Presentation to the

Water Supply Citizens Advisory Committee

**MWRA at 30:**
Then and Now

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Executive Director

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• MWRA provides wholesale water and wastewater services to over 2.5 million customers in 61 communities

• On average, 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
Make-Up Of MWRA Service Area

• 51 communities that get water service – over 6,000 miles of water pipe
• 43 communities that get sewer service
• Of those, 30 get both water and sewer

  – 39 Towns
  – 20 Cities
  – 1 Fire District

  – 37 Boards of Selectmen
  – 20 Mayors
  – 3 Council Presidents
• In 1982 and 1983, civil suits were filed against the MDC and other state agencies claiming that the Massachusetts Clean Waters Act had been violated as a result of discharges of untreated and partially treated sewage from Nut and Deer Islands.
A New Agency Was Needed

- MDC was determined to be unable to fulfill its mission

- Comprehensive legislation was ready for consideration by the legislature in 1984

- But over the summer, progress was slowed as lawmakers, regulators, lawyers, environmentalists and citizens wrangled over the details

- A Federal Judge brought the process to a head by declaring a moratorium on new sewer hookups
On July 1, 1985, The MWRA Opened

- MWRA assumed responsibility for the water and sewer infrastructure serving greater Boston, and to end the pollution of Boston Harbor from obsolete treatment plants

- MWRA was created as an independent authority charged with raising its revenue from ratepayers, bond sales and grants

- MWRA had to establish wholesale water and sewer rates to cover all costs, including a massive capital program to repair and upgrade the systems

- MWRA was also charged with promotion and enforcement of water conservation and planning for the future

- In compromise with Western and Central Massachusetts, MDC retained watershed management, but MWRA covers costs
What did we inherit?
Two Obsolete Wastewater Treatment Plants
Raw Sewage Pouring Into Boston Harbor Daily
Dry Weather CSOs
On The Water Side, Things Were Pretty Grim

- Thousands of miles of aging pipelines were leaking millions of gallons of water

- No plans were in place for upgrades to carry the water system into the next century

- And the Northeast Drought of the late 1960s cast doubt on the adequacy of existing sources

- Little covered storage
  - Open reservoirs after treatment
  - Crude and inconsistent disinfection
Gaseous Chlorine
And A Lot Of Leaky, Old Pipes
Neglected Dams And Unprotected Watersheds
And A Lot Of Leaky, Old Pipes
Tuberculated Pipe
And A Lot Of Leaky, Old Pipes
Leaking Valve Assembly
And A Lot Of Leaky, Old Pipes
Water System Demand Exceeded Safe Yield

The graph shows the demand for water in MGD (megagallons per day) from 1950 to 1987. The red line represents the safe yield, while the blue line indicates the actual demand. After 1970, the demand exceeds the safe yield, indicating a potential issue with water supply.
The Northfield Project was a proposal for skimming Connecticut River spring flood flows and diverting them into the Quabbin Reservoir.
What did we have to do?
MWRA’s $7 Billion Capital Improvement Program

- Boston Harbor Project
- MetroWest Supply Tunnel
- Spot Pond Supply Mains
- Hultman Aqueduct Rehab
- Covered Storage Projects
- Braintree-Weymouth Relief Facilities
- Weston Aqueduct Supply Mains
- Carroll Water Treatment Plant
- UV Treatment
- Union Park
- East Boston Branch Sewer
- South Boston CSO
- Community Managed CSO Projects

Year-by-Year Investments (in $ Millions):
- FY 86: $84
- FY 87: $120
- FY 88: $149
- FY 89: $196
- FY 90: $304
- FY 91: $504
- FY 92: $608
- FY 93: $580
- FY 94: $608
- FY 95: $437
- FY 96: $447
- FY 97: $498
- FY 98: $392
- FY 99: $533
- FY 00: $658
- FY 01: $297
- FY 02: $194
- FY 03: $168
- FY 04: $152
- FY 05: $178
- FY 06: $196
- FY 07: $182
- FY 08: $211
- FY 09: $139
- FY 10: $138
- FY 11: $155
- FY 12: $102
- FY 13: $138
- FY 14: $171
- FY 15: $180
- FY 16: $177
- FY 17: $177
- FY 18: $177
80% Of Capital Spending Has Been Mandated

Mandated (Court & Consent Orders)

Non-Mandated

Thousands

$ Thousands

FY86 FY88 FY90 FY92 FY94 FY96 FY98 FY00 FY02 FY04 FY06 FY08 FY10 FY12 FY14 FY16 FY18
Quabbin Reservoir
Storage: 412 billion gallons
Depth: 150 feet
Length: 17.9 miles
Width: 3 miles

Wachusett Reservoir
Storage: 65 billion gallons
Depth: 129 feet
Length: 8.5 miles
Width: 1 mile
An Civil Engineering Marvel

- 102 miles of active transmission mains and tunnels (43 miles on standby)
- 284 miles of distribution mains with over 4,700 valves
- About 85% of the water is delivered by gravity
- 11 pump stations
- 5 years of storage
“...as we progress and find that we can control the quality of the water by our own acts, we realize it is a wicked thing to turn water containing a large amount of organic matter into a city or town for people to drink – children, invalids and people whose constitutions are too weak to overcome the effects of bad water. I think we should realize the responsibility that rests on us as superintendents and engineers to do all that we can to raise the standard; to insist that a city or town should have good water and that they should judiciously spend enough to make it good.”

-Desmond Fitzgerald, Boston Water Works 1895 annual meeting of the New England Water Works Association
• Completed in July 2005

• Treatment Processes:
  – Ozonation for primary disinfection
  – Corrosion control
  – Chloramination for secondary disinfection
  – Fluoridation
WSCAC staff reviewed numerous technical reports and served on many treatment committees
Addition Of Ultraviolet Light Disinfection

- New regulations required that unfiltered systems must have two primary disinfectants, one of which must achieve *Cryptosporidium* inactivation

- UV facilities at the Carroll Treatment Plant came on-line in April 2014
MWRA Metropolitan Area Storage Capacity Over Time

2.182 million gallons of open distribution storage.

10 Year (2003-2013) Max Day Demand (7/7/2010)
MWRA has built six new covered storage tanks to replace all open reservoirs.

The last one is just about complete.
Norumbega Covered Storage Facility

- The tank was completed in May 2004
- It provides 115 million gallons of storage for metropolitan Boston
WSCAC Helped Get The Tank Built

- WSCAC supported the land swap with Weston for the tank site
• The MetroWest Water Supply Tunnel was brought on-line in November 2003

• By March 2004, the Tunnel was being fully utilized allowing the shutdown of the Hultman Aqueduct for repair
Since 2013, for the first time since originally planned in the 1930s, the Metropolitan Water System has redundancy for the Hultman Aqueduct from Marlborough to Weston.
Water Pipeline Rehabbed Or Replaced

- 81 miles of MWRA-owned pipeline
- 474 miles of community-owned pipeline
State-Of-The-Art Monitoring System
s::can Parameters Monitored At 18 Locations

- pH
- Temperature
- Conductivity
- Turbidity
- Dissolved Organic Carbon
- Total Organic Carbon
- Nitrate-N
- UV 254
- Oxidation-Reduction Potential
- Monochloramine
- Free Chlorine
- Total Dissolved Solids
• Since 1985, $133 million has been invested in land preservation

• So well protected, the Safe Drinking Water Act requires only disinfection

<table>
<thead>
<tr>
<th>Watershed</th>
<th>% of Watershed</th>
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<tbody>
<tr>
<td>Wachusett Reservoir</td>
<td>56%</td>
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<tr>
<td>Ware River</td>
<td>62%</td>
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<tr>
<td>Quabbin Reservoir</td>
<td>80%</td>
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Wachusett Watershed Protected Land: 1985 - 2014

1985 Fee
1985-2014 Fee, WPR
Other Protected Lands
WSCAC Has Always Pushed Hard For Watershed Protection

• Serving on the New England Safe Drinking Water Act Coalition providing feedback to EPA on revising the Act

• WSCAC also helped focus attention on gulls as the reason for the seasonal spike in fecal coliforms at Wachusett
Fecal Coliform Sampling Results At Wachusett Reservoir

Percent Of Samples With Counts >20/100ml

- 1990
- 1993
- 1996
- 1999
- 2002
- 2005
- 2008
Community Total Coliform Rule Compliance

% TC Positive

Standard = 5%

Jan-91 Jul-92 Jan-94 Jul-95 Jan-97 Jul-98 Jan-00 Jul-01 Jan-03 Jul-04 Jan-06 Jul-07 Jan-09 Jul-10 Jan-12 Jul-13 Jan-15
Disinfection By-Products

EPA Standard

TTHMs, ug/L

Carroll TP - July 2005
Lead Levels in MWRA Communities

Lead Action Level = 15 ppb
Water Conservation Worked

Million Gallons Per Day

Safe Yield
Boston’s Usage Is At A 110-Year Low
Collateral Issues

• Size of the treatment plant

• Storage size and water age

• Plumbing issues

• Rate setting
Hourly Flows By Month - 2014

Hourly Flow (mgd)

Monthly Maximum: 405 mgd
Monthly Median: 270 mgd
Monthly Minimum: 165 mgd

Percentage of flows lower than 165 mgd:
- January: 15%
- February: 10%
- March: 14%
- April: 21%
- May: 11%
- June: 2%
- July: 2%
- August: 3%
- September: 1%
- October: 18%
- November: 34%
- December: 36%
On The Wastewater Side

• The 15-year, $3.8 billion Boston Harbor Project was completed in 2001

• About 380 million gallons of wastewater is treated at the new Deer Island Treatment plant every day, with a peak capacity of 1.2 billion gallons

• Treated wastewater is discharged 9.5 miles out into the deeper waters of Massachusetts Bay
Metals In Deer Island Effluent

Effluent metals (lbs/day)


- Zinc
- Copper
- Nickel
- Lead
- Chromium
- Silver
Solids In Deer Island Effluent

- Effluent solids (tons/day)
- Deer Island
- Nut Island
- Sludge

Years: 1990 to 2014

Graph showing solids in Deer Island effluent from 1990 to 2014, with data for Deer Island, Nut Island, and Sludge.
The Harbor Continues To Recover

• Water quality in Boston Harbor continues to improve dramatically

  – Sewage solids discharged from Deer Island have been reduced by 85%

  – Toxic pollutants have been reduced by 90%

  – Water is three times as clear
Deer Island Construction
Five communities - Boston, Brookline, Cambridge, Chelsea and Somerville - have combined sewer systems that connect to MWRA's sewer system

Since 1996, 94 miles of new storm drains and sanitary sewers have been installed
Union Park Detention/Treatment Facility
Annual CSO Volume Has Been Reduced Dramatically

- $900 million program
- 32 of 35 projects have been completed to date
- Annual CSO volumes have already been reduced by 2.7 billion gallons
- By 2015, 93% of the remaining CSO flows will be treated

![Graph showing reduction in CSO volumes from 1988 to 2015.](chart.png)
Dramatic Improvements In Water Quality – Even In Wet Weather

1987-1998 (Before Secondary Treatment and South System transfer)

1999 - 2014 (After Secondary Treatment and New Outfall)

Average Enterococcus counts in Boston Harbor in wet weather

The lighter the blue, the better
And We Love Being Green!

- Of our $40 million annual energy budget, $22 million comes from renewable sources
• About 85% of the water is delivered by gravity
Hydroelectric Power
• 98% of methane is utilized
Solar Power
Wind Power
Public Access
Alewife Stormwater Wetland
Creative Construction Technologies

• Means and methods

• New technologies are developed all the time

• Need to choose the right tool for the job

• If it seems too good to be true, it probably is
Microtunneling East Boston Branch Sewer
Pipebursting East Boston Branch Sewer
Slurry Walls For South Boston Pump Station
Horizontal Directional Drilling The Fore River Siphon
But No Matter How Well You Plan...

...things can go wrong
A Water Main Break
A Sinkhole
Another Sinkhole
A Heave In The Street
New Foundation
In the 1890s, buildings reflected the high esteem in which water was held
1848: Water Celebration On Boston Common
1899: Chestnut Hill High Service Pump Station
1899: Sudbury Aqueduct Terminal Chamber
1900: Chestnut Hill Low Service Pump Station
But After WWII, Highways Were King
And Water Was All But Forgotten
The Mass Pike Interchange Took The Area For The Second Barrel
And the buildings got more utilitarian...
1969: Cosgrove Intake
1971: Cottage Farm CSO Facility
1967: Ward Street Headworks
1991: Commercial Point CSO Facility
We’ve tried to bring some of that sense of pride back into these critical facilities
2003: Squantum Pumping Station
2005: Intermediate Pumping Station
2008: Braintree-Weymouth Pump Station
Hopefully, the next 30 years will be as successful
Deer Island Received Its 4th Platinum Award

No permit violations for 8 years in a row!
In its latest annual report card, the EPA has given the Charles River a grade of B+ for water quality.
Boston Now Has Some Of The Cleanest Urban Beaches In The Country

Report gives Boston-area beaches high marks
Says Boston region’s waters are cleaner than Waikiki’s

Michael Levenson - Globe Staff | May 23, 2015

88 percent of the time in 2014.

On the national stage, the report found South Boston’s beaches had cleaner water than the beaches in Virginia Beach, Va., Coney Island, N.Y., Santa Monica Beach, Calif., and, yes, Waikiki and South Beach. The finding was based on comparable water quality testing data taken between 2012 and 2014 by local officials in those states and then reported to the Environmental Protection Agency.

“These beaches [in the Boston-area], from best to worst, are significantly better than they were 20 years ago, and they’re significantly better than most of the urban beaches in the country,” said Bruce Berman, director of strategy, communications and programs at Save the Harbor/Save the Bay. “We should be really proud.”
Boston’s Waterfront Is The Region’s Fastest Growing Zip Code
“Best Drinking Water” In The Country

Hub’s tap water deemed best in taste test
