



**Massachusetts Water Resources Authority**

*Presentation to*

**Mystic River Watershed Initiative  
SCIENCE FORUM**

# MWRA's Pragmatic Approach to Climate Change

Stephen Estes-Smargiassi  
Director of Planning and Sustainability

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## Best Known for the “Boston Harbor Cleanup”





# And Quabbin Reservoir





## 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

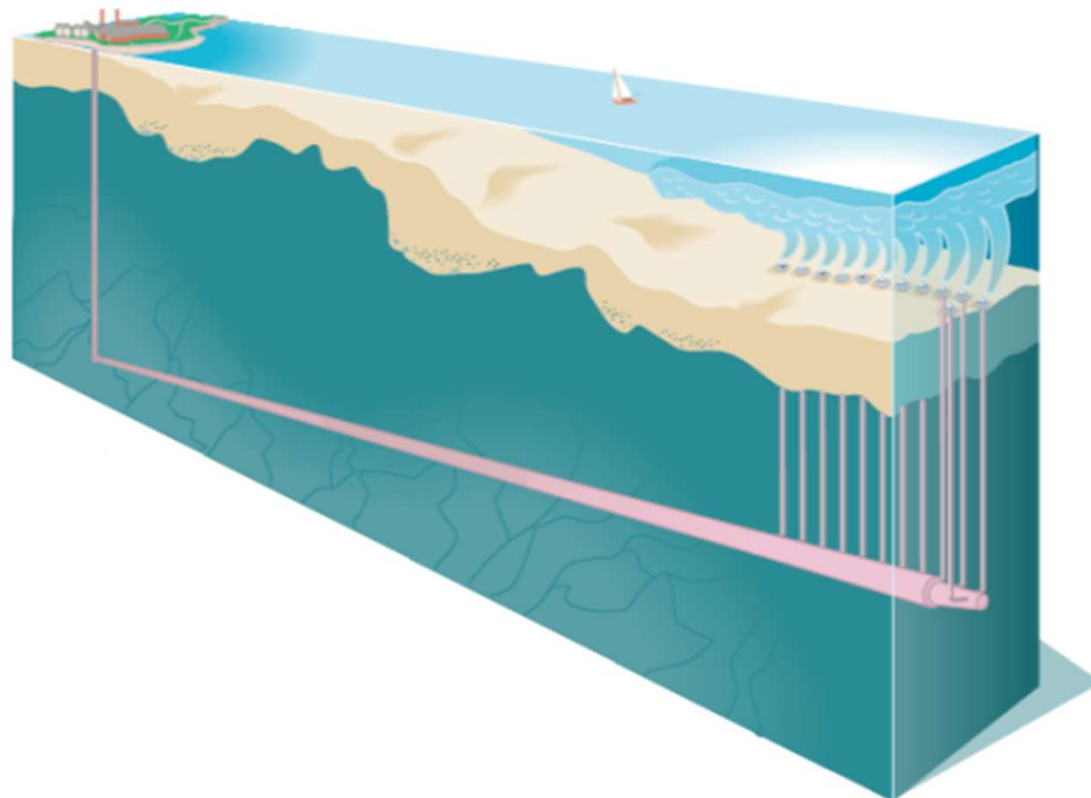






## A Rising Sea Impacts The Hydraulics Of The Outfall Tunnel

- 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





## Boston Region's Wholesale Water and Sewer Agency

- Created in 1985 to revive the regions' obsolete and aging water infrastructure
- MWRA provides wholesale water and wastewater services to over 2.5 million customers in 61 communities
- MWRA delivers an average of 200 million gallons per day to its water customers, with a peak demand of 350 million gallons
- MWRA collects and treats an average of 350 million gallons of wastewater per day, with a peak capacity of 1.2 billion gallons





## 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**



# 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





## Water System Not Threatened

- 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 Spillway



Wachusett Spillway capacity increased by lowering it 2 feet



## Examples of Dam Improvements: Wachusett New Crest Gate



Installation of a crest gate greatly enhances discharge operations





## Examples of Dam Improvements: Wachusett Auxiliary Spillway



New Wachusett Auxiliary Spillway constructed to pass flood discharge





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



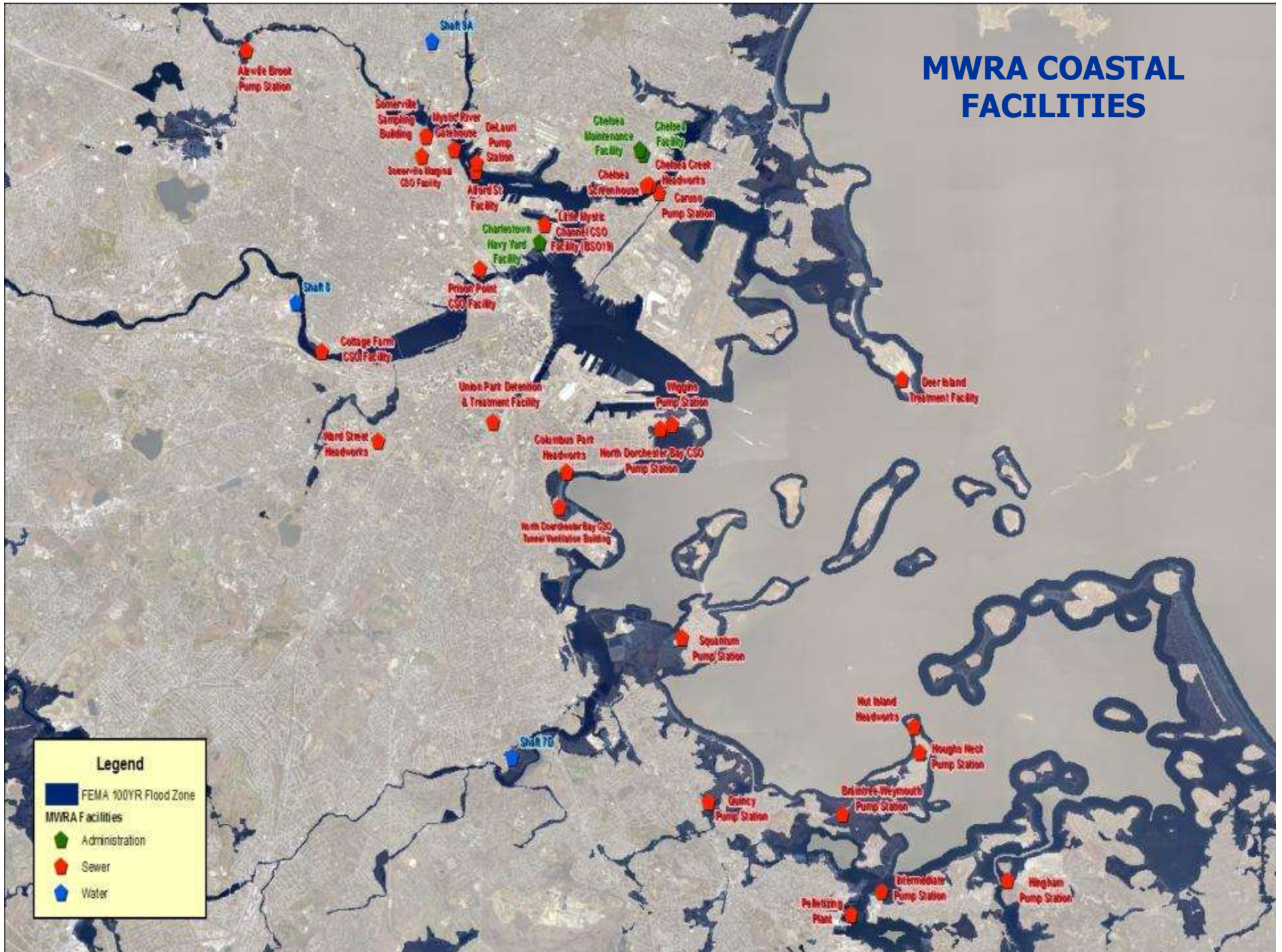




## More High Quality Water Means We Can Help Our Neighbors

- Quabbin Reservoir Can Act as the Regional “Flywheel”
- Existing Partial Users May Use More in Dry Years, Less in Wet
- Adjacent Communities May Need Emergency Supply More Often
- Some Communities May choose to Permanently Connect
- Improvementd in Reliability and Environmental Effects

# MWRA COASTAL FACILITIES





## Pragmatic Benchmarks For Evaluating Facilities

- 100 year flood as determined by FEMA (current regulatory requirement)
- **100 year flood + 2.5 feet of SLR**
- 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?

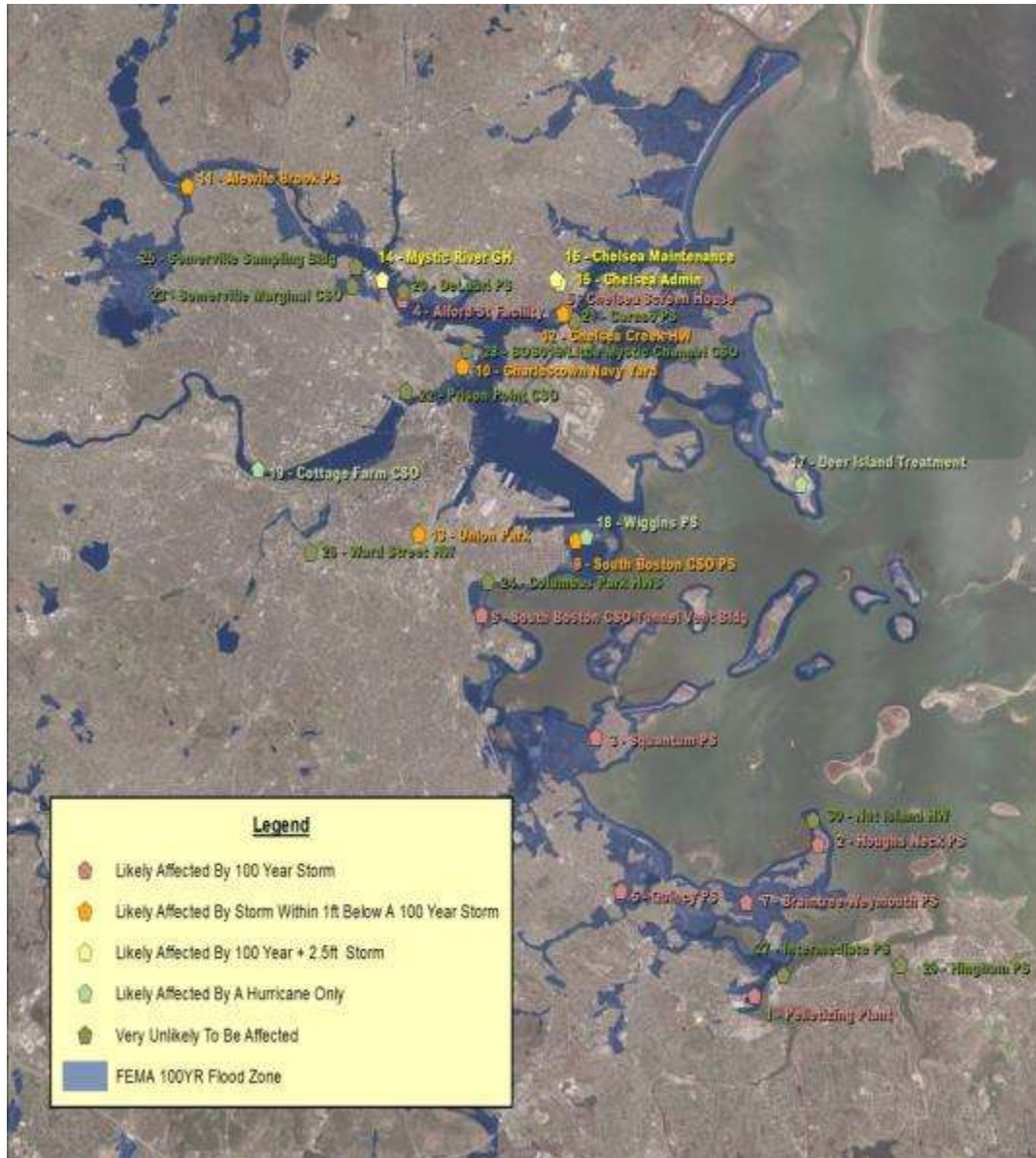
	Rank	Facility Name	Mitigation Actions Comments
Likely Affected By 100 Yr Storm	1	PELLETIZING PLANT	Barrier around backup generator and transformers erected. (*)
	2	HOUGHES NECK PUMP STATION	Stop plank barriers installed in entryways. (*)
	3	SQUANTUM PUMP STATION	Stop plank barriers installed in entryways. (*)
	4	ALFORD ST FACILITY	Sand bags will be used for flood protection. Future work under review.
	5	QUINCY PUMP STATION	Stop plank barriers installed in entryways. (*)
	6	CHELSEA CREEK SCREENHOUSE	Installed retaining wall to protect generator and main power panel; stop log barriers at all doors and roll-up doors; sump pumps inside building; two isolation gates to protect facility; raised ventilation louver above required elevation; led panels to protect all windows to required elevation; all new electrical installed above required elevation where feasible
	7	BRAINTREE-WEYMOUTH PUMP STATION	Stop plank barriers installed in entryways. (*)
	8	SOUTH BOSTON CSO TUNNEL VENTILATION BLDG	Flood protection plan drafted, flood protection specs designed, requisition for materials purchase submitted.
Likely Affected By Storm Within 1 ft below a 100 Yr Storm	9	SOUTH BOSTON CSO PUMP STATION	Flood protection design specs from vendor being reviewed in-house.
	10	CHARLESTOWN NAVY YARD FACILITY	MIS equipment and staff moved to upper floors.
	11	ALEWIFE BROOK PUMP STATION	Contractor installing flood protection system. Moving most critical equipment above flood level.
	12	CHELSEA CREEK HEADWORKS	Construction contract in progress to add stop log barriers at all doors including overhead coiling doors. Openings in façade being filled and moved above EL 119. Escape hatches, loading hatch and shaft opening being protected to EL 119. Valves being added to ductwork on mezzanine to isolate shafts upstream of influent gates.
	13	UNION PARK DETENTION & TREATMENT FACILITY	Operating Contractor designing specs which call for using sand bags at entry ways and isolating facility if required.
Likely Affected By a 100yr+2.5ft	14	MYSTIC RIVER GATEHOUSE	No adverse impact if flooded.
	15	CHELSEA ADMINISTRATION FACILITY	Flood protection plan drafted, flood protection specs designed, material specs out on street for quote Flood protection design specs from Vendor being reviewed in-house and modified due to requirement changes.
	16	CHELSEA MAINTENANCE FACILITY	Flood protection plan drafted, flood protection specs designed, material specs out on street for quote Flood protection design specs from Vendor being reviewed in-house and modified due to requirement changes.
Likely Affected By a	17	DEER ISLAND TREATMENT FACILITY	Plant processes designed to withstand a Category 3 Hurricane to allow uninterrupted facility operation. Some support facilities and access may be impacted.
	18	VIGGINS PUMP STATION	Will include flood plain protection in upcoming capital replacement project.
	19	COTTAGE FARM CSO FACILITY	
Very Unlikely To be Affected	20	DELAURI PUMP STATION	
	21	CARUSO PUMP STATION	
	22	PRISON POINT CSO FACILITY	
	23	SOMERVILLE MARGINAL CSO FACILITY	
	24	COLUMBUS PARK HEADWORKS	
	25	SOMERVILLE SAMPLING BUILDING	
	26	WARD STREET HEADWORKS	
	27	INTERMEDIATE PUMP STATION	
	28	LITTLE MYSTIC CHANNEL CSO FACILITY	
	29	HINGHAM PUMP STATION	
	30	NUT ISLAND HEADWORKS	

Projects have been prioritized from the top of the chart (most immediate risk) down through the rankings.

\* In some cases specifications are being revised due to more recent updates to the FEMA flood maps. Future modifications to protection measures will be made as necessary.



# Facilities Impact Summary



- 8 Sewer Facilities Likely Affected by a 100 Year Event
- 4 Sewer and 1 Administration Facilities Within One foot of a 100 Year Event
- 3 Sewer Facilities Affected by 100 plus 2.5 ft Event
- 3 Sewer Facilities Likely Affected by Hurricane Flooding
- 11 Sewer Facilities Unlikely Affected
- **No Water Facility At Risk of Service Disruption**





# Flood Elevations At Chelsea Creek Headworks





# Braintree-Weymouth Replacement Pump Station High Tide







# LiDar Based Simulated Inundation of the Chelsea Area at 100 Year Plus 2.5 Feet Flood Level





## Past Practice for Major Storms

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

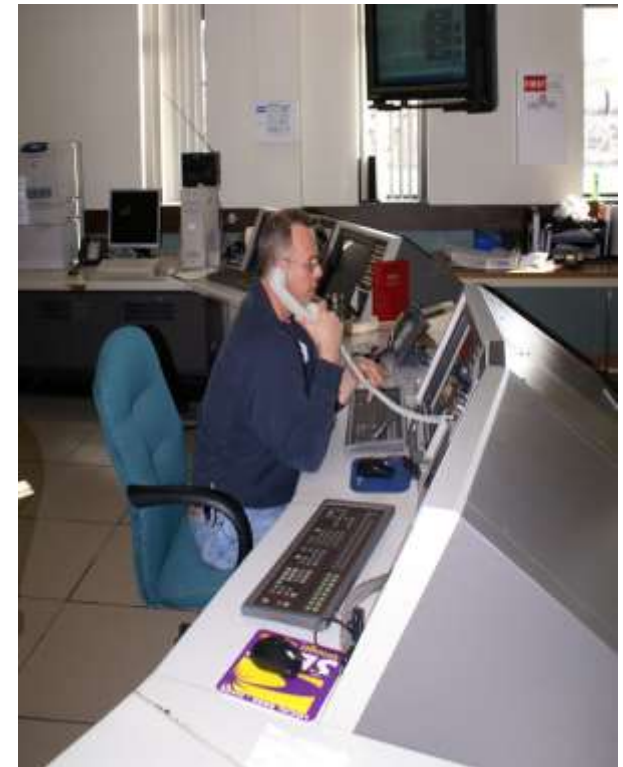






## Emergency Action Plan

- Back-up water and wastewater operations control center created at Carroll Treatment Plant in Marlborough
- Staff and equipment redeployed to pre-determined locations in advance of storms
- Install temporary flood barriers
- Purchased additional large, portable pumps
- Long-term capital rehabilitations include flood protection







## MWRA Approach Going Forward – Short Term

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





# Chelsea Admin Building SCADA Building





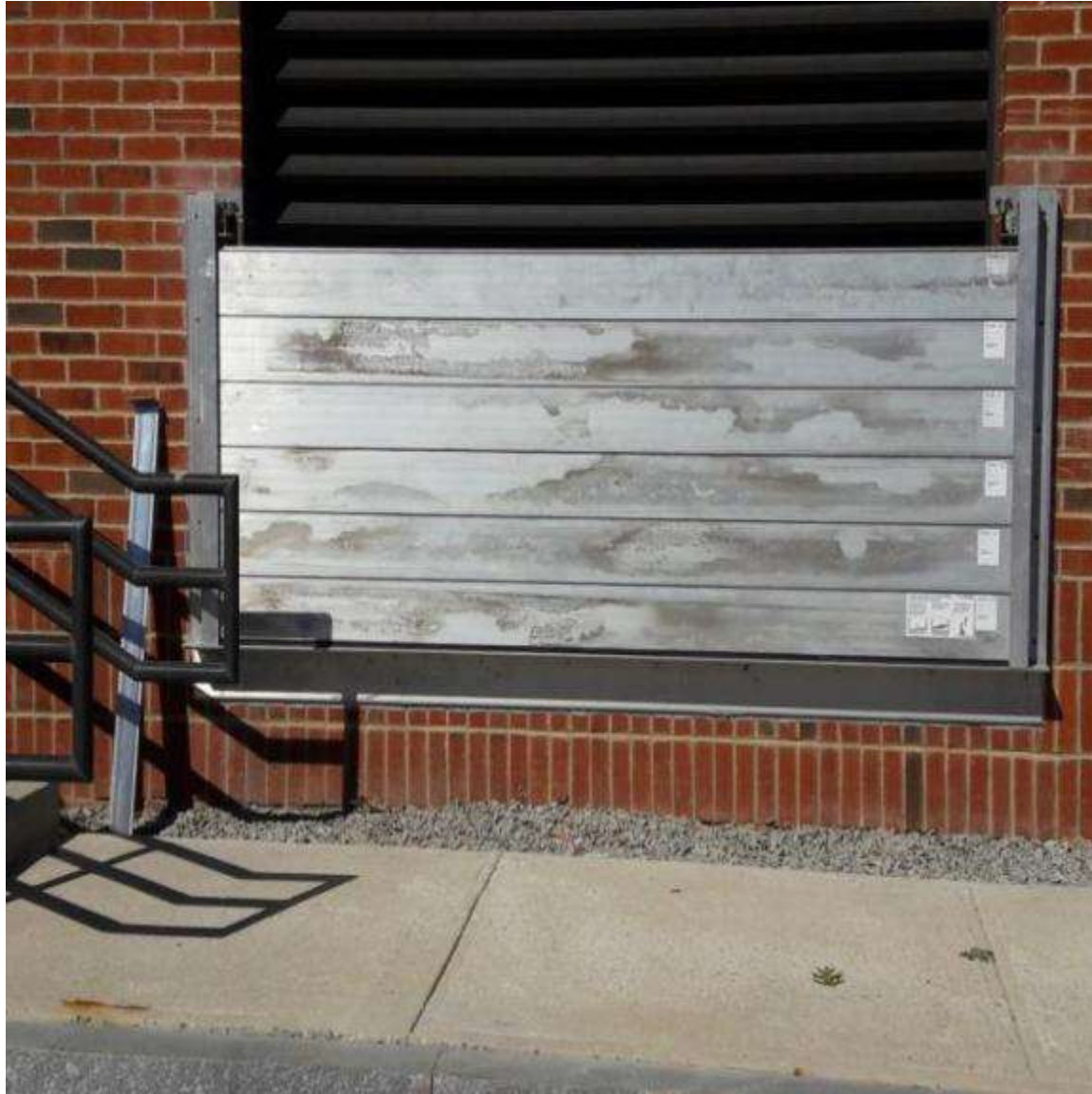
## Braintree Weymouth Side Entrance







# Braintree Weymouth Generator Louvers





## Braintree Weymouth Hatch to Screen room







# Flood Barrier Stop Plank Storage Cabinet



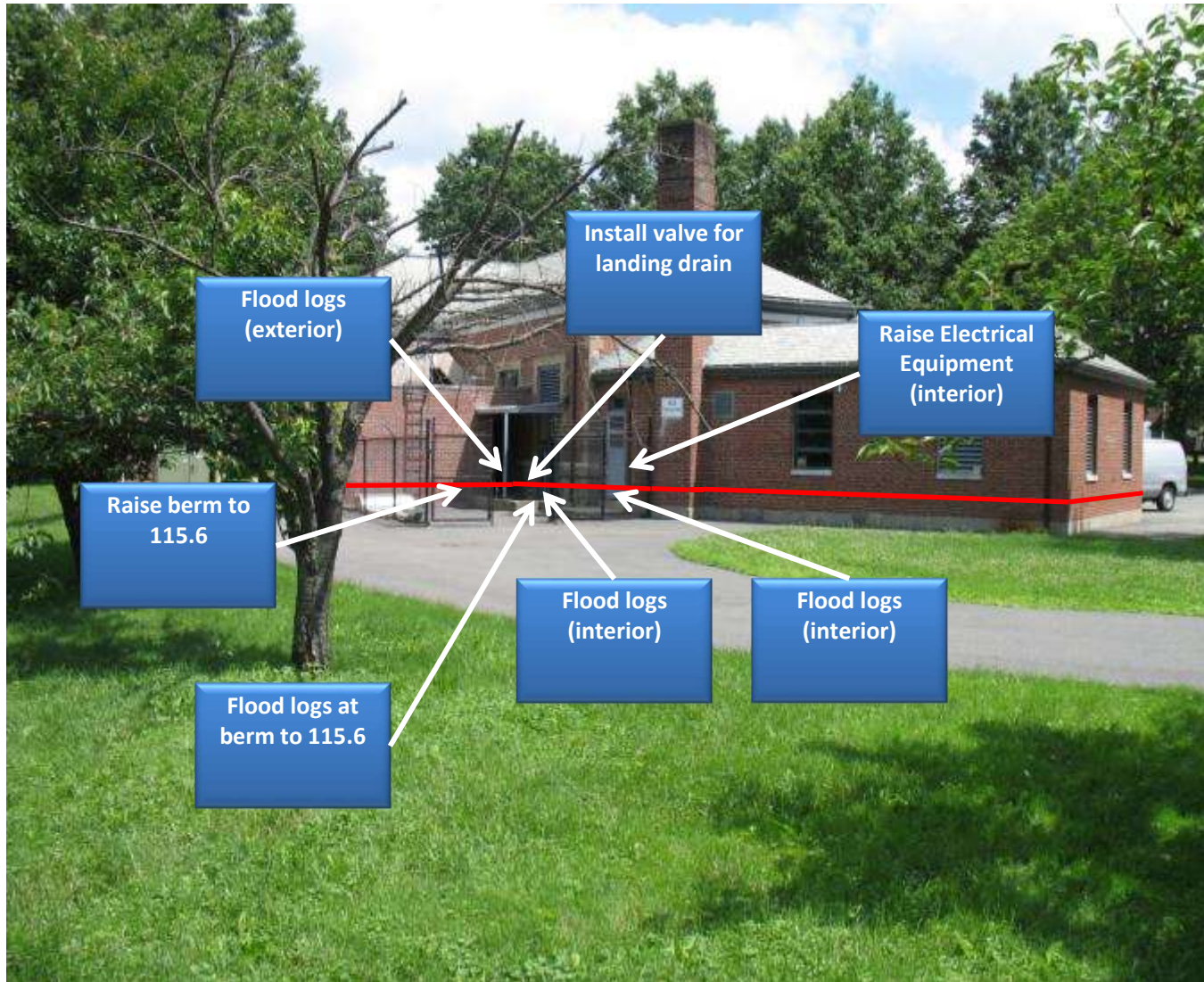


## MWRA Approach Going Forward – Long Term

- 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



# Alewife Brook Pump Station – Envelope Flood Protection Measures





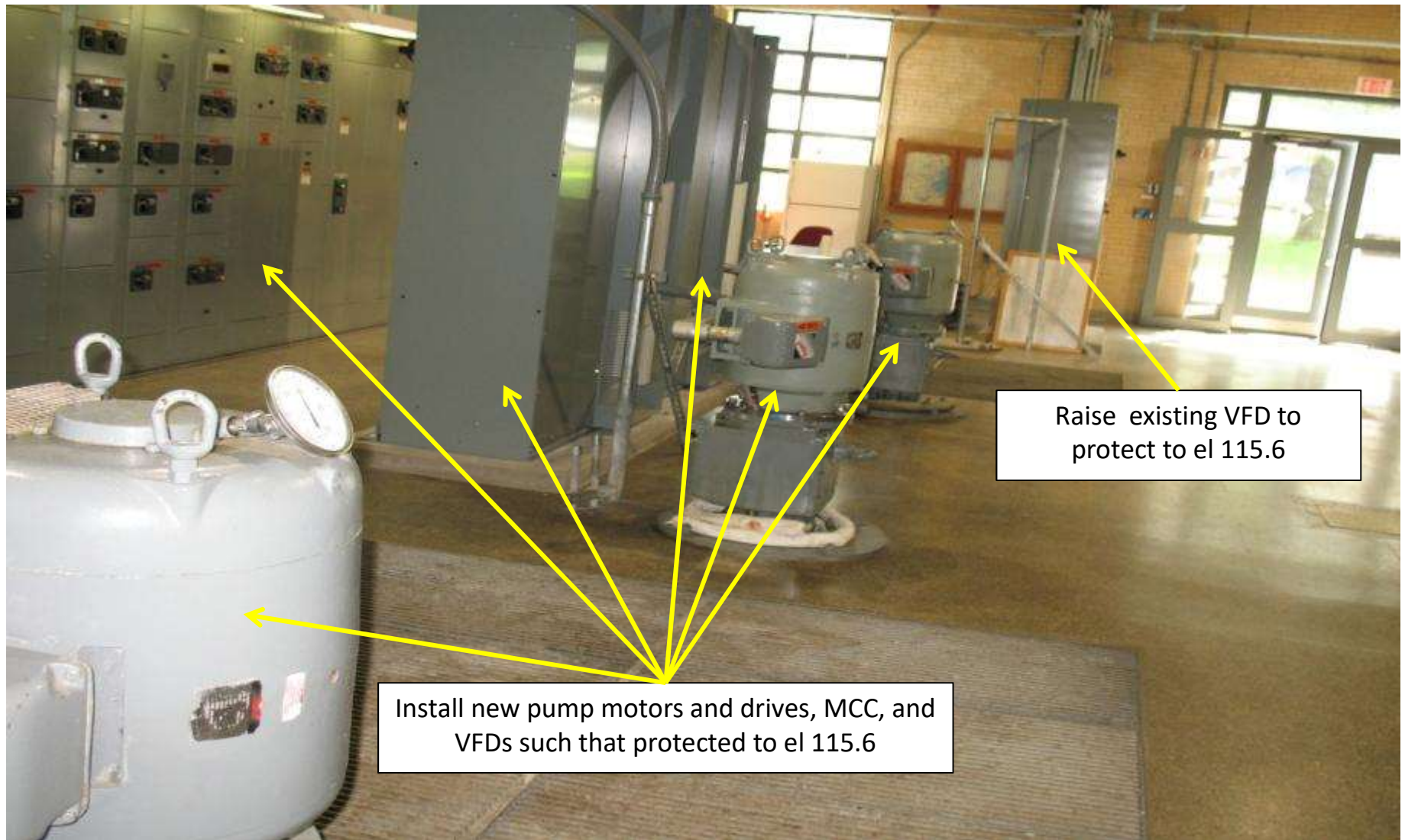


## Alewife Screen Room





## Operating Room – Flood Protection Measures





# Chelsea Screenhouse Generator







## Chelsea Screenhouse MCC room





## Chelsea Screenhouse Screen room





## Flood Panel Barrier (Demo at MWRA)







## Tiger Dam (Demo at MWRA)





# MegaSecur Watergate







# Passive Flood Protection







# MWRA is a Partner in the Metro Mayors Climate Mitigation Commitment





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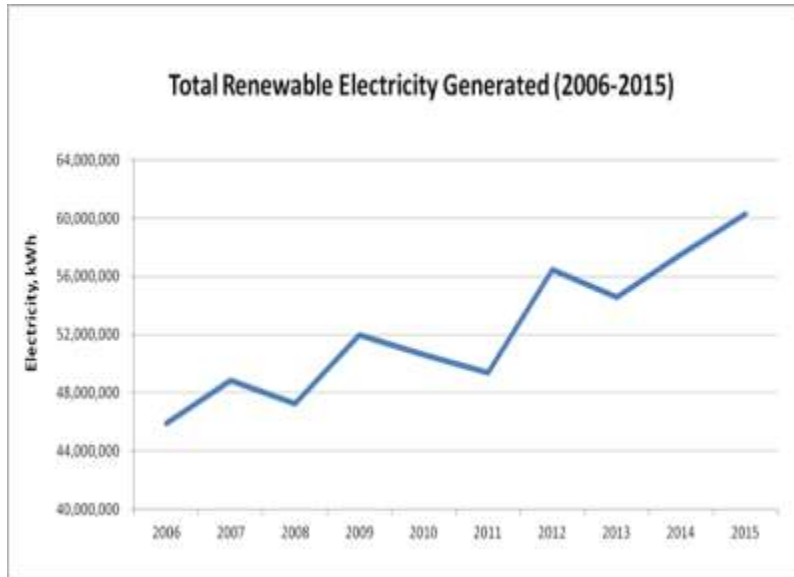


# Renewable Energy at MWRA



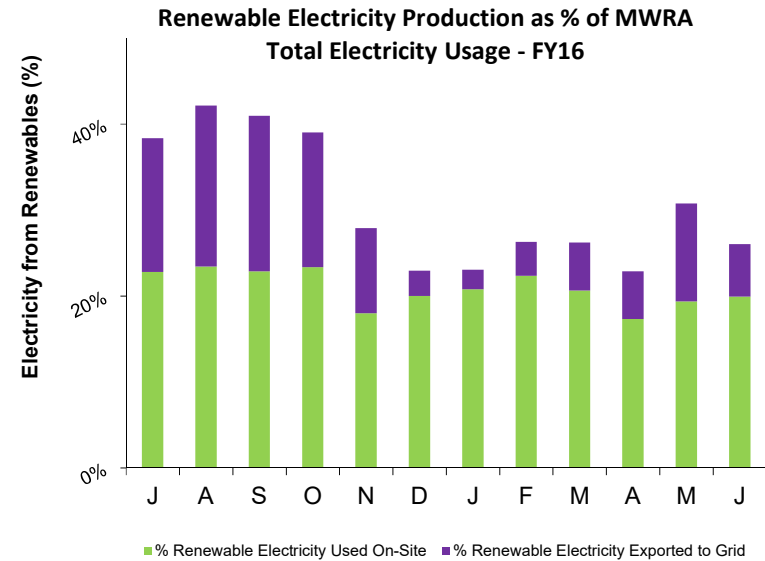


# Renewable Energy at MWRA



Renewable generation increased from 45.9 M kWh in 2006 to 60.3 M kWh in 2015, an increase of 31.3 %

Renewable generation in FY16 = 31 % of total MWRA total electricity usage





## Deer Island Treatment Plant

- Deer Island is one of the largest electricity users in the Northeast
- Deer Island currently self-generates 28% of its electricity needs
- Over 60% of the plant's energy demand is provided by on-site, renewable generation (heat and electricity)







## 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
- Avoid purchase of about 5 million gallons in fuel oil annually
- Approximately 31 million kWh per year electricity production
- Approximately \$3.3 million per year electricity savings and revenue





# Hydroelectric Power

- Deer Island, Oakdale, Cosgrove, Loring Road
- Over 8 MW capacity
- Approximately 20 kWh per year in electricity production
- Over \$1.4 million in annual savings and revenue







## Solar Power - Deer Island Treatment Plant

- 736 kW capacity
- Over 890,000 kWh per year in electricity production
- Approximately \$207,000 in annual savings and revenue







## Solar Power – Carroll Water Treatment Plant

- 496 kW capacity
- Approximately 580,000 kWh per year in electricity production
- Over \$120,000 in annual savings and revenue





## Wind Power – Deer Island Treatment Plant

- Two 600 kW turbines
- 1.9 million kWh per year in electricity production
- Approximately \$225,000 in annual savings and revenue





## Wind Power - Charlestown

- 1.5 MW capacity
- Over 2.2 million kWh per year in electricity production
- Approximately \$413,000 in annual savings and revenue







## Facility Energy Efficiency Audits

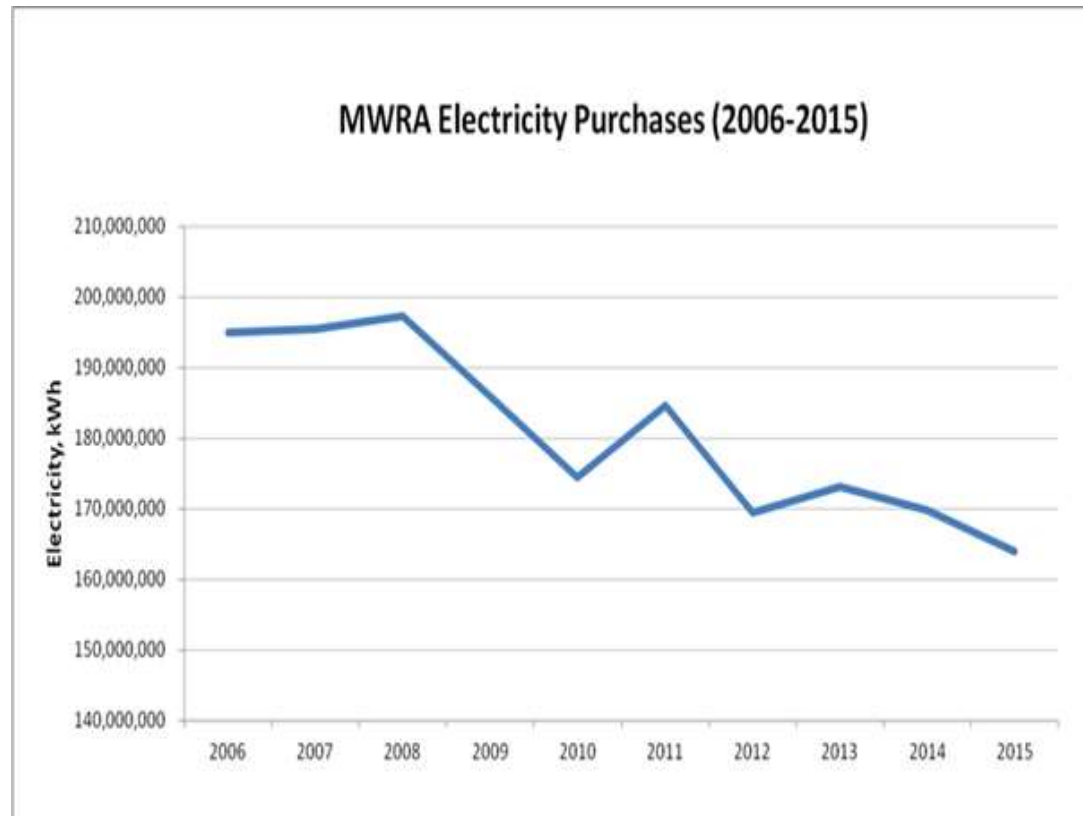
- MWRA has completed over 50 energy audits at most major facilities
- Implementation of audit recommendations and other process optimization efforts have saved over 25M kWh or \$2.5 million annually





## Electrical Energy Purchases Have Decreased by 16 Percent

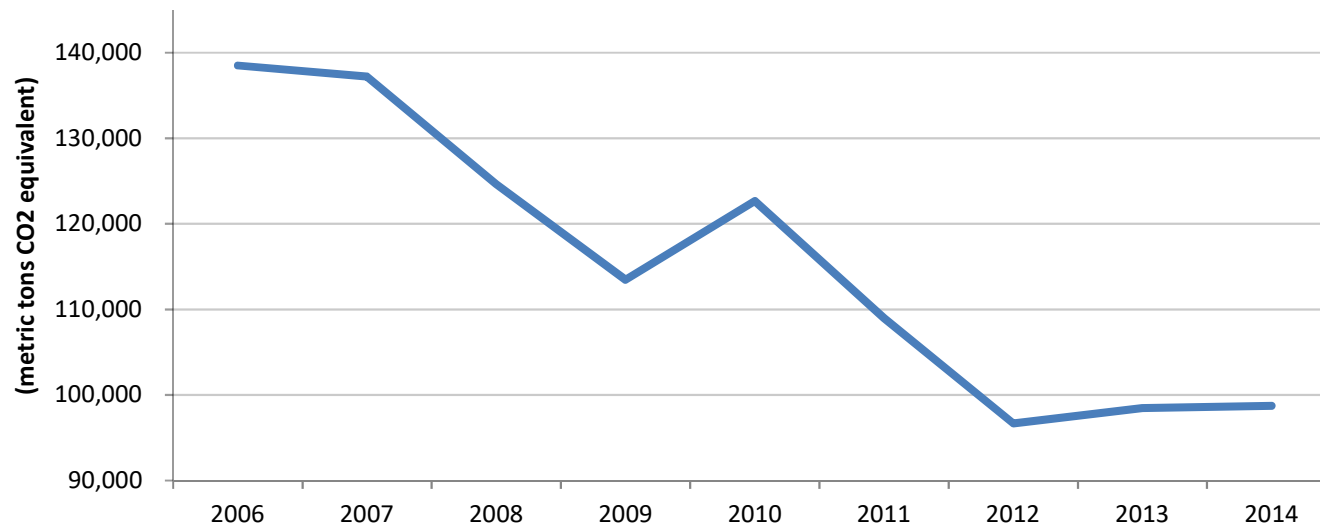
- From 2006 to 2015, MWRA's purchases of electricity have been reduced by 16%, or 31.5 million KWh





## Green House Gas Inventory – 29% Reduction 2006 - 2014

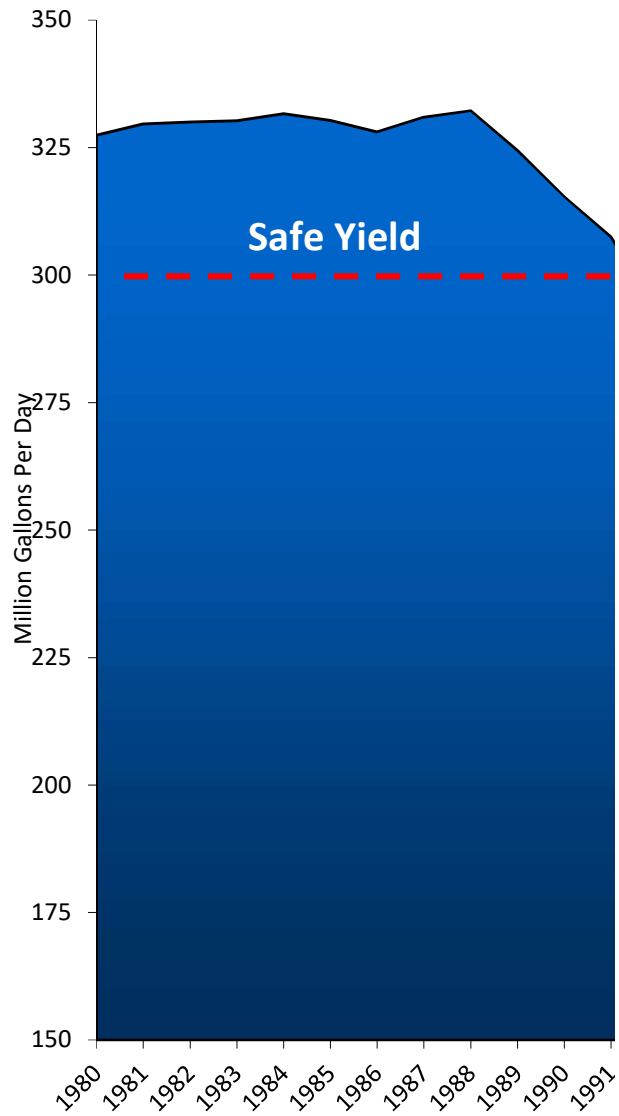
- Calculate historical GHG emissions to identify major sources and reveal trends
- Highlight successes to date regarding GHG emission reductions
- Manage GHG risks
- Identify emissions reduction opportunities





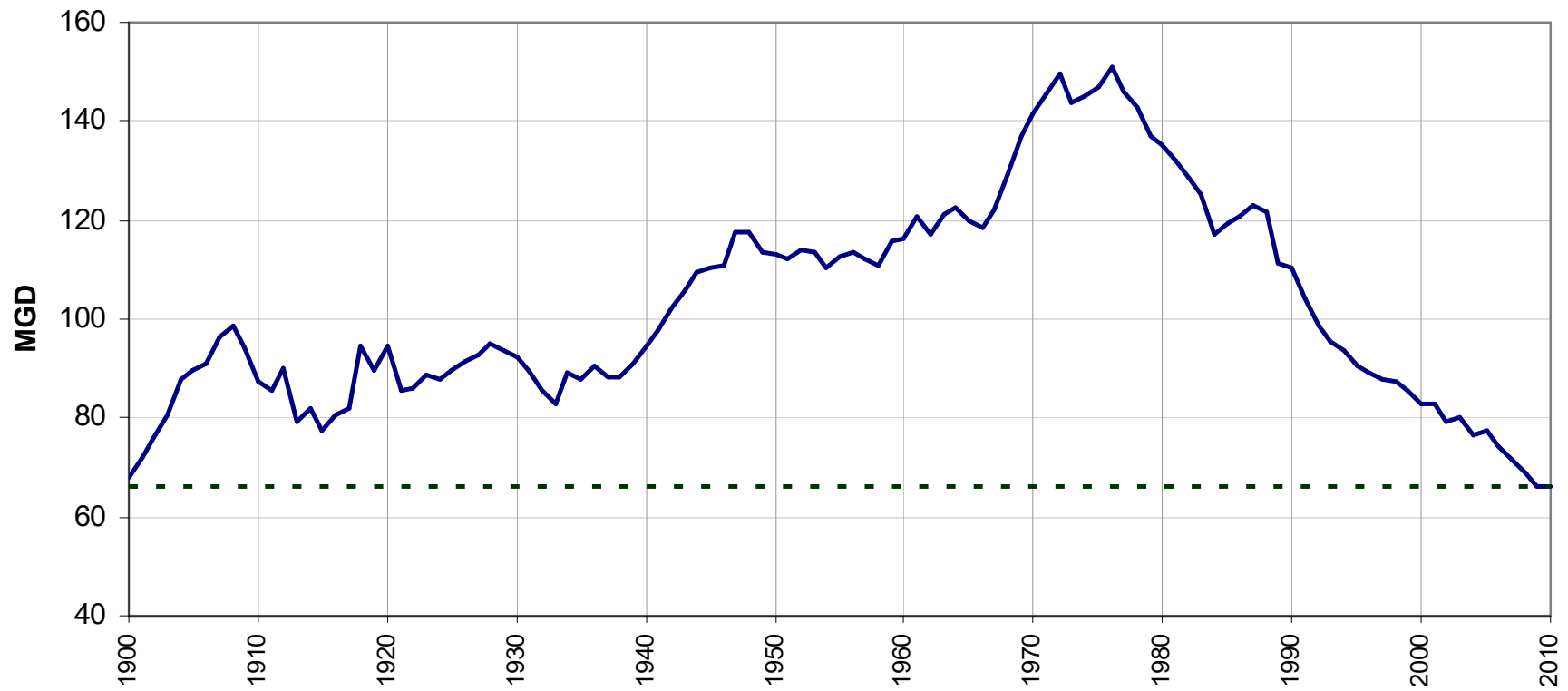


# Water Conservation Worked



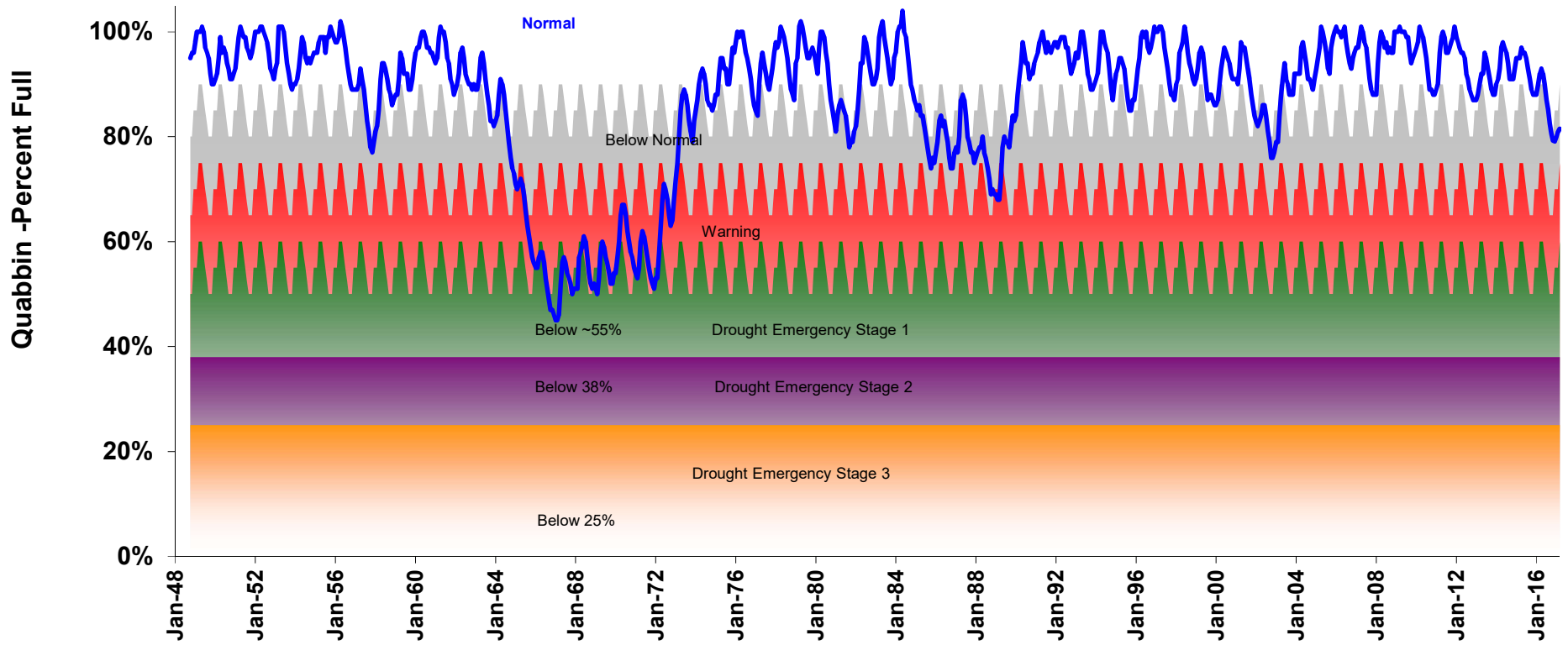


# Boston's Usage Is At A 110-Year Low





# Quabbin's Long-Term Storage







# “Best Drinking Water” In The Country: Don’t Waste It!



1 2 3 4 5  
(Boston, MA, 06/10/14) Water taste test at the American Water Works Association Annual Conference and Exposition at the Boston Convention and Exhibition Center. Judges for the contest were from left to right: Roy Desrochers from Woburn, MA, Peter Howe from New England Cable News, Matthew Tolcher from Norcross, Georgia and James Naylor from Fort Worth Texas.. Tuesday, June 10, 2014. Staff photo by Ted Fitzgerald



# Questions or Comments?

**Stephen Estes-Smargiassi**

**smargias@mwra.com**

**617-788-4303**

**[www.mwra.com](http://www.mwra.com)**

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