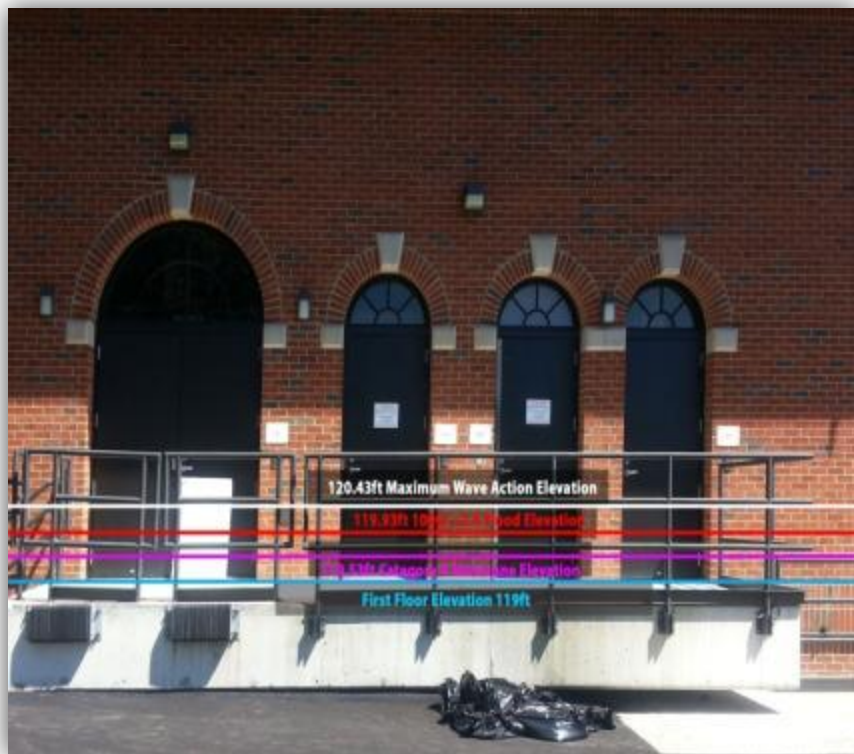
Chelsea Creek Screen House
Southwest Facility View



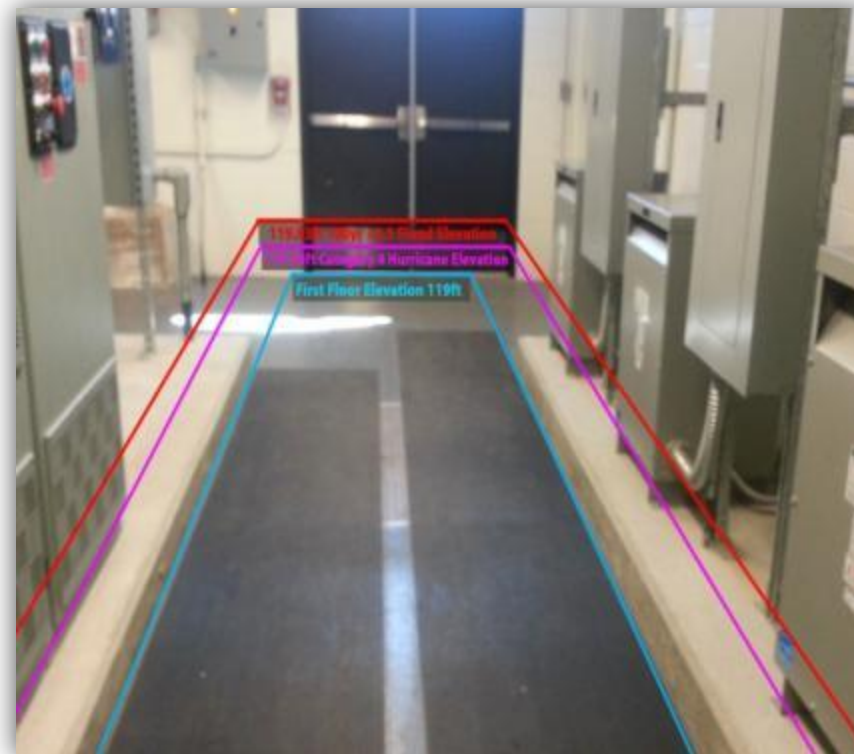
Chelsea Creek Screen House
Backup Generator



Braintree-Weymouth Replacement Pump Station



Exterior South Side View
First Floor



Interior South Side View
First Floor Switch Gear Room



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.



Our Goals

- Protect our staff
- Protect our facilities
- Protect the 2 million people that depend on us
- Recover quickly
- Better to have an environmental disaster that lasts a few hours – not weeks or months





MWRA Approach Going Forward – Short Term

- At-risk buildings fitted with temporary flood barriers
- Move electrical/computer equipment off the floor





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.





MWRA Approach Going Forward – Long Term

- Will continue to monitor the latest science and predictions
- On average, we rehabilitate our facilities every 15 or 20 years
- Every future rehabilitation contract will take sea level rise into account
- Three significant rehabilitation projects were under design
 - Alewife Brook Pump Station
 - Chelsea Creek Headworks
 - Chelsea Screenhouse
- Amended each design to account for 2.5 feet of sea level rise
- Re-evaluate targets as science evolves

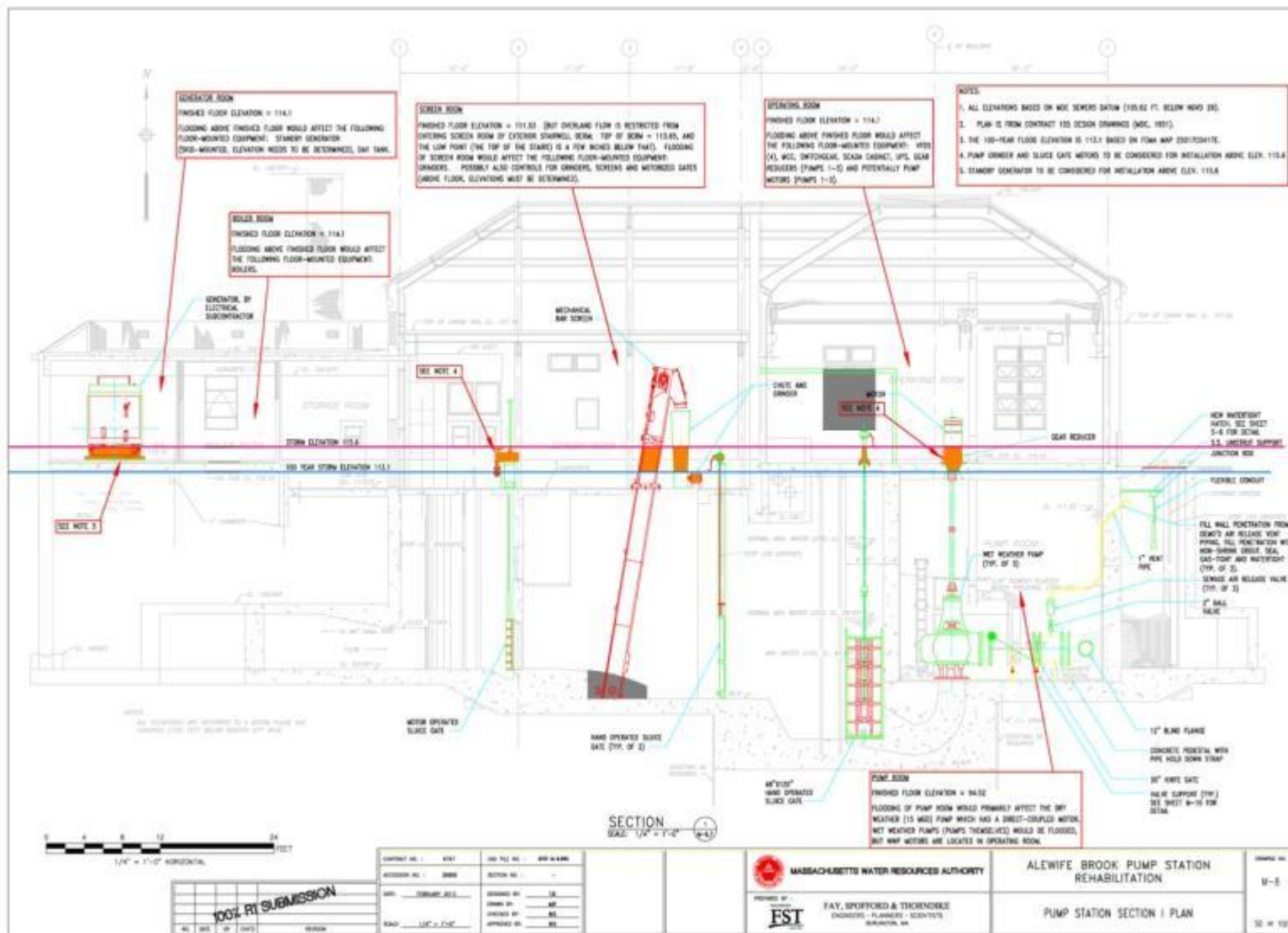


Alewife Brook Pump Station





Alewife Pumping Station Proposed Modifications





East Elevation





West Elevation – Envelope Flood Protection Measures





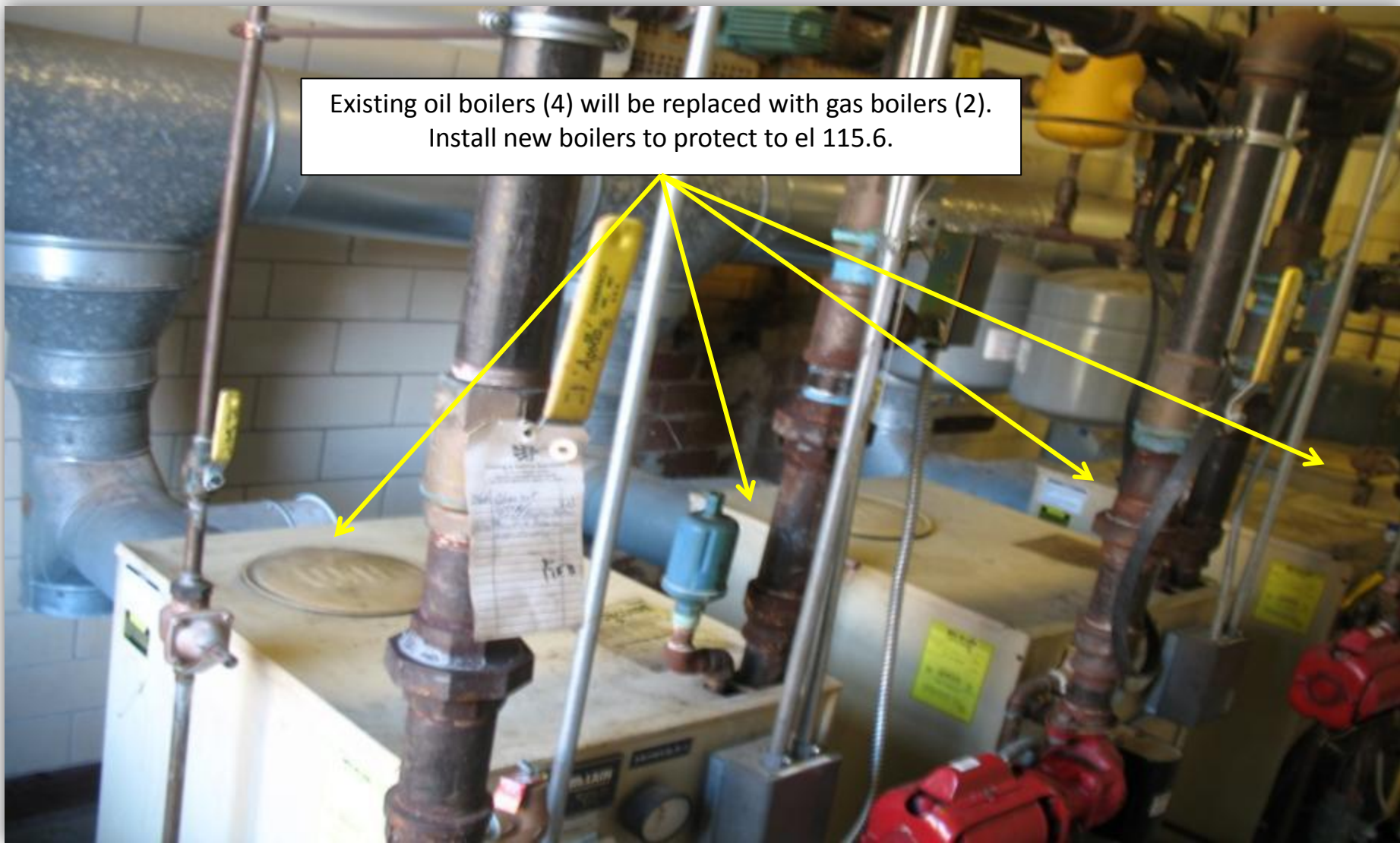
Alewife Brook Pump Station Flood Barriers





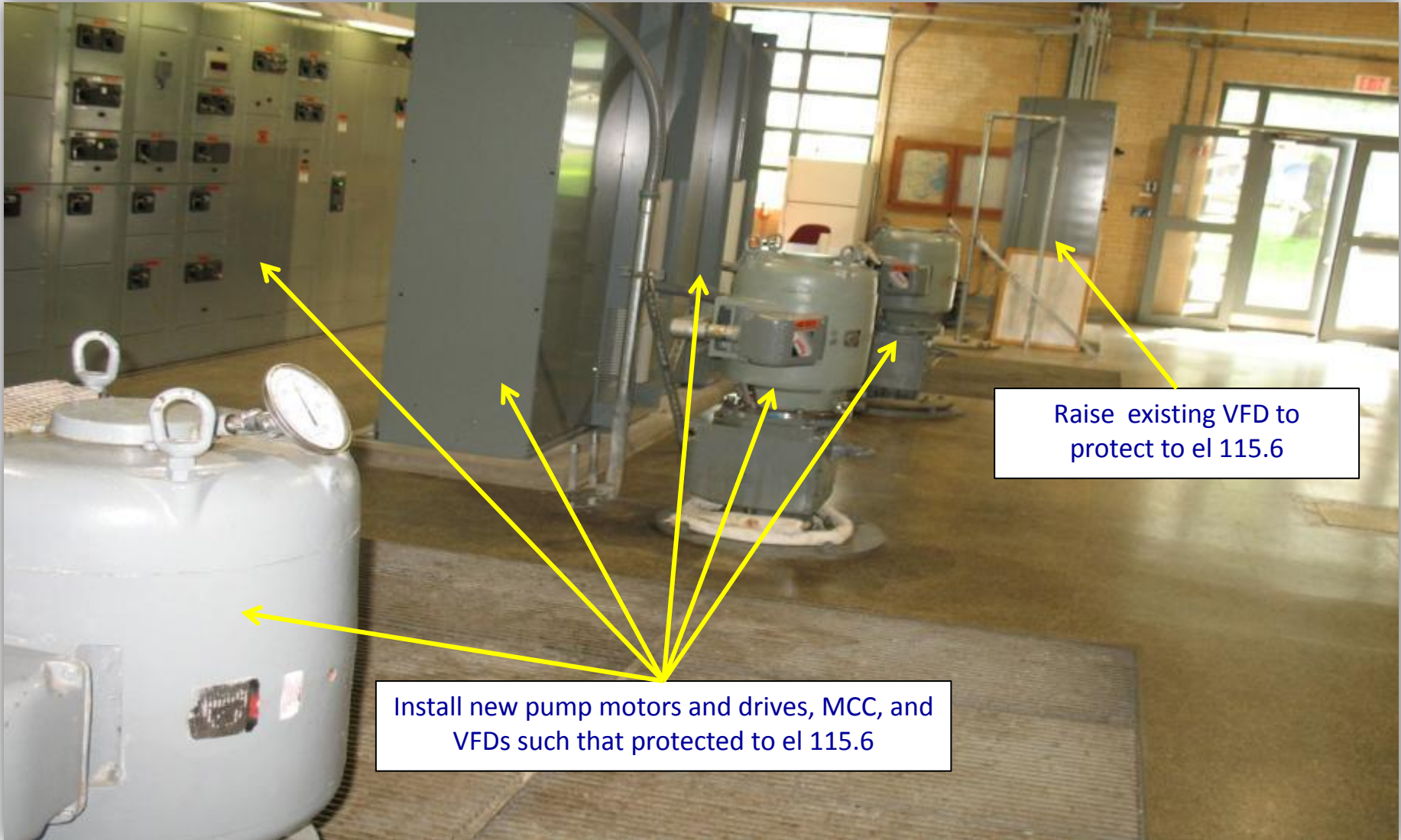
Boiler Room – Flood Protection Measures

Existing oil boilers (4) will be replaced with gas boilers (2).
Install new boilers to protect to el 115.6.





Operating Room – Flood Protection Measures (2 of 2)



Install new pump motors and drives, MCC, and VFDs such that protected to el 115.6

Raise existing VFD to protect to el 115.6



Clinton Influent Wet Well March 2010





Clinton Influent Wet Well Flood Gates





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Renewable Energy at Deer Island

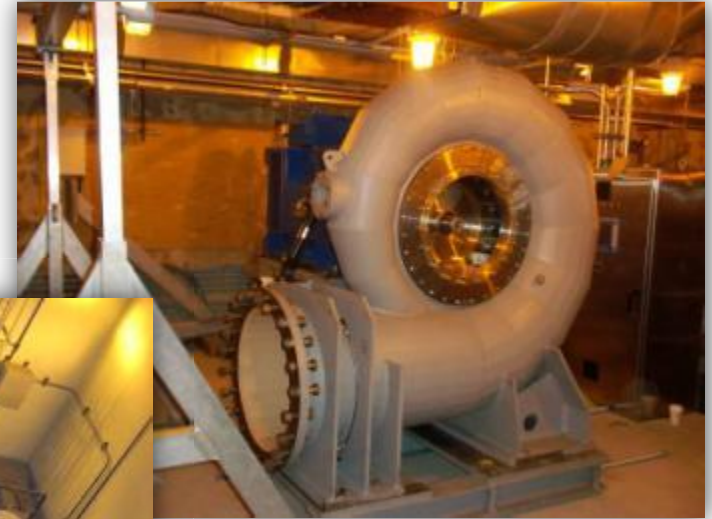
- Deer Island currently self-generates approximately 25% of its electricity needs and more than half of the Island's energy demand is provided by on-site, renewable generation – with more to come.
- Avoids purchase of about 5MG in fuel oil annually
- Approximately 33 MkwH/yr electricity production





Hydroelectric Power

- Cosgrove, Oakdale, Loring Rd, Deer Island
- Over 8MW Capacity
- Approximately 23 MWh/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



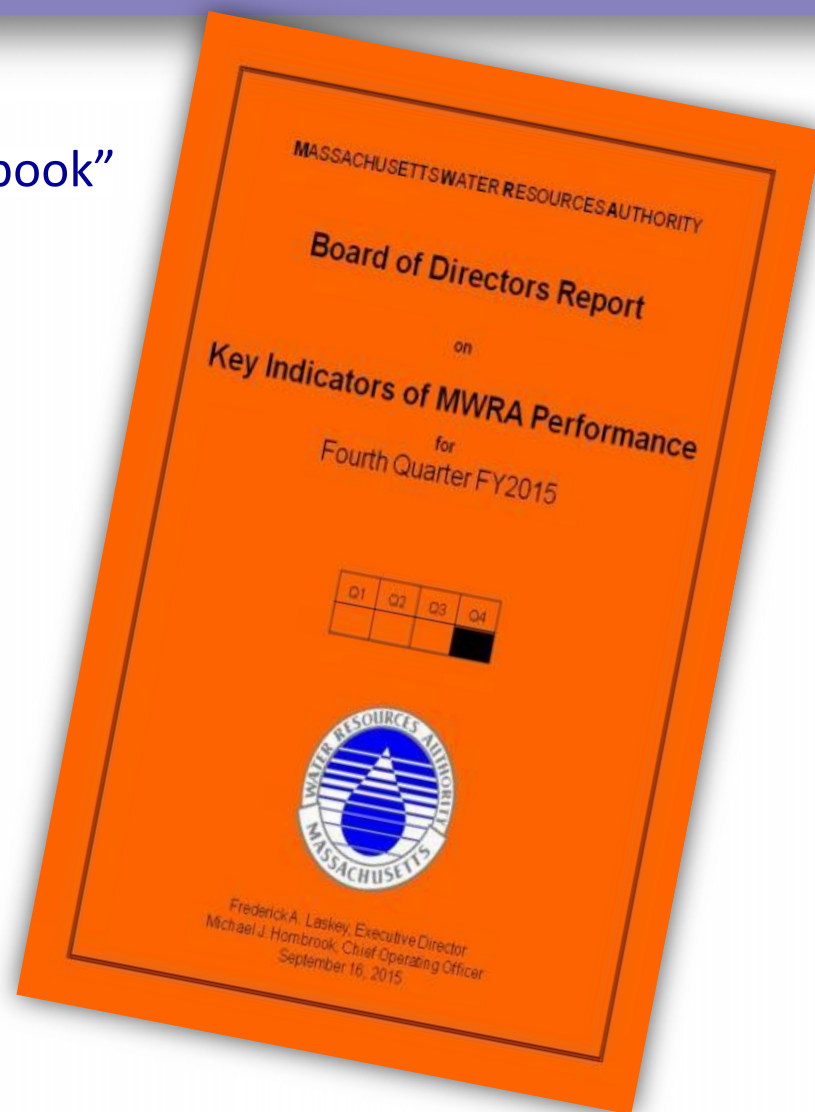


Management Indicators Report

- MWRA's Quarterly "Orange Note book"
- Measure it
- Track it
- Report it

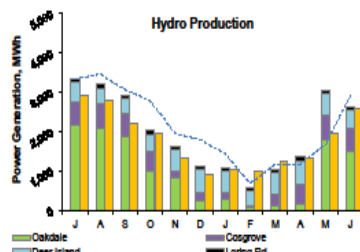
- Manage it

- Publicize it

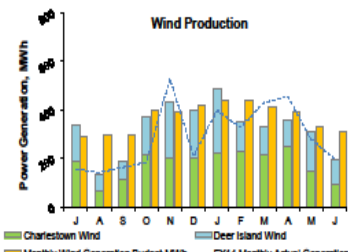




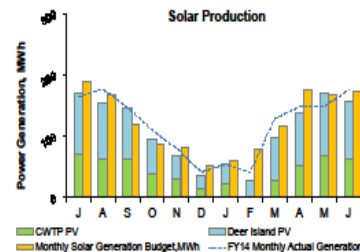
Renewable Electricity Generation: Savings and Revenue 4th Quarter - FY15



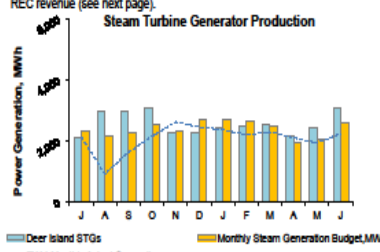
In the 4th Quarter, the renewable energy produced from all hydroelectric facilities totaled 7,059 MWh; 20% above budget. The total energy produced to date in FY15 is 24,038 MWh; 13% above budget. The total savings and revenue² to date in FY15 (actual through June³) is \$1,190,829; 15% below budget², partly due to the fact that the actual electricity unit price for Deer Island has been 16.6% below the budgeted² estimate for the same period. The savings and revenue value does not include RPS REC revenue (see next page).



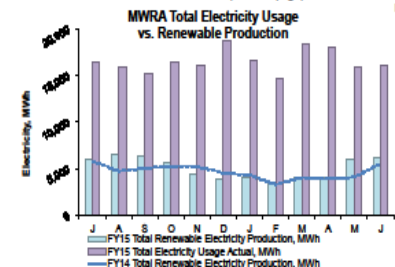
In the 4th Quarter, the renewable energy produced from all wind turbines totaled 869 MWh; 17% below budget; partly due to Charlestown Wind being off-line after grid power was lost due to a damaged main power cable. The total energy produced to date in FY15 is 3,913 MWh; 12% below budget. This is partly due to DI T2 wind turbine being off-line from the end of January to May 11th for repairs made on its main power cables. The total savings and revenue² to date in FY15 (actual through June³) is \$586,961; which is 9% above budget²; partly due to limited Charlestown wind history data for creating a budget line. The savings and revenue value does not include RPS REC revenue (see next page).



In the 4th Quarter, renewable energy produced from all solar PV systems totaled 465 MWh; 9% below budget; partly due to DI MW solar being temporarily off-line for inverter repairs. The total energy produced to date in FY15 is 1,317 MWh; 10% below budget. The total savings and revenue² to date in FY15 (through June³) is \$154,048; 6% below budget². The savings and revenue value does not include REC revenue (see next page).



In the 4th Quarter, the renewable energy produced from all steam turbine generators totaled 7,665 MWh; 15% above budget. The total energy produced to date in FY15 is 30,814 MWh; 7% above budget. The total savings² to date in FY15 (through June³) is \$2,429,699; 11% below budget²; partly due to the fact that the actual electricity unit price for Deer Island has been 16.6% below the budgeted² estimate for the same period. The savings and revenue value does not include RPS REC revenue (see next page).



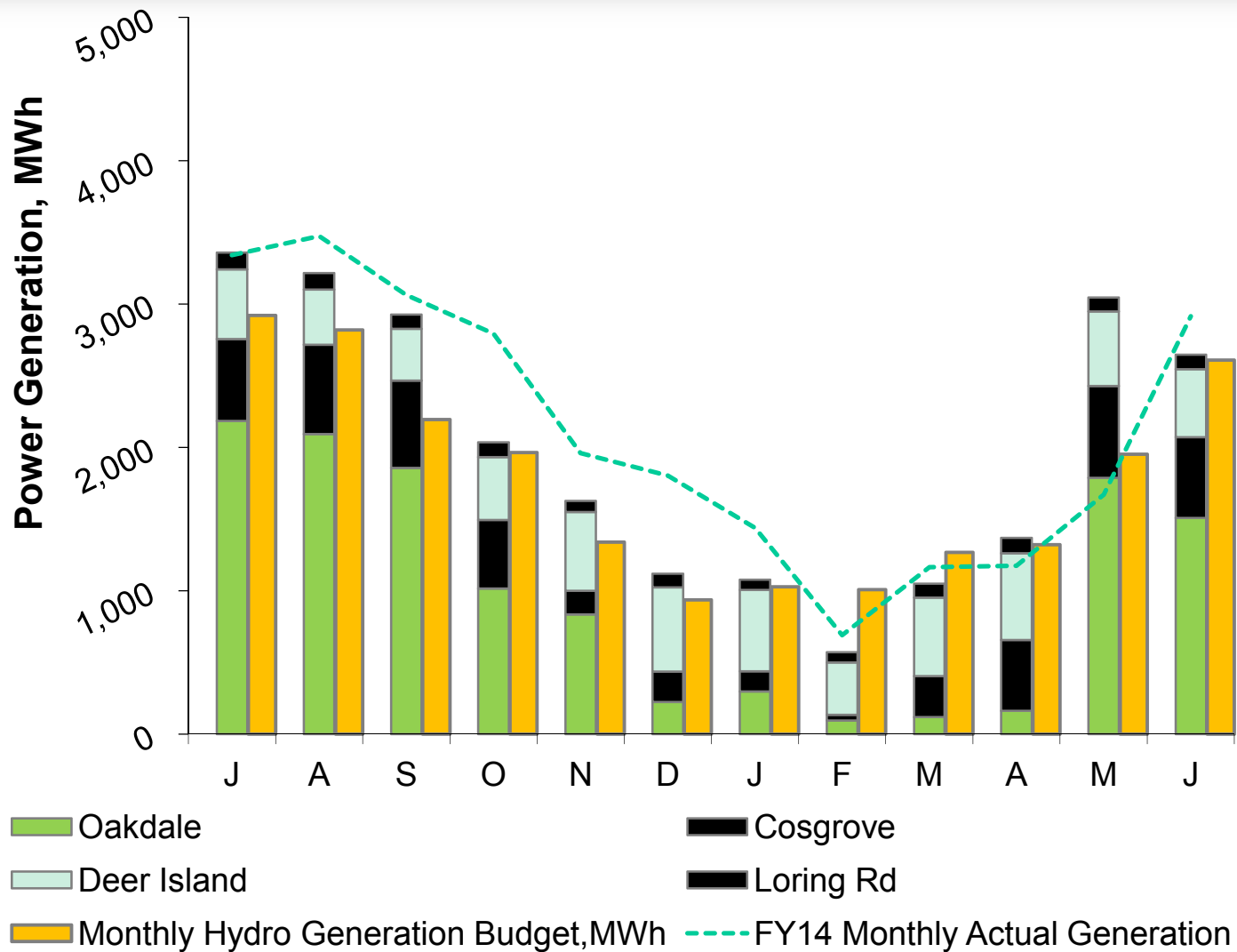
In the 12 months of FY15, MWRA's electricity generation by renewable resources totaled 60,081 MWh. MWRA's total electricity usage was approximately 198,361 MWh. The MWRA total electricity usage is the sum of all electricity purchased for Deer Island and FOD plus electricity produced and used on-site at these facilities. Approximately 97% of FOD electrical accounts are accounted for by actual billing statements; minor accounts that are not tracked on a monthly basis such as meters and cathodic protection systems are estimated based on this year's budget. In the first 12 months of FY15, green power generation represented approximately 31% of total electricity usage. All renewable electricity generated on DI is used on-site (this accounts for more than 50% of MWRA renewable generation). Almost all renewable electricity generated off-DI is exported to the grid.

- Notes:
1. Only the actual energy prices are being reported. Therefore, some of the data lags up to (2) months due to timing of invoice receipt.
 2. Savings and Revenue: Savings refers to any/all renewable energy produced that is used on-site therefore saving the cost of purchasing that electricity, and revenue refers to any value of renewable energy produced that is sold to the grid.
 3. Budget values are based on historical averages for each facility and include operational impacts due to maintenance work.

Monthly Renewable Electricity Production Tracking

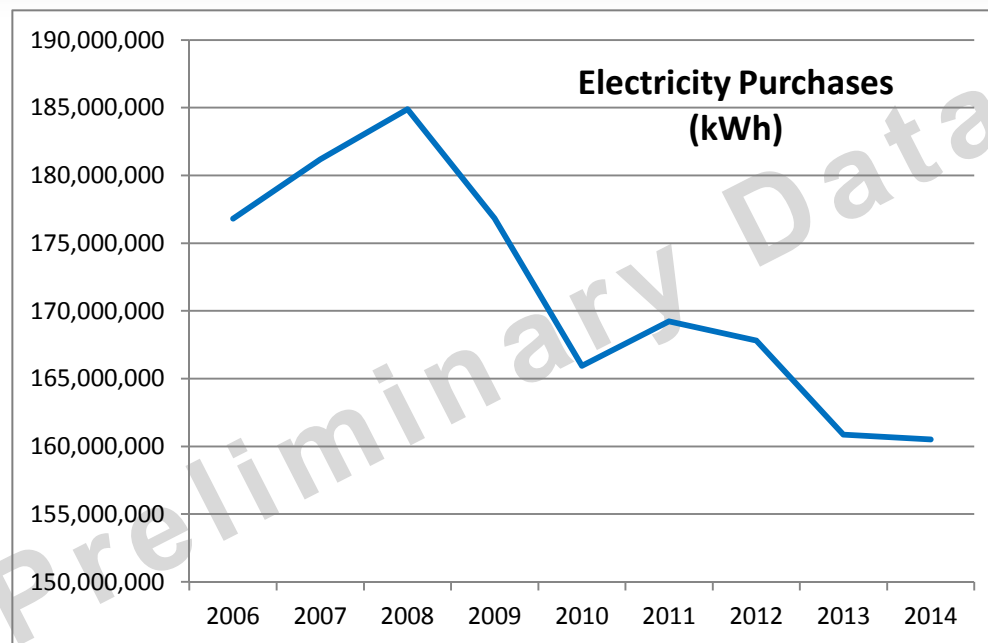


Example: Hydro Production





Trend in Electricity Purchases (2006-2014)



9% reduction in MWRA electricity purchases from 2006-2014. This is partly due to increases in renewable electricity usage and energy efficiency improvements made throughout the MWRA system.



- Installation of Energy Management Systems

Control HVAC system components including thermostats, heat pumps, cooling towers, boilers and domestic hot water

Energy Reduction of 1,086,331 kWh and 21,600 therms annually

GHG reduction of 878 metric tons of CO₂e

Annual savings of \$238,800.



Energy Efficiency Improvements-Lighting

Energy Efficient Interior and Exterior Lighting has been installed at over 40 MWRA facilities.

The annual energy savings from 21 lighting replacement projects over the past three years totals 2.3 million kWh with an associated GHG reduction of 1,616 metric tons of CO₂e and an annual savings of \$254,105.





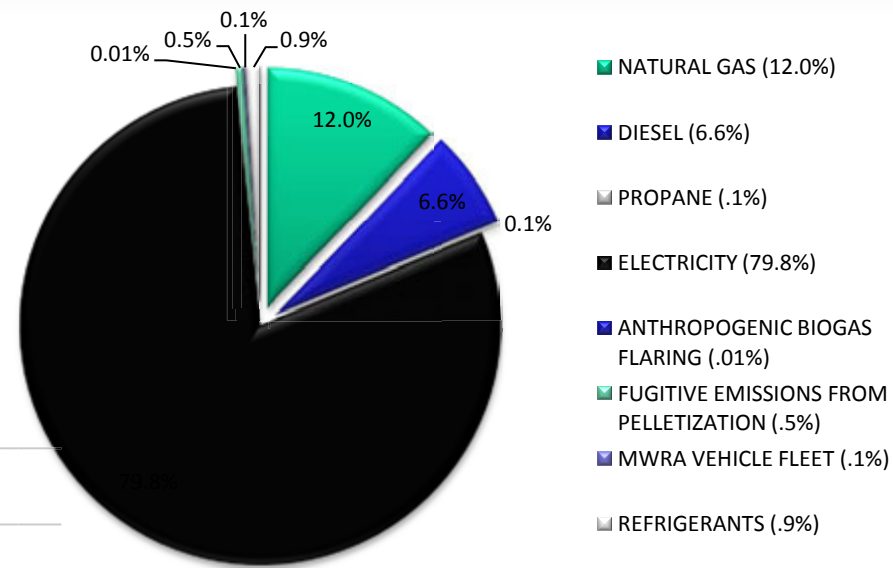
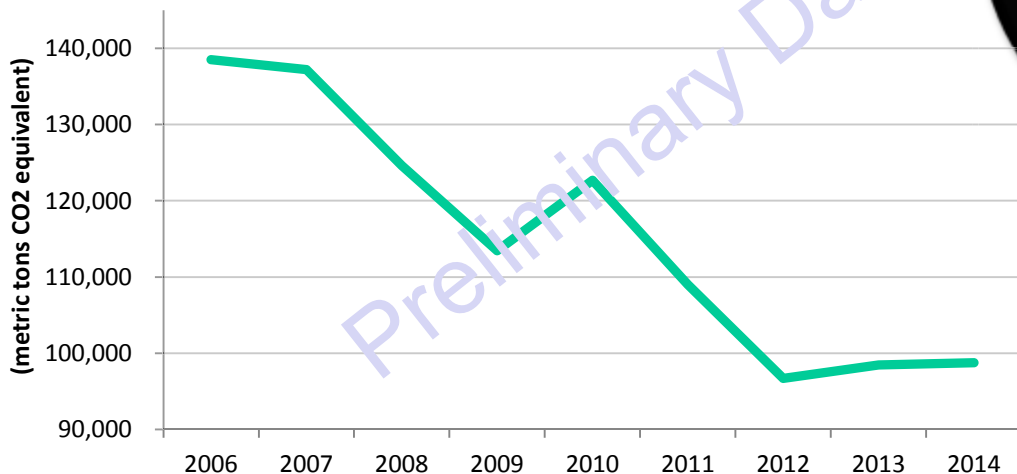
Energy Efficiency Improvements-Pipe Insulation

Custom pipe insulation installed at Reservoir Road, Spring Street and Brattle Court Water Pump Stations. This helped to eliminate condensation and thus, the need for dehumidification.

This saved 164,800 kWh annually resulting in a reduction of GHG emissions of 116 metric tons of CO₂e and an annual savings of \$25,000.



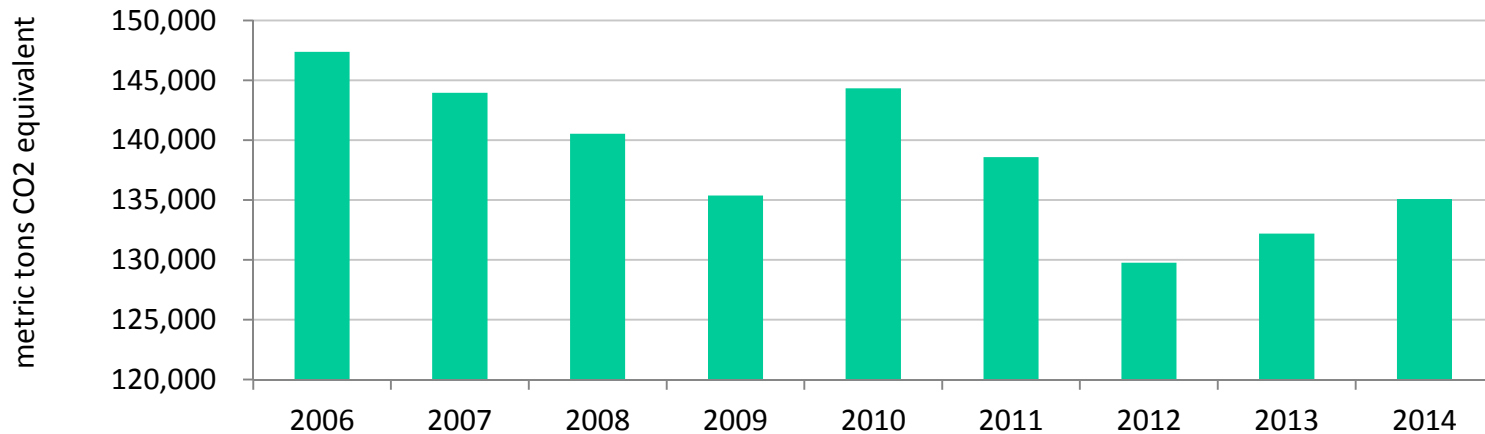
Green House Gas Reductions - 2006 - 2014



Percent Contribution Towards Reduction



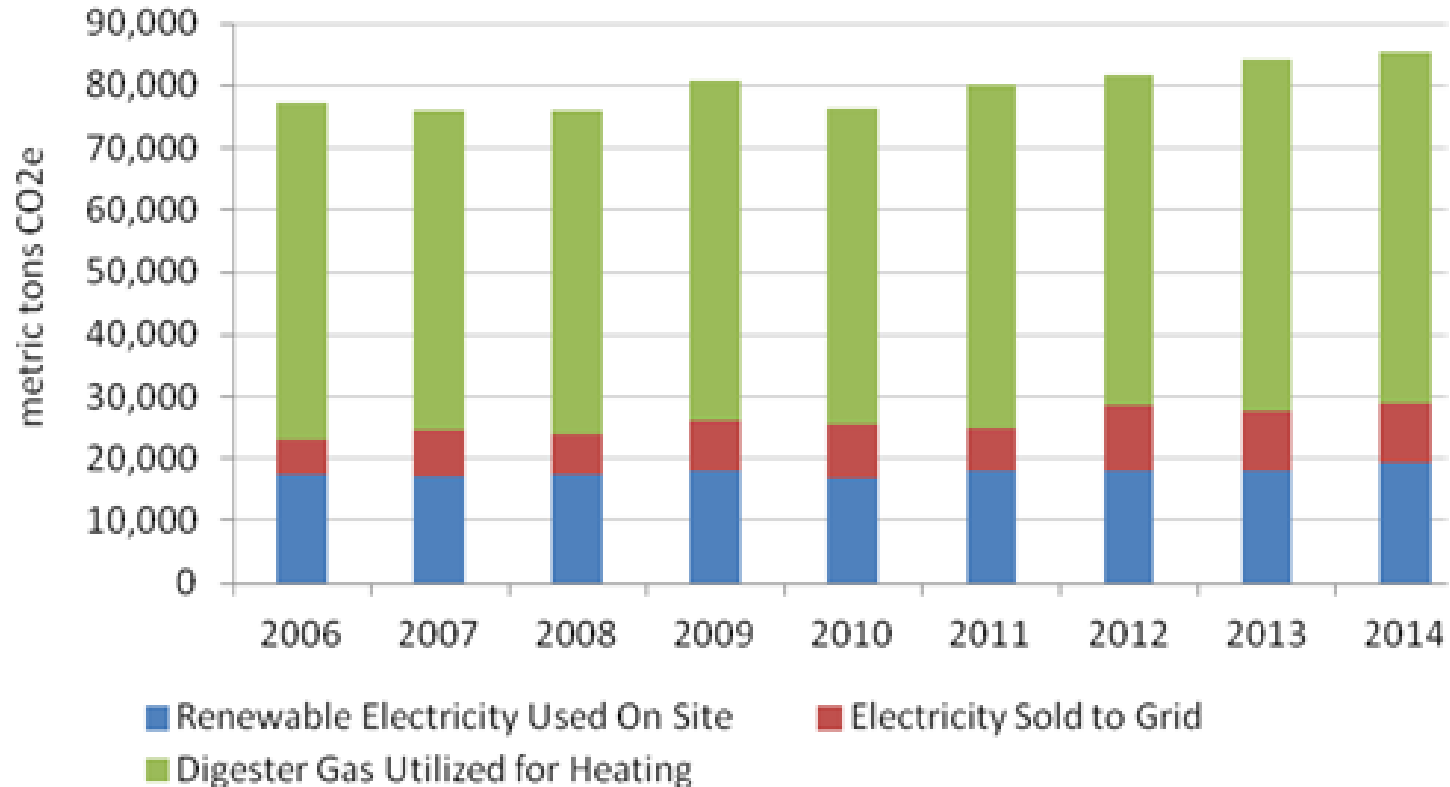
GHG Emissions 2006 to 2014



- GHG emissions have declined 8.3% since 2006.
- In 2014, direct energy use accounted for more than 64% of GHG emissions with electricity at 41%.
- 91% of GHG emissions are wastewater related and
- 9% of GHG emissions are water related

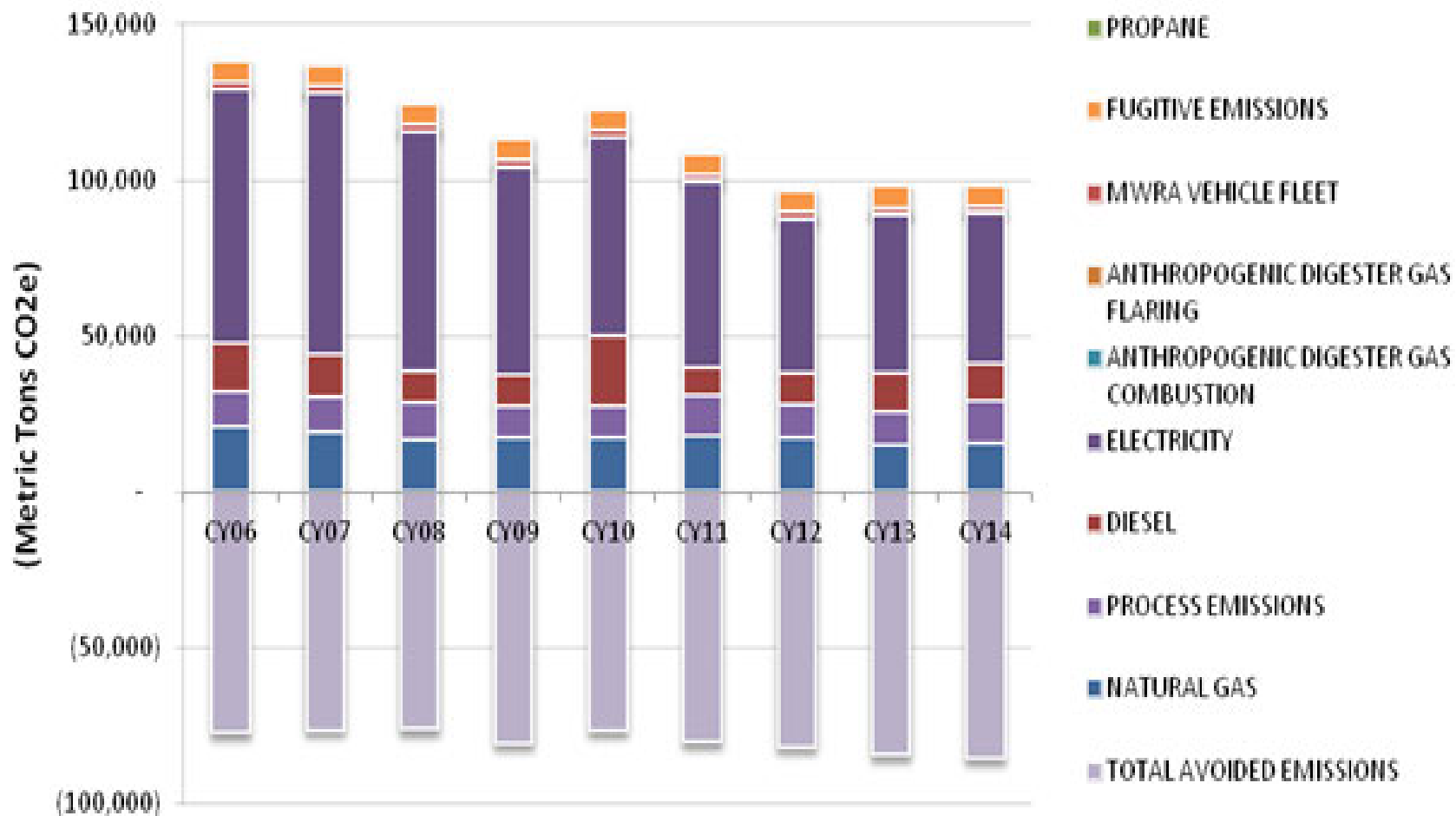


Renewables Impact on Avoided GHG Emissions





Total GHG Reduction Over Time



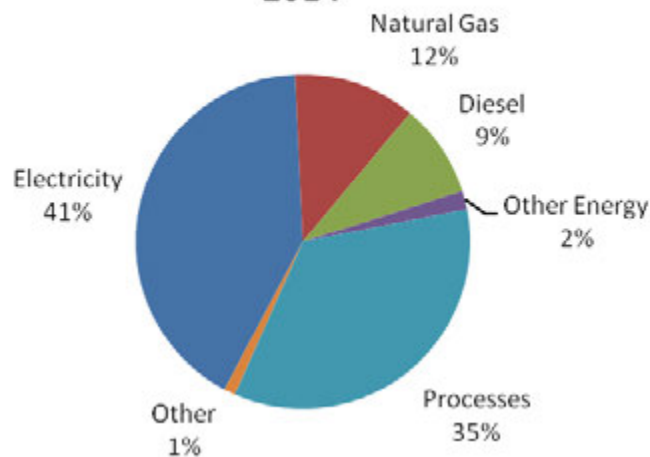


Questions?

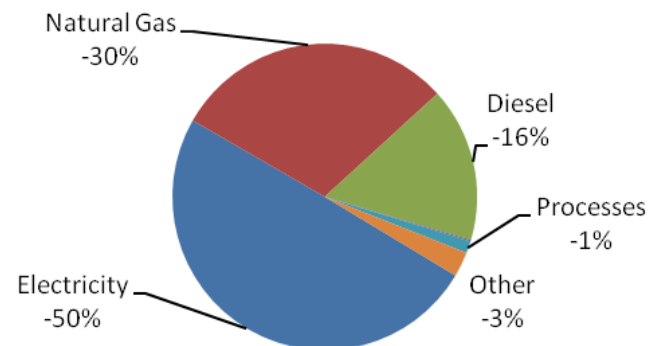


Emissions and Reductions by Source

**MWRA GHG Emissions by Source
2014**



**% Contribution to MWRA GHG Emissions
Reductions by Source
(from 2006-2014)**



- Reductions in Electricity purchased from 2006 through 2014 = 13%
- Drop in electricity demand accounts for 50% of GHG reductions.