



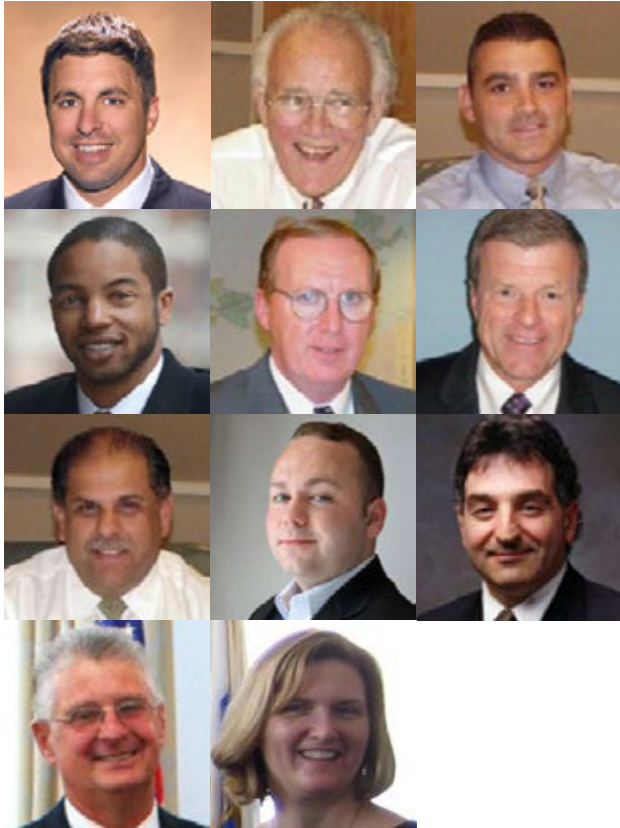
MASSACHUSETTS WATER **30** YEARS RESOURCES AUTHORITY

5 YEAR PROGRESS REPORT 2011-2015



MWRA Board of Directors

MWRA is governed by an 11-member Board of Directors who are appointed by the Governor or directly or indirectly by elected officials in MWRA customer communities.



Matthew A. Beaton, Chairman

Mr. Beaton was named Secretary of Energy and Environmental Affairs in November 2014. Prior to his appointment, Mr. Beaton served as a member of the Massachusetts House of Representatives, representing the Eleventh Worcester District. (Appointed in 2015 by the Governor, the Secretary serves as Chairman of the Board.)

John J. Carroll, Vice-Chairman

Mr. Carroll is the Town Manager of Norwood. He previously served as Superintendent of Public Works and Town Engineer for Lexington. From 1974 to 1978, Mr. Carroll was Commissioner of Public Works for Massachusetts. (Appointed in 1985 by the MWRA Advisory Board)

Joseph C. Foti, Secretary

Mr. Foti is the Director of Public Works for the City of Chelsea. Mr. Foti also spent fourteen years with the City of Somerville as the Water Superintendent and then as the Director of Operations for the Department of Public Works. (Appointed in 2001 by the MWRA Advisory Board)

Austin Blackmon

Mr. Blackmon is Boston's Chief of Environment, Energy and Open Space. Most recently, Mr. Blackmon served as Interim Head of Project Finance at Terraverde Renewable Partners. (Appointed in 2015 by the Mayor of Boston)

Kevin L. Cotter

Mr. Cotter is retired after serving 25 years as the Business Manager and Financial Secretary/Treasurer. He joined the Plumbers and Gasfitters Local 12 in 1966 and also served as Vice President of the Massachusetts AFL-CIO. (Appointed in 2002 by the Mayor of Boston)

Paul E. Flanagan

Mr. Flanagan is the Fire Chief and Director of Emergency Management for the Town of Winthrop. Prior to his appointment as Fire Chief in 2008, Mr. Flanagan served as Captain and Operations Officer for 21 years and has been a member of the Winthrop Fire Department since 1978. (Appointed in 2012 by the Winthrop Council President)

Andrew M. Pappastergion

Mr. Pappastergion is the Commissioner of the Department of Public Works for the Town of Brookline. Prior to that he was Director of the Water and Sewer Division for 25 years, and previously served as a project engineer for design and construction of improvements to the utility infrastructure. (Appointed in 1997 by the MWRA Advisory Board)

Brian Peña

Mr. Peña is the Commissioner of the Lawrence Water and Sewer Department. Prior to joining the Lawrence Water and Sewer Department, Mr. Peña was an engineer at Woodard and Curran. (Appointed by the Governor in 2015)

Henry F. Vitale

Mr. Vitale is the Executive Director of the Boston Water and Sewer Commission. Prior to this appointment, Mr. Vitale served as Chief Financial Officer and Treasurer for 18 years and has been with the Commission since 1992. (Appointed in 2013 by the Mayor of Boston)

John J. Walsh

Mr. Walsh is a lifelong Quincy resident and environmental community activist. He has been Chairman of the Nut Island Citizens Advisory Committee since 1980. He is a retired Manufacturing Engineer. (Appointed by the Mayor of Quincy in 2009)

Jennifer L. Wolowicz

Ms. Wolowicz is the Assistant Town Administrator for the Town of South Hadley. Prior to that she was the Personnel Officer/Chief Procurement Officer for seven years. (Appointed by the Governor in 2013)

Citizen Panel

In accordance with Section 22(b) of Chapter 372 of the Acts of 1984, every five years, MWRA must submit a progress report to the Governor and the Legislature.

The Enabling Act also requires that an independent citizen panel review the report and make recommendations concerning the future activities of the MWRA.

The panel must include persons selected by the Authority and approved by the MWRA Advisory Board who are experienced in environmental protection, civil engineering and public management and finance. MWRA is fortunate to have had the following individuals serve on the panel for this report.

Hon. Stephen M. Brewer

Senator Brewer is a former member of the Massachusetts State Senate, representing the Worcester, Hampden, Hampshire and Middlesex district, which included MWRA's source reservoirs, from 1996 to 2015. Mr. Brewer served in the Massachusetts House of Representatives from 1989 to 1996.

Marcis Kempe

Prior to his retirement, Mr. Kempe served as Director of Operations Support and Emergency Preparedness for MWRA and was the defacto Waterworks Director. He played a major role in many of MWRA's most important water system projects. He is a Civil Engineer with 35 years of experience in all facets of water supply and is an avid historian who specializes in the history of water supply practices. He most recently served as the Executive Director of the Metropolitan Waterworks Museum.

Vivien Li

Ms. Li was recently appointed as the President and Chief Executive Officer of Riverlife in Pittsburgh. Prior to that, she served as the President of The Boston Harbor Association, a non-profit public interest organization founded in 1973 by the League of Women Voters and the Boston Shipping Association to promote a clean, alive and accessible Boston Harbor. TBHA has long been a staunch advocate for the clean-up of Boston Harbor, and is now focused on helping to support the City of Boston and neighboring communities' efforts to prepare for rising sea levels and coastal flooding.

Charles Lyons

Mr. Lyons served as Superintendent/Director of the Shawsheen Valley Technical School District, located in Billerica, Massachusetts from 1987 to 2015. Mr. Lyons was a founding member of the MWRA Board of Directors, as a representative of the MWRA Advisory Board from 1985 to 1997. Mr. Lyons played a pivotal role in both the Boston Harbor Clean-up and the development of the MWRA's Long-Term CSO Control Plan.

Hon. Michael J. McGlynn

Mayor McGlynn served as Mayor of Medford from 1988 to 2015. He was the longest serving Mayor in the MWRA service area and provides insight from the perspective of the communities and the ratepayers. He also served from 1977 to 1988, when the MWRA was formed, as a member of the Massachusetts House of Representatives representing the 37th Middlesex District.

Robert Varney

Mr. Varney is the Executive Vice President of Normandeau Associates, one of the nation's largest science-based environmental consulting firms. Mr. Varney was the longest-serving regional administrator for EPA Region 1 New England, where he was nationally recognized for instituting many innovative approaches and policy initiatives that have served as national models, including MWRA's Long-Term CSO Control Plan.



Seated: Vivien Li, Hon. Stephen M. Brewer

Standing: Marcis Kempe, Hon. Michael J. McGlynn, Robert Varney, Charles Lyons



5-Year Report Panel Letter

Honorable Charles D. Baker, Governor
Honorable Karyn Polito, Lieutenant Governor
Honorable Stanley C. Rosenberg, Senate President
Honorable Robert A. DeLeo, Speaker of the House
Honorable Karen E. Spilka, Senate Ways and Means Chair
Honorable Brian S. Dempsey, House Ways and Means Chair

We, the Citizen Panel, want to begin by congratulating the Massachusetts Water Resources Authority for successfully implementing the court-mandated Combined Sewer Overflow (CSO) Control Program by December 2015. This, together with the completion of the Boston Harbor Project in 2002, is an extraordinary milestone, perhaps best said by the Conservation Law Foundation (CLF), a key plaintiff in the Boston Harbor case, in its final formal correspondence to Federal Judge Richard G. Stearns:

“...CLF had no idea at the time how deep the underlying infrastructure and institutional problems were that produced the desperate contamination situation that we all faced back then when 70 tons of raw sludge and 350,000 million gallons of poorly treated wastewater were being discharged into the harbor every day. And looking today at the results of the past 33 years’ activities, it is easy to gloss over the truly Herculean, multi-institutional effort that ultimately materialized in response to that 60-day notice of violation. Somehow, almost miraculously, the entire wholesale sewerage and water system for metropolitan Boston has been rebuilt-in many cases from scratch-while metropolitan life continued on without a hitch on the surface.

“...We note our appreciation to the Massachusetts Water Resources Authority ... one of the preeminent water and sewerage agencies in the world. The MWRA,

its staff, and its boards showed what was possible for a public works project in Massachusetts, bringing the vital new systems on line, on schedule and under budget.”

Of the 35 completed CSO-related projects involving not only MWRA facilities but also improvements to local systems in Boston, Brookline, and Cambridge, most notable within the last five years was the South Boston CSO Storage Tunnel. Completion of the tunnel has resulted in almost non-existent beach closings in South Boston and allowed a new generation of residents and families to now be able to safely swim at these local beaches.

Overall water quality has vastly improved in the last five years, making Boston Harbor one of the cleanest urban harbors in the country. Water quality in the Charles River received a B+ grade for 2014 from the federal Environmental Protection Agency, unthinkable 20 years ago. Save the Harbor/Save the Bay’s five-year review of water quality at fifteen Boston Harbor beaches showed that overall beach safety ranged from 90% in 2011 to 92% in 2015.

Since the last Five Year Progress Report, two significant crises have occurred nationally to remind us how fragile water infrastructure systems are – the drinking water debacle in Flint, Michigan and Superstorm Sandy.

The Flint crisis has drawn national attention to potable water quality throughout the country. Following a change in water supply and treatment measures in 2014, Flint’s drinking water exposed residents and children to lead contamination and potentially other health issues.

By contrast, customers in the MWRA service area are fortunate that the Authority has consistently delivered drinking water that meets every state and federal drinking water standard. High-quality source water comes from two reservoirs which are surrounded by more than 240,000 acres of watershed lands covered by forests and wetlands. Water for 46 communities in eastern and central Massachusetts comes from the Quabbin and Wachusett Reservoirs, and is treated by ozone, the primary disinfectant, with additional ultraviolet light treatment beginning in 2014. Water from the Quabbin Reservoir for the communities of Chicopee, South Hadley, and Wilbraham is treated by chlorine and, starting in September 2014, with additional ultraviolet light.

Drinking water is tested continuously, and over the past five years, the quality has been rated as excellent, meeting every standard for 120 contaminants. Moreover, MWRA drinking water has long been recognized for its purity, and in 2014, won the American Water Works Association’s national taste test.

In addition, the MWRA recently extended its community assistance program to allow up to \$100 million in loans to fund lead service line replacement projects where needed, effectively supporting its partner communities that want to replace lead pipes connecting homes to water mains in the street.

MWRA customers receive in the mail an annual Consumer Confidence Report update on their drinking water from the Authority and local municipality. A large print version of the report is available upon request, and the report contains a note in thirteen non-English languages indicating that the report contains important information about drinking water. We urge the Authority to continue to write these updates in a clear, straightforward manner so that MWRA customers can easily track changes in drinking water quality.

In October 2012, a different crisis occurred when Superstorm Sandy hit the East Coast of the United States. The impacts were devastating to human lives and property, including to the region's infrastructure. According to an April 2013 report by Climate Central, "Along much of the Atlantic coastline, treatment plants, pumping stations and pipelines were overwhelmed and billions of gallons of untreated sewage flowed into hundred of rivers, streams, bays, and streets from Virginia to Rhode Island" ("Sewage Overflows from Hurricane Sandy", page 4).

The report further noted, "In most of the cases where Sandy affected treatment plants, plant operators followed their best management practices to reduce the volume and quantity of the associated bypasses. But too often they found themselves overwhelmed by the sheer volume of sewage and wastewater runoff flowing through the system, or crippled because storm surge flooding inundated their facility or because power outages simply shut down the plant" (page 4).

Much of the MWRA service region was spared these extreme impacts because of the timing of the storm. Superstorm Sandy hit the Greater Boston region at low tide; had the storm arrived 5 1/2 hours earlier, the impacts and damage would have been very different. Fortunately the designers of MWRA's Deer Island Wastewater Treatment Plant had the foresight to raise the elevation of the plant by one foot, protect it with a massive seawall, and make the outfall larger to preserve its design capacity. But many other MWRA facilities lie within the floodplain. Superstorm Sandy was a powerful reminder of how we must continue to plan for potential impacts associated with sea level rise and severe storm activity.

Going Forward

Continue to maintain a sound water system:

This and prior reports have emphasized the importance of full delivery system redundancy. During fiscally challenging times, the term "redundancy" can be confusing when there is public pressure to curb spending. Greater attention should be given to educating public officials, decision makers, and the public on the critical need for maintaining a sound system for delivering water, with back-up alternatives to allow for emergency responses and for maintenance repairs and servicing.

A major water main break that occurred in May 2010 helps illustrate the importance of redundancy. Because the MWRA had the foresight to maintain the old reservoirs and aqueducts as back-ups to the regional water system, MWRA staff were able to quickly react to the emergency and shift to a backup aqueduct and reservoirs while the broken water main was shut down and repairs were being made, thereby avoiding a major disruption in water service for the greater Boston area. Since then, MWRA has achieved transmission system redundancy from

Marlborough to Weston with the rehabilitation of the Hultman Aqueduct. Progress was also made on the new Wachusett Aqueduct Pump Station which will provide better redundancy for the Cosgrove Tunnel.

In 2015, a new water storage facility and pump station for 21 communities currently served by the Gillis Pump Station came on line to ensure adequate back-up. Likewise, in coming years, back-up alternatives for the City Tunnel, City Tunnel Extension, and the Dorchester Tunnel, a part of the delivery system that has never been able to be shut down since construction half a century ago, must be a priority. While such projects will require significant investment, they are key to reliable future service and will allow for the proper on-going maintenance of tunnel components. Moreover, given the importance of such projects to the region's economy, they would be excellent projects to solicit state debt service assistance.

Monitor infrastructure condition and risk

MWRA facilities are aging. The start-up of Deer Island's primary treatment facilities began in 1995, with the last batteries of Deer Island secondary treatment coming on line in 2001. The MetroWest Water Supply Tunnel was completed in 2003, while the Norumbega covered storage facility was completed a year later. In the next five years, these facilities will be 25 or more years old. Even with routine maintenance, these facilities may experience problems as they age. Continued evaluation of these assets is important, and sufficient capital funding for rehabilitation and/or replacement will be key.

Promote green infrastructure

A 3.4-acre wetland completed in 2013 along Alewife Brook is a prime example of an innovative way to contain stormwater runoff while improving the environment. Bioswales, landscaping, and previous surface treatments are just some of the measures available to minimize stormwater runoff and pollutants.

Planning, redevelopment, and conservation entities within the MWRA service area should encourage green infrastructure as part of development projects to complement MWRA efforts.

Incorporate efficiencies

Controlling costs to ratepayers has been managed well to date by the MWRA, primarily through automation and an efficient capital delivery program. Authority staffing has been reduced gradually as larger capital projects have been completed. The Authority has also aggressively embraced green energy and taken advantage of related state and federal funding sources to lower operating costs through green technology.

The Authority currently has \$5.6 billion in secured debt, accounting for 60% of the current expense budget. Efforts during the past five years to manage existing debt have been commendable, especially the use of under-spent funds for defeasance of earlier debt. This has allowed a greater level of control in year-to-year variations for customer community assessments, significantly reduced the debt created in past peak periods, and should be continued.

Creativity on expanding sources of revenue is strongly encouraged, in particular from potential new water sales, new energy production technologies, and from seeking debt assistance to complete projects essential to reducing risks to the region's economic well-being.

At the same time, the Authority should continue to acquire new parcels around the reservoirs to protect the water supply for the 2.5 million customers of the MWRA service area.

Deal proactively with climate challenges

While the Deer Island Wastewater Treatment facility was not adversely impacted by Superstorm Sandy, a subsequent review indicated that of the Authority's

30 coastal wastewater facilities, 18 may potentially be vulnerable to storm surge flooding. Climate change raises the threat of major damage and severe service disruptions as evidenced in the Tri-State NY-NJ-CT region. We urge continued attention to minimize threats to MWRA facilities through a combination of immediate smaller risk reduction measures along with full flooding protection improvement of facilities when routinely rehabilitated.

The MWRA has also been a leader in helping to reduce greenhouse gas emissions which contribute to sea level rise. While MWRA facilities operate around the clock and are inherently large energy users, the Authority has met some of its energy needs through on-site renewable energy. Methane from the egg-shaped digesters is used to heat buildings and water at Deer Island; solar energy and wind energy are generated for on-site usage at Deer Island. In the future, we anticipate and support the implementation of a co-generation program mixing food waste with wastewater.

Emphasize resiliency in the organization

In a world of threats from natural disasters, terrorism, cyber attacks and unexpected failures, emphasizing resiliency within the organization is key. The Authority needs to continue its post 9/11 efforts in planning for disaster scenarios of all types and using a double-prong approach of risk reduction through preparation and elimination of single points of vulnerability, and by developing a culture of emergency response training and readiness.

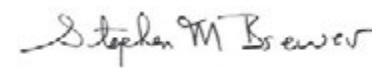
Remain a good neighbor

MWRA should be commended for its efforts to improve public health and the environment for all citizens, regardless of race, color, national origin or income, who are working and living in its service area. It should continue to keep local neighborhoods informed during construction phases, and involve citizens and key

stakeholders in the required 2020 post-construction monitoring and performance assessment to verify that the long-term levels of combined sewer overflows have been met.

In the past, the MWRA has allowed passive recreation in areas once off limits to the public. We support continuation of this program to allow greater public access and enjoyment of the aqueduct trails.

The MWRA, in partnership with its member communities through the MWRA Advisory Board, continues to demonstrate the ability to fulfill the mandate given to it more than thirty years ago. The Citizen Panel has every confidence that continued sound financial management, together with pro-active, innovative solutions designed to ensure public health and environmental benefits, will serve the agency well. It is an honor to serve on the Citizen Panel for this five year review. We urge you to consider our recommendations and to join us in supporting a successful future while we celebrate the Authority's exceptional accomplishments.



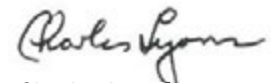
Stephen M. Brewer



Marcis Kempe



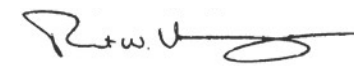
Vivien Li



Charles Lyons



Michael J. McGlynn



Robert Varney

A letter from the Executive Director

On behalf of the Board of Directors and staff, I am pleased to submit the MWRA's Five-Year Progress Report for 2011 through 2015, in accordance with Section 2(b) of Chapter 372 of the Acts of 1984.

In the thirty years since the creation of the MWRA, the greater Boston area has seen the successful clean-up of Boston Harbor – once labeled the nation's dirtiest – and a complete modernization of the region's drinking water system. We have invested more than \$7 billion to reverse decades of neglect and established aggressive maintenance programs to make sure this critical infrastructure never again falls into a cycle of disrepair.

Over the last five years, we have focused on the completion of the \$900 million Combined Sewer Overflow (CSO) Control Program. I am proud to report that all 35 projects were completed by the December 2015 federal court deadline. Over the last 20 years, we have worked closely with the five CSO communities – Boston, Brookline, Cambridge, Chelsea and Somerville – on dozens of contracts to meet the 184 court milestones. The results have been dramatic. Boston Harbor's beaches are now considered the cleanest urban beaches in the country. The water quality in the Charles and Mystic Rivers is better than it has been in centuries, earning B+ ratings from the U.S. Environmental Protection Agency.

On the drinking water side, we completed the addition of UV disinfection facilities at our two water treatment plants in Marlborough and Ware. Water quality remains excellent and we were honored to be named "best drinking water in the country" by the American Water Works Association in 2014. We were finally able to complete the rehabilitation of the Hultman Aqueduct, which since the 1940s served as the sole transmission main for most of the water we supply into the city. We also recently completed the last of seven underground water storage facilities that provide needed water storage while protecting the treated water from potential contamination. The Spot Pond tank in Stoneham also includes a water pump station that provides redundancy for 21 communities.

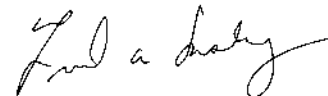
The last five years were not without challenges. Although we were spared the brunt of Superstorm Sandy, the threat of rising sea levels on coastal infrastructure was really brought home. Also, the recent drinking water crisis in Flint, Michigan put a spotlight on all water suppliers across the country.

Financially, we have successfully utilized a multi-year rates management strategy to meet the challenge of "four no more" posed by the MWRA Advisory Board, achieving an average combined increase over the last five years of 2.98% without placing the burden of past debt on future generations.

In addition to the talented professionals who work at MWRA, the key to our success is our 11-member Board of Directors – past and present – who invest the time and interest necessary to make the often-difficult decisions needed to keep our water and sewer systems running at optimum levels, ensuring the protection of the public health and the environment.

I would like to thank the members of the Citizen Panel for their thorough review of this report and their thoughtful and valuable recommendations. We will keep them in mind as we face the challenges the next five years bring.

Sincerely,



Frederick A. Laskey
Executive Director

Chapter 1: Building on a Strong Foundation

MWRA continues to fulfill its mission of repairing, replacing and updating the region's water and sewer infrastructure to ensure public health and protect the environment. Through the end of 2015, MWRA has invested \$8 billion on projects large and small to meet this goal.

This chapter describes the progress made over the last five years.

Successful Completion of the CSO Program

December 2015 marked the completion of the court-ordered Combined Sewer Overflow (CSO) Control Program. As part of the federal Boston Harbor court case that began with the construction of new wastewater treatment facilities at Deer Island, the \$900 million CSO Program was aimed at the protection of the area's beaches, shellfish beds and other sensitive waters.

The Program included 35 separate projects to eliminate or drastically reduce CSOs. MWRA, in partnership with Boston, Brookline, Cambridge and Somerville, completed 82 construction contracts, 33 engineering contracts, and 10 planning and technical assistance contracts necessary to meet the 184 court-ordered milestones. Over the last five years, MWRA has completed the remaining projects utilizing a variety of methods - from a massive storage tunnel to sewer separation to an innovative wetland.

South Boston CSO Storage Tunnel

At \$225 million, this was the largest project built under this Program. Completed in May 2011, in accordance with the federal court milestone, the tunnel stores CSO and stormwater flows during rain events. Once the storm subsides the tunnel is pumped out and the flows are sent to Deer Island for treatment and discharge.

Before this project, combined sewer overflows discharged about 20 times a year at six outfalls along the South Boston beaches.

Since the tunnel opened, beach closings are almost non-existent and Boston boasts some of the cleanest urban beaches in the country.

MWRA has partnered with the CSO communities in the service area to fund projects to control these overflows. Most of these community managed projects have involved the physical separation of sewer and stormwater pipes. This work is labor-intensive, costly and very disruptive to the neighborhoods where they are located. Even so, several projects were completed in the last five years:

Reserved Channel Sewer Separation

The Boston Water and Sewer Commission has completed the installation of 8 miles of new storm drains and the rehabilitation of 2.2 miles of existing sanitary sewers in 37 streets. Consisting of nine separate construction contracts, this \$72.6 million project has minimized CSO discharges into the Reserved Channel, reducing the average annual volume of CSO from 28 million gallons to 1.5 million gallons. Activations will be reduced from 37 to three in a typical year.

Brookline Sewer Separation – Phase II

The Town of Brookline completed this \$15.8 million project in April 2013, which included the installation of 3,390 feet of new storm drains and over a mile of new sewers. This work supports CSO control for the Charles River.

Cambridge Sewer Separation

The City of Cambridge has completed four sewer separation projects - together called "CAM004" - that will remove large quantities of stormwater from Cambridge's and MWRA's sewer systems in a 211-acre area,

With the completion of the South Boston CSO Tunnel, Boston now has the cleanest urban beaches in the country.



What Is A CSO?

While modern systems transport rainwater and sewage from homes and businesses through separate pipes, some older systems like Boston's have "combined" sewers that carry both flows together. During normal conditions flows are delivered to treatment plants. During very heavy rains, when flows sometimes double and even triple, these systems become overloaded. Built-in overflows (called combined sewer overflows or "CSOs") must then act as relief points by releasing excess flows into the nearest body of water. This prevents sewage backups into homes and onto area streets, but the discharges can impact water quality.

allow Cambridge to close Outfall CAM004 and, together with other Alewife Brook CSO projects, reduce annual CSO volume to the Alewife Brook by 85% in a typical year, from 50 million gallons to 7.3 million gallons. CSO activations in a typical year will be reduced from 63 to seven. The last project was completed in December 2015 in accordance with the Federal Court milestone.

Alewife Stormwater Wetland

This innovative, 3.4-acre wetland stores and treats stormwater runoff and improves water quality in the Little River and the Alewife Brook. Completed in 2013, the \$26 million wetland incorporates both conventional and bioengineered structures designed with a natural look and feel. Together with the separation of stormwater from combined sewers, the basin will increase historically low flows in the brook and enhance the health of adjacent natural wetlands, providing a significant improvement over the existing degraded habitat caused by many decades of neglect. The wetland includes plant and wildlife habitat, natural flood control, and recreational and educational facilities.



Alewife Stormwater Wetland, Cambridge

Central Heating Loop

Completed in February 2011, this \$11 million project was for the installation of a central heating loop to provide a continuous supply of hot water to maintain building heat and process heat to the digesters.

MWRA also completed upgrades to its Clinton Wastewater Treatment Plant that serves the towns of Clinton and Lancaster.

Protecting Our Assets

To protect the investment of MWRA ratepayers in the Deer Island Treatment Plant, MWRA is ensuring timely replacement of the plant's systems, which include more than 60,000 pieces of equipment with an approximate value of \$1 billion. Based on MWRA's Wastewater Master Plan developed in 2006 and updated in 2013, MWRA expects to sequentially replace equipment and structures in the facility as they reach the end of their useful life.

Several large projects have been completed over the past five years.

Clarifier Rehabilitation

This \$60 million project included cleaning the 48 Primary and 54 Secondary clarifier tanks of sludge and scum and replacing nearly 60 miles of stainless steel collection chains and sprockets. Work was completed in February 2012.



Deer Island Clarifier Rehabilitation

Clinton Aeration Efficiency Improvements

This project included the installation of fine bubble diffusers in three of the six secondary aeration tanks to replace less efficient mechanical mixers. The work resulted in a better oxygen transfer rate while reducing electricity consumption by about 15%. This \$1.8 million project also included the installation of four permanent submersible auxiliary pumps to increase pumping capacity during high flow conditions in the plant. Work was completed in February 2013.

Rehabilitation of Anaerobic Digesters, Primary Clarifiers and New Influent Gates

The Clinton plant has two digesters, which were in need of rehabilitation. The work included replacement of the covers, piping, and valves. In 2012, the scope was expanded to include two new 36-inch influent gates to control flow from Clinton and Lancaster to prevent flooding and protect plant assets. The \$4.37 million contract began in late FY2014 and is scheduled to be completed in spring 2016.

Water Treatment Facilities Get An Upgrade

EPA's Long-Term 2 Enhanced Water Treatment Rule requires that unfiltered water systems, like MWRA's, utilize two methods of primary disinfection. The John J. Carroll Water Treatment Plant has been using ozone since it was completed in 2005 to serve 46 communities in central and eastern Massachusetts. In April 2014, MWRA completed the installation of ultraviolet light (UV) facilities at the Carroll Plant to meet the requirements of the regulation. The \$32 million project enables MWRA to inactivate the most difficult to kill pathogens - which could potentially be in the source water - without the use of additional chemicals and any associated disinfection by-products.

UV light is essentially a more potent form of the natural disinfection from sunlight. UV light inactivates bacteria, viruses and other pathogens by damaging the DNA. UV light also inactivates chemically resistant parasites such as *Cryptosporidium* and *Giardia*.

MWRA also operates a water treatment facility in Ware that serves three communities, Chicopee, South Hadley FD1 and Wilbraham - collectively called the Chicopee Valley Aqueduct system - directly supplied by the Quabbin Reservoir. UV was added to this facility to supplement the chlorination system and brought on-line in September 2014, in time to meet the new mandate. The plant was renamed in honor of William A. Brutsch, the long-time director of waterworks for MWRA and its predecessor agency.



UV Reactors at Carroll Treatment Plant



Federal District Court Judge Richard G. Stearns tours the site during construction



Dedication of Brutsch Water Treatment Facility

Construction of the Spot Pond Covered Storage Tanks and Pump Station



Redundancy Is A Good Thing

A redundant water system is not a new idea. Planners for Boston's water system were working on plans for tunnel loops north and south of the city back in the 1930s. Like many infrastructure projects, these plans were filed away after World War II and nearly forgotten. MWRA has been working on a number of projects over the last several years that continue to improve the agency's flexibility and emergency response capabilities by being able to reroute water flows in order to take a pipeline out of service for repairs or ensure adequate service after a break.



Spot Pond Covered Storage Tanks and Pump Station

This \$51 million, 20 million-gallon water storage facility and pump station near Spot Pond in Stoneham will provide water storage for MWRA's Low Service area, which includes Charlestown, Chelsea, Malden, Medford, Everett and Somerville. The pump station will provide

system redundancy for 21 communities currently served by the Gillis Pump Station. The first tank was brought on-line in August 2015, the second in November 2015.

The top of the buried tanks is planted with upland meadows providing additional open space and public access adjacent to the Fells Reservation.

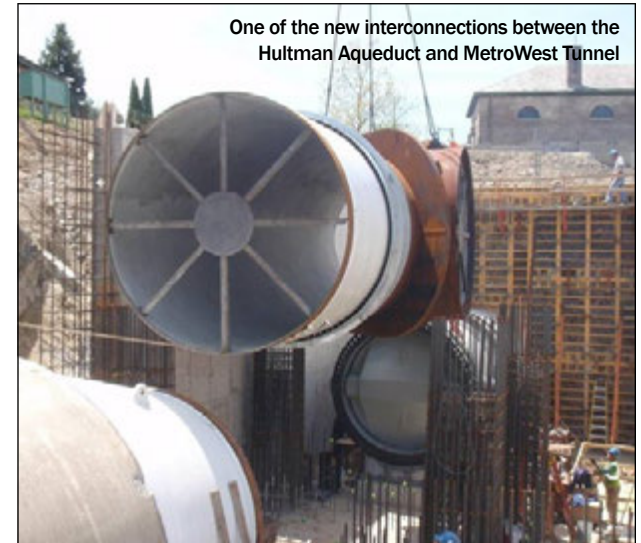
The Spot Pond Covered Storage Facility is the last of seven covered storage tanks constructed by MWRA over the last several years that protect and store treated drinking water in compliance with the Federal Safe Drinking Water Act. Benefits include:

- Covered tanks protect drinking water from potential contamination by natural sources, such as algae, bacteria, birds and other animals.
- In total, MWRA's storage tanks hold a day's worth of water—approximately 200 million gallons. The water is continuously used and replenished.
- Storing treated water at points across the water system keeps a supply of treated water available for communities' critical needs in the event of an emergency, such as a natural disaster or a major break in the transmission system.
- MWRA's service area ranges from the hills of Central Massachusetts to near sea-level communities on the East Coast. Our covered water storage tanks are located at key elevation points, helping to maintain appropriate water pressure levels across the system.

The Spot Pond Storage Facility tanks replace a 100-year old system of open reservoirs. Many of the original, open reservoirs are still maintained for emergency use.

Hultman Aqueduct Rehabilitation and Interconnections

Before MWRA turned on the MetroWest Water Supply Tunnel in 2003, the greater Boston area relied on a single 1940s-era surface aqueduct, the Hultman Aqueduct, to serve all of Metro Boston. With its leaks and aging valves, the Hultman needed to be taken



One of the new interconnections between the Hultman Aqueduct and MetroWest Tunnel

off-line for major repairs. This project required the inspection of nearly 5,000 joints along the 14.8-mile pipeline; 1,372 joints were repaired. In addition, four additional connections were made between the Hultman and the MetroWest to allow increased interoperability between the pipelines. When the \$52 million project was completed in May 2013, the metropolitan water system had full redundancy from Marlborough to Weston for the first time.

Other Redundancy Projects

As progress was being made on these projects, MWRA's Waterworks Master Plan identified other pressing needs such as providing redundancy for the Cosgrove Tunnel, which supplies water to the Carroll Treatment Plant. For the western portion of the transmission system, the study has identified the construction of a new emergency pump station as the most cost effective means to provide redundancy for a raw water supply to the John J. Carroll Water Treatment Plant and to support the shut-down and repair of the Cosgrove Tunnel.

Work has progressed over the last five years and design of the Wachusett Aqueduct Pump Station has been completed. It includes a zero net energy goal for stand-by mode, when no pumps are operating. This is being achieved through a variety of building envelope and system improvements that include the following:

- Geothermal Heating & Cooling System
- High Efficiency Lighting & Controllable Water Efficient Fixtures
- Low VOC Emitting Paints and Adhesives
- Non-CFC Refrigerants
- Premium Efficiency Motors
- Regional Materials

The construction contract for this project was awarded in November 2015.

For the transmission system tunnels east of Weston including the City Tunnel, the City Tunnel Extension, and the Dorchester Tunnel, MWRA is currently in the planning stages for redundancy. Read more about that in Chapter 5.

Maintaining Critical Dams

In 2004, MWRA took over responsibility for the major dams in the waterworks system. New dam safety regulations have required several projects. In 2012, MWRA completed six dam projects that represent most of the needed improvements stemming from regulatory dam safety inspections:

- Tree clearing at the Wachusett Reservoir South Dike
- Spillway masonry and fencing at the Wachusett Open Channel Dam
- Tree clearing and parapet wall at the Weston Reservoir Dam
- Spillway masonry and rip-rap improvements at the Sudbury Reservoir Dam
- Spillway and gatehouse masonry at the Foss Reservoir Dam
- Embankment earthwork, rip-rap and gatehouse repairs at the Chestnut Hill Reservoir Dam

Other Completed Projects

The following table provides a summary of a number of other projects that were completed during the five-year period covered by this report.



Tree Removal at the Wachusett Reservoir



Quabbin Reservoir

Completed Projects

Date Completed	Project	Description	Cost	Benefits	Category
September 2011	Deer Island Sludge Pump Replacement - Phase 1	First phase includes the installation of one centrifugal sludge pump and one flushing pump.	\$1.5M	New pumps operate at a higher velocity to ensure that grit does not settle out of the sludge before reaching the Pelletizing Plant in Quincy.	Asset Protection
October 2013	Digested Sludge Overflow Piping and Plug Valve Replacement	Replacement of 2,500 feet of damaged glass-lined piping and 400 plug valves in Digester Modules 1 and 2 and the sludge/gas storage tanks at the Deer Island Treatment Plant.	\$6M	To reduce corrosion due to residual sludge, improve overall reliability and performance.	Asset Protection
February 2011	Section 28 Suction to the Brattle Court Pumping Station, Arlington	Cleaning and cement-mortar-lining of approximately 6,250 feet of 20-inch diameter, cast-iron pipe (Section 28) and the replacement of its connection to the 56-inch-diameter Weston Aqueduct Supply Main 3 transmission main.	\$2.3M	To support the future rehabilitation of WASM 3.	Redundancy
November 2011	Rehabilitation of Section 18, 50 & 51 Supply Mains in the Northern High Service area	Cleaning and cement-mortar-lining of approximately 15,000 feet of 16-, 20- and 48-inch cast-iron pipe (Sections 18, 50 & 51) in Medford and Somerville.	\$5.5M	Protects water quality, improves hydraulic capacity and provides better reliability of both the pipelines and valve operations.	Redundancy
October 2012	Northern Intermediate High Service Stoneham - Reading Connection	Installation of a larger emergency connection between Stoneham and Reading and upgrades to the valves and connections between Woburn, Wilmington, and Reading.	\$3.4M	Replaced obsolete units for better reliability and efficiency.	Redundancy
May 2013	Rehabilitation of the Hultman Aqueduct and Interconnections	Inspection and repair of joints over 14.8 miles of aqueduct; installation of interconnections with the MetroWest Tunnel.	\$52M	For the first time since originally planned in the 1930s, the Metropolitan Water System has full redundancy for the Hultman Aqueduct from Marlborough to Weston.	Redundancy
August 2013	Dam Repairs - Sudbury, Wachusett Open Channel Lower, Chestnut Hill, Weston and Foss Reservoir Dams	Dam Repairs at all five locations, parapet walls along portions of Foss and Weston dams, and installation of a gated spillway at Foss Dam.	\$2M	Achieves regulatory compliance for dam safety.	Dam Safety
December 2010	Braintree-Weymouth Relief Facilities, Rehabilitation of Section 624	Rehabilitation by cured-in-place lining of approximately 2,050 feet of Section 624, a 70-year-old, 60-inch by 57-inch interceptor in North Weymouth, which has been considerably corroded by hydrogen sulfide downstream of the discharge from the Hingham Pump Station.	\$2.5M	Improves reliability and prevents premature failure.	Sewer
July 2012	Section 156 Rehabilitation - North Metropolitan Sewer	Installed a cured-in-place lining in 1,800 feet of a major sewer interceptor to facilitate the redevelopment of an old General Electric site on Air Force Road along the shores of the Malden River.	\$2.6M	Project expedited at the request of the City of Everett and State Economic Development officials.	Sewer
February 2013	Lynnfield/Saugus Pipeline Construction	Installation of two new water mains under Route 1 in Saugus.	\$6.5M	Improves water service to both communities.	Water
April 2013	Phase 7 Valve Replacement	Replacement of two mainline isolation valves, two water revenue meters, eleven meter valves, manholes, piping, and eight blow-off valves.	\$3M	Eliminates cross connections in Somerville, Boston, Medford, and Malden.	Water

Phase VII Valve Replacement, Somerville



Chapter 2: Water Quality - From Quabbin to Massachusetts Bay (and Everywhere in Between)

Best of the Best

That's what the trophy says. But it's not just the taste that's good. Before it arrives at the customer's tap, hundreds of thousands of tests are conducted each year to ensure a clean, safe water supply for the 2.5 million people that depend on it every day.



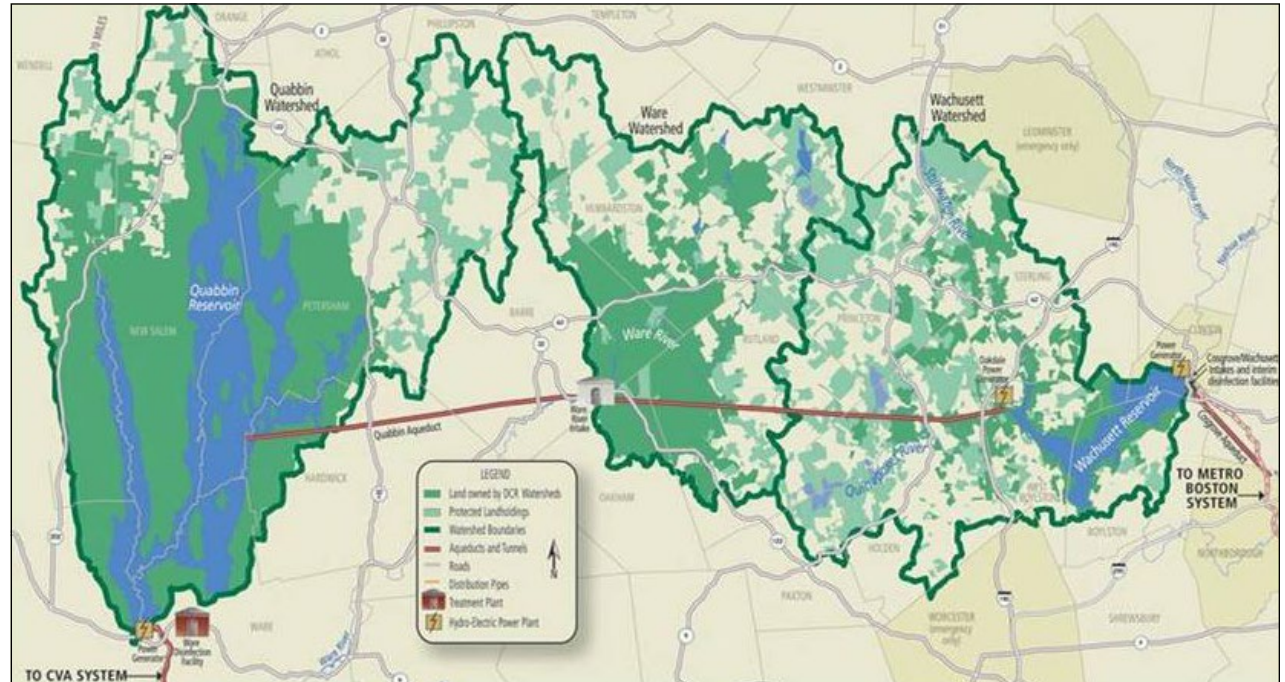
At the AWWA national conference in 2014, Boston's water was named "Best of the Best"

Watershed Protection
But what makes the water so good? It starts in the 240,000 acres of watershed that surround the Quabbin and Wachusett Reservoirs. Over 85% of these lands are covered in forest and wetlands. The streams and reservoirs are tested often and patrolled daily by Department of Conservation and Recreation rangers.

Since 1985, MWRA has invested \$133 million to acquire new parcels as they become available. Over the past five years, MWRA has spent nearly \$7.5 million to purchase over 1,260 acres, either in fee or under a Watershed Preservation Restriction.

Drinking Water Treatment

Since 2005, the Carroll Water Treatment Plant has used ozone as a primary disinfectant. Ozone consists



of three atoms of oxygen. It is created by applying an electrical current to pure oxygen in a specially designed stainless steel chamber.

In April 2014, ultraviolet ("UV") light treatment was added in compliance with the EPA's Long-Term 2 Enhanced Surface Water Treatment Rule, which required the addition of a second disinfection process.

UV light is a strong disinfectant that damages the DNA of bacteria, viruses and other pathogens, making it a strong disinfectant. UV light also inactivates chemically resistant parasites such as *Cryptosporidium* and *Giardia*.

Water Quality Testing

MWRA and its member communities continuously test

thousands of water samples, under strict federal and state guidelines. The results over the last five years have continued to be excellent. For the 120 contaminants tested for, every standard was met.

Real-Time Monitoring

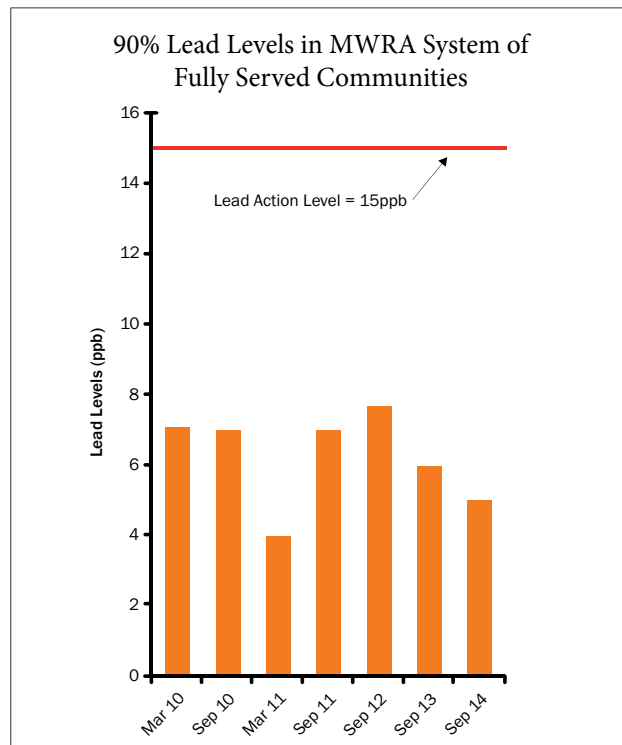
Over the last five years, MWRA has implemented a state-of-the-art water quality monitoring system that allows staff to watch for physical and chemical attributes of the water in real-time. The units have been installed in 18 locations throughout the water system and have proven to be a reliable early warning system.

Reducing The Risk Of Lead In Tap Water

Lead in drinking water typically comes from having lead bearing materials in contact with water.

These can include lead service lines (the pipe connecting the home to the water main in the street), leaded solder and some brass fixtures. If the water is corrosive and is left in contact with lead bearing material for enough time, lead can leach out. It is important to note that MWRA's water does not contain lead, and the MWRA and community pipes carrying that water are made of concrete, iron or steel and do not add lead to the water.

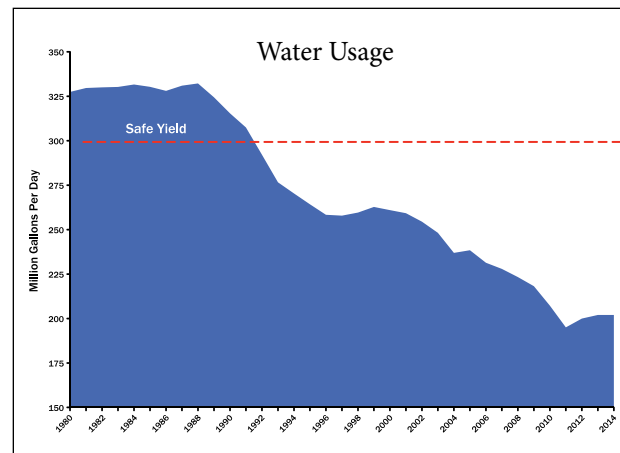
Since MWRA began adjusting the pH of its drinking water in 1992 to make it less corrosive, lead levels measured at customers' taps have continued to decline. Over the last five years, the MWRA system has consistently been below the EPA's Action Level.



Keeping Up With Invasive Species

MWRA has been working to control aquatic invasive species in both the active and back-up reservoirs since 2002. Eurasian Water Milfoil, Fanwort and Water Chestnuts are all found within the Wachusett, Sudbury and Chestnut Hill reservoirs.

In 2013, MWRA began utilizing specialized boats with suction hoses and screening trays to filter out the plant matter from the water. Divers carefully pull the invasive plants, roots and all, and guide them to the suction hose underwater. The plants emerge on the screens and are collected and temporarily stored in a hopper on board. The filtered water is returned to the reservoir. Once the boat hoppers are full, the plant matter is transported to a composting facility.



Water Supply Protection Trust

A water supply protection trust was created by Chapter 149 of the Acts of 2004 to provide a more efficient mechanism for MWRA's funding of the Office of Watershed Management, under the Department of Conservation and Recreation.

The Water Supply Protection Trust has a five person board of trustees responsible for approving the Office of Watershed Management's annual work plan and budget each spring for the following fiscal year beginning in July. The members of the Board of Trustees are:

- Matthew A. Beaton, Secretary of Energy and Environmental Affairs
- Fred Laskey, Executive Director of the MWRA
- William Meehan, representative jointly selected by the North Worcester County Quabbin Anglers Association, Inc. and the Quabbin Fishermen's Association, Inc.
- Katherine Haynes Dunphy, representative of the MWRA Advisory Board
- Fred Heyes, Representative from the Swift River Valley Historical Society

Conservation Is Key

Over the last five years, water demand in the MWRA service area continued to decrease, leveling off at about 200 million gallons a day. This is a decrease of more than 120 million gallons a day from the late 1980s. Aggressive leak detection, water conservation measures and low-flow plumbing codes and fixtures have all been part of this remarkable achievement.

A Healthy Boston Harbor

Keeping It Out Of The Sewer System In The First Place

Toxic substances from homes, industries and storm runoff can cause serious problems if allowed to enter our sewer system uncontrolled. Excessive levels of chemicals could threaten the marine environment, limit MWRA's use of wastewater sludge as fertilizer or hinder the treatment process.

To reduce toxic discharges at their source, MWRA's Toxic Reduction and Control (TRAC) Department regulates



industrial discharges in accordance with its Sewer Use Rules and Regulations and works with industries to encourage voluntary reductions in their toxic chemical use.

Wastewater Treatment With No Violations

The Deer Island Wastewater Treatment Plant utilizes secondary treatment to remove solids, organic matter, and contaminants. An average of 99 percent of the wastewater reaching Deer Island received full secondary treatment over the last nine years.



The Deer Island Wastewater Treatment Plant continues to perform as well as – or better than – it was designed to do. For the eighth consecutive year, MWRA has operated the plant with no violations, earning its fourth Platinum Award – after four straight Gold Awards - from the National Association of Clean Water Agencies (NACWA).

The effluent – treated flow leaving the plant - meets stringent permit limits that protect marine life. The



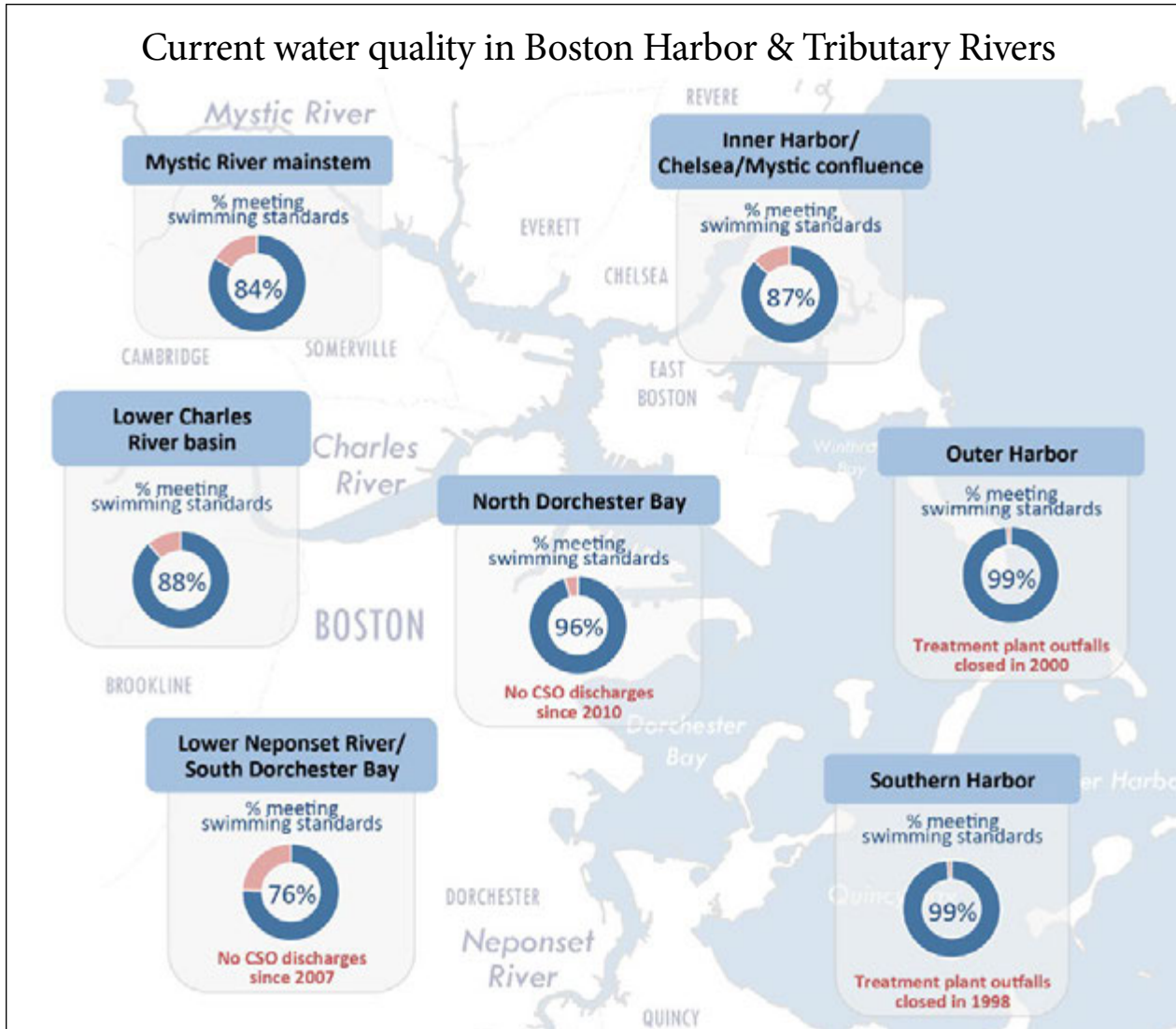
outfall-diffuser system in Massachusetts Bay rapidly dilutes the treated effluent in seawater so that nitrogen remaining in the discharge quickly reaches the normal oceanic background level.

At the Pelletizing Facility in Quincy, over 36 dry tons of fertilizer pellets were processed each year. In 2015, a five-year contract extension was negotiated for the Operation and Maintenance of the Facility to provide MWRA with an opportunity to review technology changes that could improve operations, and to provide increased competition when a new, 20-year contract is bid in 2020. The contract extension resulted in savings of \$1.25 million over the five-year term.

Monitoring Each Step Of Way

MWRA has invested more than \$30 million in specialized discharge and oceanographic monitoring and studies of water quality, sediment quality, and the health of marine species. The work, which is ongoing, has been exhaustively reviewed by regulatory agencies and an independent panel of scientists, presented at numerous public meetings, and published in peer-reviewed literature.

Current water quality in Boston Harbor & Tributary Rivers



More than 300 technical reports and more than 1,000 scientific papers on the subjects of Boston Harbor and Massachusetts Bay document environment conditions and changes since the treatment facilities were brought on-line.

MWRA monitors water quality at more than 50 locations in Boston Harbor. Measurements are also made in the Charles, Mystic, and Neponset rivers. The monitoring

program is designed to document the Harbor's recovery and monitor the impacts of combined sewer overflows (CSOs) on the Harbor and rivers.

CSO Program Brings Positive Results

In December 2015, the last combined sewer overflow construction milestones in the Federal District Court Order were achieved, capping a nearly 30-year effort by MWRA, its member communities and ratepayers

to bring this last construction program in the Boston Harbor Clean-up to successful completion.

Once known as the dirtiest harbor in America, even the smallest rainstorm would result in beach closings due to human waste overflowing onto the beaches. The harbor itself was dirty and uninviting.

Today, the beaches in the Boston area are considered the cleanest urban beaches in the country. The water quality of the Charles and Mystic Rivers earned a B+ rating. The Harbor is swimmable even during rain events.



"...Boston's beaches, once synonymous with sewage and sludge, boast some of the cleanest waters of any urban beach in America — cleaner even than the iconic sun-splashed tourist meccas of Waikiki Beach in Honolulu and South Beach in Miami, according to a new report by a local environmental group."

- Boston Globe, May 23, 2015

Chapter 3: State-Of-The-Art Maintenance and Operations



Since its inception, MWRA has continuously constructed or rehabilitated major water and sewer facilities to bring them up to date and ensure compliance with state and federal regulations that protect the public health and the environment. But that's just the beginning. MWRA must also maintain and operate these facilities so that they never again fall into a cycle of neglect and disrepair.

Maintenance With A Capital "M"

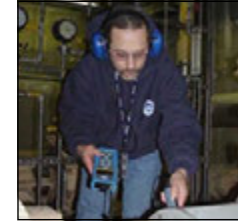
MWRA has developed and implemented a well-structured, robust maintenance and asset protection program that includes predictive, preventive and corrective maintenance, and condition monitoring and assessments.

MWRA's use of Reliability Centered Maintenance (RCM) methods has made it a leader in the industry. The RCM approach is to review the preventive maintenance program for all assets to ensure that the correct maintenance activities are completed and to identify assets where condition monitoring can be beneficial. The use of condition monitoring techniques, such as

vibration, acoustic, ultrasonic, infrared thermography, leak detection, and TV inspection are used to identify potential failures, thereby providing staff with sufficient time to plan to correct these issues prior to failure.

A key component of MWRA's maintenance program is a computerized maintenance management system, Maximo, which has been in use since 1995. Although it began as a tool to manage the thousands of new pieces of equipment on Deer Island, its usage has spread to most other areas of the agency, including field operations and vehicle maintenance.

Through Maximo, MWRA tracks over 120,000 individual pieces of equipment, manages work orders, and schedules preventive and predictive maintenance. In 2015, MWRA began implementation of an upgrade that will enhance functionality and add new user groups, ensuring that every part of the organization is tracked using the same technology.

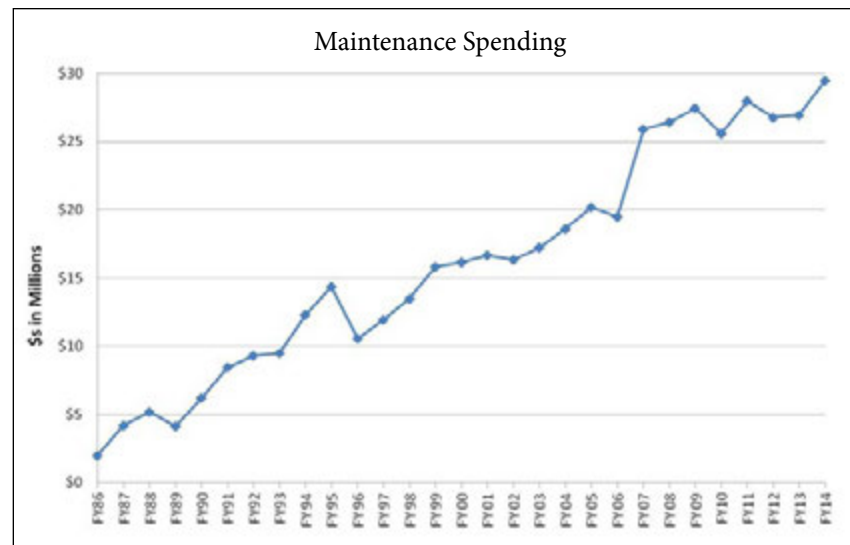


MWRA has been committed to ensuring that assets are well protected and replaced as needed by increasing spending on maintenance year to year.

Equipment Availability Is Key

MWRA has historically

maintained a high level of equipment availability for operations. At each major facility, regular feedback from facility operators is used to supplement the scheduled work orders generated by the maintenance system. For example, at Deer Island, an equipment availability report is generated daily that details the critical equipment required to treat the maximum flow of 1.3 billion gallons per day. Higher maintenance priority is assigned to equipment that drops below the number required, and work orders are rescheduled to return to 100%. In FY2014, critical equipment availability averaged 99.6%. Deer Island has been better than the industry-best practice benchmark of 97% for each of the past nine years.



The critical equipment for wastewater collection and transport to Deer Island includes pumps and screens in the pump stations, CSOs, the screen house, and headworks. Operational staff evaluate the availability of critical equipment on a daily basis and report on a weekly basis. The critical equipment availability for FY2014 for "off-island" wastewater facilities was 99.98%.

On the drinking water side, MWRA has experienced essentially 100% critical equipment (treatment

and pump station) availability due to both the practice of redundancy and effective maintenance. Valves are used to control water in every water distribution system, allowing flow re-direction, and both planned and emergency shutdowns.

Valve operability is one key measure of the health of the water distribution system. MWRA has more than 5,000 valves in its system. When MWRA began to evaluate its distribution system in the early 1990s, only about half of the valves were found to be operable, making emergency and planned shutdowns difficult and disruptive to customers. Since that time, hundreds of valves have been replaced. Valve maintenance staff perform regular valve exercising to maximize the operability of the valves and have been very successful repairing broken valves when encountered in the field. The target for main line valve operability has steadily increased from 84% in FY03 to 95% as the target was met. Targets for the three other classes of valves have also been increased to 95% in 2014.

Keeping Track

Another important element of MWRA's maintenance program is the use of key performance indicators to track compliance and progress with program goals.



MWRA senior staff review the status of maintenance and operation of all water and wastewater facilities by the use of extensive metrics in the monthly and quarterly Key Indicators of MWRA Performance reports.

Thirty-six maintenance metrics were developed by benchmarking best practices for all areas of MWRA. The maintenance metrics for MWRA's maintenance program support that the correct and adequate maintenance is being completed. These metrics

demonstrate preventive and predictive maintenance compliance at industry-best levels, and maintenance backlogs remain within industry standards. These include indicators of equipment availability, predictive and preventative maintenance task orders, and backlog. Inspection and maintenance of interceptors and water mains, valves, and meters are reported on, with targets set each fiscal year.

Planning Ahead

MWRA's Master Plan includes projects that are projected to be needed based upon age and condition of facility and infrastructure assets. Short-term and long-term replacements are identified. The use of condition assessments is critical to determine when and what assets require replacement. These assessments are completed by engineering firms or internal MWRA engineering staff on an ongoing basis to determine what replacements and improvements are necessary to extend the asset life. These plans are incorporated into MWRA's capital budget. A comprehensive update to the Master Plan was completed in 2013.

Renewable and Sustainable Operations

MWRA staff operate all of its water and wastewater facilities – from treatment plants, to pump stations, to CSO control facilities. These facilities are interconnected by telephone, radio, and microwave communication links, and are monitored and controlled at MWRA's central Operations Control Centers that ensure coverage 24 hours a day, seven days a week.

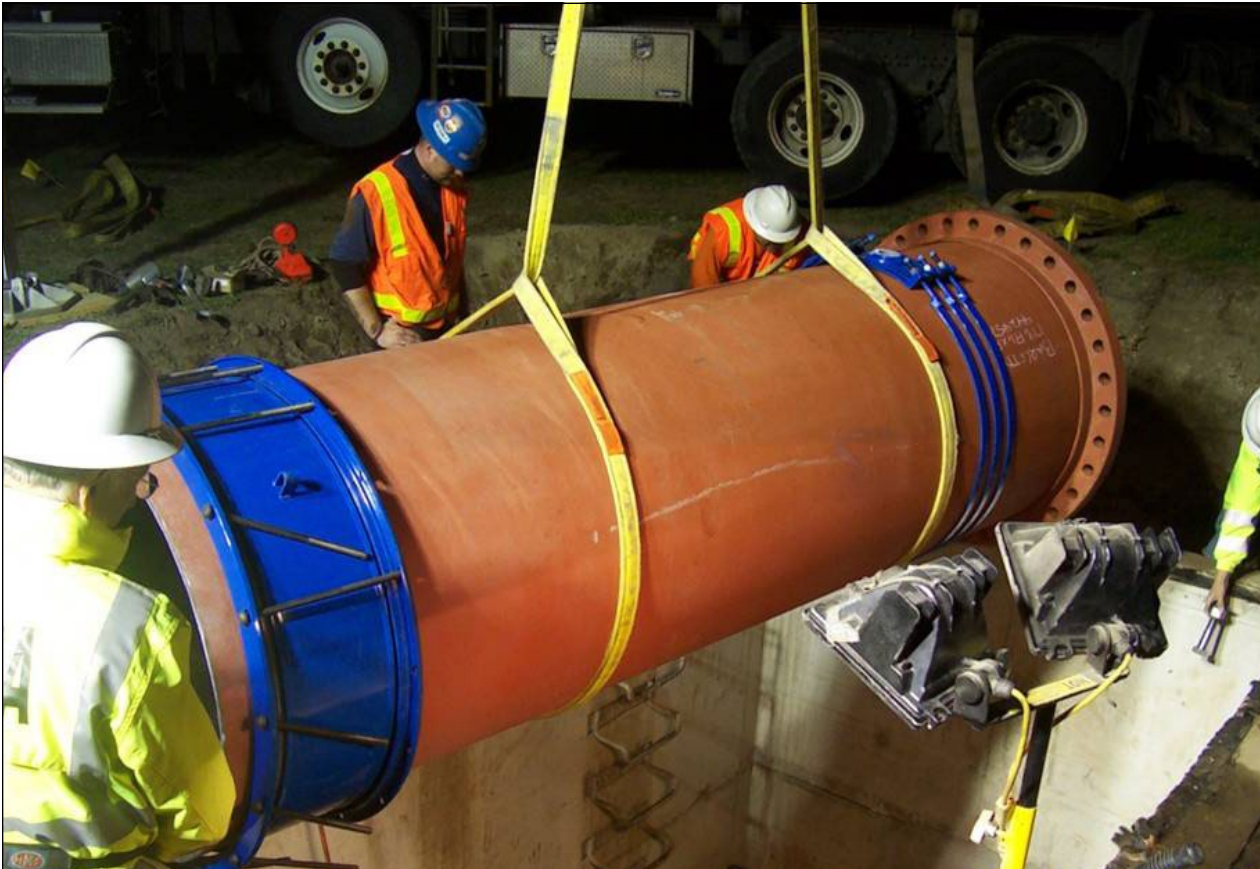
MWRA strives to conduct its day-to-day operations in an environmentally friendly manner. Although water

and wastewater operations are inherently energy intensive, MWRA has been able to offset some of that usage with on-site renewable sources, including wind, solar, hydro-power and reuse of digester gas.

Over the last five years, the Deer Island Wastewater Treatment Plant has produced an average of 26% of its electricity needs on-site and over 60% of its total energy demand. In 2011, the 365-foot, 1.5 megawatt Charlestown Wind Turbine was installed. The turbine generates 3 million kilowatt hours per year and provides an annual savings in electrical costs of \$400,000. This \$4.7 million project was fully funded through the American Recovery and Reinvestment Act (ARRA). In early 2012, the foundation was found to have settled more than anticipated, but it was successfully redesigned and repaired, with all costs borne by the contractor.



Charlestown Wind Turbine



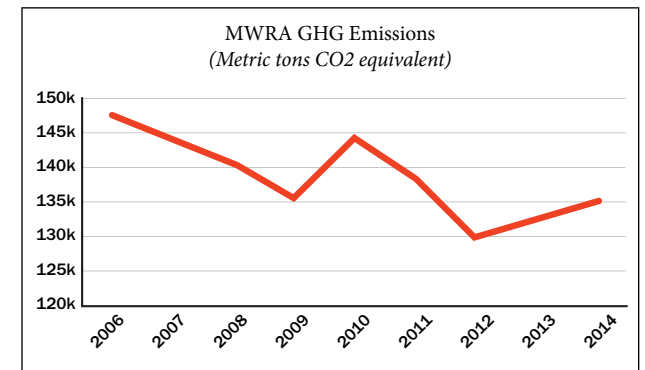
Plans are also underway for a new hydroelectric generator as part of a new pipeline project that will provide the McLaughlin Fish Hatchery in Belchertown with cold water directly from the Quabbin Reservoir. The electricity generated would be utilized at the Brutsch Water Treatment Facility, with any surplus sold back to the grid. The hydro turbine project has received funding from the Alternative Energies Initiatives Project and the Massachusetts Leading By Example Program. Along with these renewable energy initiatives, MWRA has been focused on reducing overall energy demand

to decrease the quantity of purchased power and reduce operating expenses while increasing non-rate revenue through the sale of green energy credits. Significant reductions in electrical demand have been achieved through a number of different no-cost and low-cost process optimization efforts (pump station shaft level adjustments, secondary aeration/cryogenic oxygen production optimization), coupled with energy-efficient equipment installation and lighting improvements. Over the last five years, MWRA's net electricity usage has been reduced by 17%.

In 2014, MWRA entered into a Memorandum of Understanding (MOU) with NSTAR, now Eversource, with a goal to achieve approximately 5% savings in electricity use each year. The MOU sets forth a minimum “incentive” payment by the utility for approved energy efficiency projects.

In 2011, MWRA received its second “Leading By Example” award from the Executive Office of Energy and Environmental Affairs for completing a number of new renewable energy projects across its service area.

MWRA is committed to operating its facilities in a low-carbon and sustainable way. In 2015, MWRA undertook a Greenhouse Gas Emissions Inventory project to account for and report on these emissions to better manage and track progress as the agency continues to grow its renewable energy program.



Preparing for Sea Level Rise

MWRA has been closely monitoring all available research about the effects of climate change in the service area. Although the water system and the Deer Island and Nut Island facilities are well-protected, there are some 25 coastal facilities that will require modifications. Since these facilities are generally on a 20-year rehabilitation cycle, staff are planning to include



protective measures, such as raising generators and electrical equipment, and installing water-tight stoplogs at facility openings. In addition, in-house staff have:

- Installed flood protection walls for the Chelsea Administrative Radio Building and for the electrical equipment in the yard at the Pelletizing Plant in Quincy.
- Completed designs for the rehabilitation of the Alewife Pump Station and the Chelsea Creek Headworks to include flood protection measures.

Co-Digestion of Food Waste

In 2014, the Massachusetts Department of Environmental Protection announced a ban on the disposal of commercial and industrial food wastes to

state landfills. These products are considered valuable for their energy potential. MWRA conducted a feasibility study and a bench scale test that showed that more methane could be produced with the addition of organic food waste to the digesters - a process known as co-digestion - to generate additional energy that could be used to further reduce the purchase of electricity.

MWRA had hoped to conduct a pilot program mixing food waste with wastewater sludge in one of the Deer Island digesters. If the pilot program proves successful, MWRA will contract for a long-term program. With full-scale operation, Deer Island's total energy demand could go from 64% to 75% produced on-site. Electricity alone could go from 25% made on-site to 45% - providing over \$7 million in savings for MWRA's ratepayers.

Initially, the pilot program called for trucking food waste to Deer Island, with the permanent program, if adopted, utilizing barges. However, the residents of neighboring Winthrop expressed their concerns about increased industrial truck traffic through Winthrop's narrow streets. In response MWRA has promised the Town that it will instead pursue a barging program for the pilot program as well. MWRA continues to explore options to move this program forward.

Chapter 4: Running a 21st Century Agency

Conservative - But Creative - Financial Management

Each year, the MWRA Board of Directors approves an annual operating budget and capital spending plan as well as community assessments adequate to cover all planned expenses. Each MWRA member community, in turn, establishes local water and sewer charges to support both the community's MWRA assessment and the cost of operating the local water distribution and wastewater collection system.

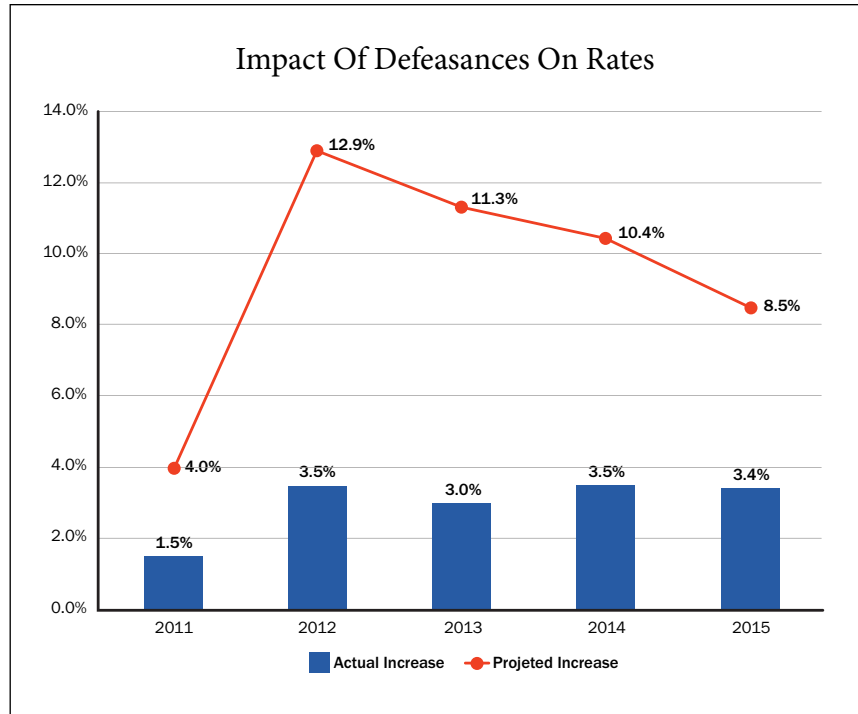
MWRA remains committed to finding ways to keep costs down and ensuring that every dollar spent provides real public health or environmental benefits.

MWRA maintains strong credit ratings, Aa1, AA+, AA+ from Moody's, Standard & Poor's and Fitch respectively. MWRA's credit ratings from all three major agencies are only one ratings step below the highest rating of AAA. These high credit ratings enable MWRA to borrow at very advantageous interest rates, minimizing debt service expenses.

Managing Debt

In order to finance its Capital Improvement Program, MWRA issues long-term revenue bonds. MWRA has \$5.6 billion in outstanding secured debt, including fixed-rate, variable-rate and State Revolving Fund (SRF) debt. Debt service on these bonds accounts for 60% of MWRA's Current Expense Budget.

In FY2014, MWRA started to reduce its total bonded indebtedness over the cap period by paying off more principal on debt than the annual capital spending for the first time since the Boston Harbor Clean-up Project.



MWRA aggressively manages its debt portfolio to take advantage of lower interest rates while maintaining its optionality. MWRA has also lowered borrowing costs and managed rates through the use of the subsidized SRF loan program, a variable rate debt portfolio, the refunding of outstanding bonds for both savings and restructuring purposes, and the use of surplus revenues to defease debt.

MWRA has taken advantage of favorable interest rates whenever possible to refund debt for savings. Since 1992, MWRA has refunded \$5.3 billion of outstanding debt to achieve present value savings of \$283.3 million.

Reining In Rate Increases

In 2015, MWRA successfully gained the release of \$113 million in reserves that had been created during its early years. \$103 million was combined with \$30 million from a defeasance account and used to prepay bonds coming due over the next six years. This, combined with continued conservative budgeting, has put MWRA in a position to finally manage future rate increases to a level of 4% or lower – a major goal of the MWRA Advisory Board on behalf of MWRA's member communities.

Also in 2015, the MWRA Board of Directors voted to create an Other Post Employment Benefit

	Refinancing for Savings
2011	MWRA sold \$477.2 million in new money and refunding bonds resulting in \$25.3 million in present value savings
2012	MWRA sold \$236.8 million in new money and refunding bonds resulting in \$5.2 million in present value savings
2013	MWRA sold \$170.6 million in refunding bonds resulting in \$13.1 million in present value savings
2014	MWRA sold \$358.7 million in new money and refunding bonds resulting in \$20.2 million in present value savings



Sudbury Aqueduct Trail

(OPEB) Trust and use the remaining \$10 million for the initial deposit. In addition, after years of aggressive funding, the MWRA Retirement System is virtually fully funded.

treatment plant through local pipelines to customers' taps. Over the last five years, \$83.5 million has been distributed through this program.

Infiltration/Inflow (I/I) is excess water that enters the wastewater systems of both the MWRA and its 43 member communities through a variety of sources. High levels of I/I reduce pipeline capacity in the sewer system. During extreme storm events, this may cause back-up of sewage into homes and businesses, local overflows of untreated sewage and increased operating costs. I/I also results in the transport of groundwater and surface water out of the natural watershed, which may adversely impact groundwater and surface water resource areas.

Over the last five years, \$93.1 million has been distributed through this program. In FY2015, at the urging of the MWRA Advisory Board, two new phases of funding were added to this program doubling the amount of previous phases – from \$80 million to \$160 million.

5-Year Business Plan

In 2015, MWRA completed an update to its 5-Year Business Plan, which provides a management tool for identifying and prioritizing the strategic initiatives critical to MWRA's mission. It ensures that staff are all working toward the same goals and objectives in an ever-changing environment while allowing staff to track progress and identify new issues as they arise.

Aqueduct Trails Program

In 2012, MWRA launched an initiative to open up over 30 miles of back-up aqueducts to public access. Since then, nearly 19 miles of trails have been permitted in six communities, with 11.3 miles open and being enjoyed by the public.



Partnering With Member Communities

Community Financial Assistance Programs

MWRA's Phase 2-Local Water System Assistance Program provides \$210 million in interest-free loans to member water communities to perform water system improvement projects. Community loans will be repaid to MWRA over a 10-year period. The program's goal is to improve local water system pipeline conditions to help maintain high water quality from MWRA's



Newton Receives I/I Grant

School Education Program

MWRA's School Education Program provides classroom presentations throughout the school year in MWRA's member communities. Learning about their places in the water cycle helps students see the links between their daily lives and important environmental issues like water conservation and pollution, and will help ensure that future generations appreciate the importance of water and wastewater infrastructure.

MWRA educational guides contain hands-on activities for a range of topics and grade levels and are supported by free teacher workshops. Each year,

classroom presentations reach over 10,000 students. In addition, MWRA holds an annual Poster, Essay and Video contest to focus on a particular topic of interest. Over the last five years, topics have ranged from “Science, Technology, Engineering and Math (STEM) Careers in the Water and Wastewater Field” to “It’s a Toilet, Not a Wastebasket” to “Tap Water versus Bottled Water.” The contest is very popular and garners over 2,500 entries each year.



Since 2011, MWRA has been deploying its portable water fountain to events around the service area. The fountain provides free, fresh water and helps organizers cut down on the cost and waste of bottled water while providing a great educational opportunity for MWRA to let people know where their water comes from and how good it tastes.

Advisory Committees



MWRA Advisory Board

The MWRA Advisory Board was created by the Legislature to represent the interests of the communities within the MWRA service area. The Advisory Board reviews and comments on MWRA’s capital and current expense budgets, as well as the agency’s practices and policies. The Advisory Board meets monthly to provide budget updates and discuss topics of interest. Over the last five years, the Advisory Board has been successful in focusing attention on the importance of investing in “forgotten” water and wastewater infrastructure.

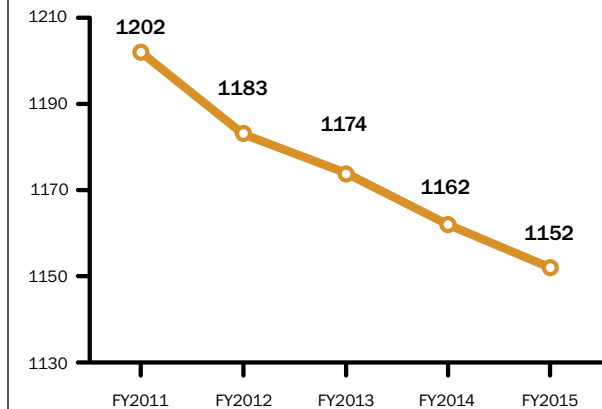
Water Supply Citizens Advisory Committee

WSCAC’s current focus is water quality - source protection and management of the watersheds, reservoirs and distribution system.

Wastewater Advisory Committee

WAC’s mission is to be an independent public forum for holistic discussion of wastewater issues.

MWRA Staffing FY2011–2015



Determining The Right Staffing Level

In 2011, MWRA commissioned a staffing study designed to provide an independent review of MWRA staffing levels as compared to similar water and wastewater agencies to determine the appropriate staffing level going forward. The goal was set at 1,150 employees by 2017. MWRA reached that goal in 2015. Despite the reduction to staff, all performance measures continue to be met.

Succession Planning Put To The Test

As expected, a number of senior managers and other key staff have retired over the last five years. In anticipation of this, MWRA had a deep, qualified “bench” from which to draw on. In some cases, departments were reorganized to take advantage of particular skill sets. A transition plan was created to prevent any drop off in performance.

Commitment To Equal Opportunity

MWRA's Affirmative Action Plan sets out the basic parameters of MWRA's commitment to Equal Opportunity in the areas of Employment and Minority/Women Business Enterprise participation in MWRA procurements and contracted services. MWRA updates its Affirmative Action Plan annually and provides information on the development, implementation and monitoring of the various plan elements in accordance with guidelines of the U.S. Department of Labor, Office of Federal Contract Compliance Programs.

Through CY2014 the overall MWRA affirmative action workforce staffing goal for minorities was 20.0% in the aggregate and workforce staffing at the end of 2014 Plan Year was 20.0%. The current overall MWRA affirmative action workforce staffing goal for females was 25.6% in the aggregate and workforce staffing at the end of the 2014 Plan Year was 22.0%. MWRA is working to increase these numbers across the agency.

MWRA has also taken steps to meet expansive new regulations from the US Department of Labor's Office of Federal Contract Compliance Program, effective as of March 2014, that require greater efforts be taken to employ veterans and individuals with disabilities.



Accountability And Transparency

As a public agency, MWRA believes its ratepayers should have easy access to information on water quality, rates and charges, and construction programs. Over the last five years, MWRA's website – www.mwra.com – has continued to evolve into a user-friendly repository for our customers. In 2011, MWRA created its own "Open Checkbook" portal in-house, well ahead of the deadline required under the Commonwealth's "Accountability and Transparency Act." Other information posted on the website includes:

- Drinking Water Quality Reports
- Lead Sampling Results
- Boston Harbor and Massachusetts Bay Water Quality Data
- Quarterly Performance Report
- Water Conservation Information
- Press Releases
- Agendas and Materials for Board of Directors' meetings
- Court Reports
- Rates and Budget Information
- Official Financial Statements
- Construction Project Updates

MWRA also has a social media presence on Twitter, Flickr and YouTube, and is implementing a new subscriber service on its website.

Staying Safe And Secure

Since September 11, 2001, MWRA has made major investments to ensure the security of its critical water and sewer infrastructure. An agency-wide Security Task Force continues to meet regularly. In addition to security, MWRA also maintains plans to respond to large water main breaks, chemical spills, pandemics, hurricanes and other natural disasters.

Over the past five years, MWRA has performed drills on a number of these scenarios to make sure that staff are prepared to respond in the event of a real emergency, in order to limit damage to facilities and ensure continued service.

Employing New Technologies

MWRA continues to adapt to new technologies to gain efficiencies and keep up with the ever-changing times. In 2011, MWRA commissioned a 5-Year Strategic Plan to provide a road map to take the agency through the next five years of technology growth.

- In 2013, MWRA launched a Vehicle Locator System that tracks the 49 vehicles in MWRA's fleet.
- Also in 2013, MWRA went live with an eProcurement electronic bidding system.
- In 2014, enhancements were made to the GIS mapping system to allow detail to be added at the completion of MWRA construction projects.
- In 2015, eDiscovery Archive and Purge system was put into place to automate the archiving and retrieval of electronic documents across all formats.

Chapter 5: What Lies Ahead

As the Citizen Panel's letter at the beginning of this report pointed out, there are a number of issues that need to be addressed over the next five-year period. And of course, there are always new challenges that arise without warning. The region's aging infrastructure isn't getting any younger and regulators continue to impose new mandates while funding opportunities rapidly dwindle.



Preparing for Climate Change

As part of successive efforts to plan effectively for the long term, MWRA has examined and responded to the potential impacts of climate change on its facilities, operations and reliability.

Currently, the service area averages 104 rain events per year with an average of 44 inches of rainfall. Models suggest there will be longer dry spells with shorter, more intense rain events.

The good news is that the water supply system will likely see an increase in available reliable yield, which MWRA will be able to use to help other nearby systems during the projected more frequent drier periods. MWRA's

source reservoirs and water treatment plants are located well west of the coast and at high elevations. Eighty-five percent of the water is delivered by gravity.

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, bringing it into full compliance with new dam safety regulations.

Staff and equipment can be redeployed to pre-determined locations in advance of storms. Back-up water and wastewater operations control centers have been created at the Carroll Water Treatment Plant in Marlborough.

The Deer Island Wastewater Treatment Plant was designed in 1989 to account for the then projected two feet of sea level rise: the entire plant was raised up and the outfall made slightly larger to protect the facility and preserve its design capacity. The plant is also protected by a massive seawall and the on-site power plant ensures uninterrupted power supply.

However, MWRA also has 30 coastal wastewater facilities. A detailed review indicated that 18 may potentially be affected by storm surge flooding. Short-term actions are being implemented for the most vulnerable, and longer-term modifications are being programmed into planned and anticipated rehabilitation projects for each facility.

MWRA is including the potential impacts of climate change into its emergency action plans and has already taken critical steps to ensure reliable operations. Going forward, the agency must continue to monitor the most recent science and adjust its plans accordingly.

CSO Program Review

In April 2006, the Federal Court allowed a joint motion (MWRA, EPA, and DOJ) and issued an Order (July 2006) incorporating changes to the Long-Term CSO Control Plan and schedule. This Order was the result of extensive negotiations and eventual agreement by the parties that resolved remaining outstanding issues associated with the Long-Term Control Plan.

The 2006 agreement resulted in: increased CSO control for the Charles River Basin; a revised recommended plan for CSO control for North Dorchester Bay (South Boston Beaches CSO Control); provided MWRA a five year period after achievement of the last construction milestone (2015) during which MWRA would have no additional construction responsibilities, and would conduct a three year post-construction assessment in 2020. This was in keeping with the MWRA's Advisory Board and Board of Directors' requirement that in exchange for the additional Charles River CSO projects, MWRA would be allowed a five year period (2015-2020) of no additional CSO obligations and capital project spending. With this agreement, approvals and court orders, MWRA gained greater, necessary certainty in managing its capital program and rate increases over the 15-year period through 2020.

Under the Order, MWRA has five years following construction of the last CSO project in 2015 to complete, by December 2020, post-construction monitoring and a performance assessment to verify that the approved long-term levels of CSO control are achieved. Also as part of the agreement, DEP agreed to continue to reissue, and EPA agreed to continue to approve, the Charles River and Alewife Brook/Upper Mystic River CSO variances through 2020 without additional CSO controls beyond the approved plan. The current variances end in October and September, 2016, respectively.

The Next Generation of Power for Deer Island

MWRA is pursuing improvements to Deer Island's Thermal/Power Plant to increase the quantity and efficiency of electrical power produced on site and more fully utilize the digester gas generated by the plant.

The original Deer Island Thermal/Power Plant consisted of two steam boilers and one 18 megawatt steam turbine. One boiler operates at a time and burns all the digester gas that is generated from the anaerobic digestion process. The boiler produces heat in the form of steam, which is followed by a steam topping turbine to produce electrical power in what is called a "bottom cycle" process. The heat efficiency of Deer Island's bottom cycle process is fairly high at approximately 60%; however the electrical efficiency is low at approximately 9%.

In the summer, with significantly lower facility heat demands, the thermal plant wastes heat to the plant effluent. In 2014, more than 95% of all digester gas produced was utilized in the boilers, meeting greater than 95% of the plant's total heat demand. Overall, 60% of Deer Island's energy needs (heat plus electricity) were met by the use of digester gas.

MWRA is now planning to change the paradigm to a "topping cycle" that uses a gas turbine and a duct burner as the main components. This design produces electricity first, and heat as a by-product as compared to Deer Island's current bottom cycle generator. The electrical efficiency overall could be between 35% to 40% over that of Deer Island's current 9% efficiency. The thermal efficiency would be reduced to 40% or 45% (from a current 60% efficiency). However, a duct



burner can be added to boost thermal efficiencies to more than 90%. Although the initial capital costs would be high, this newer technology would result in substantial increases in electric and heat production, and MWRA is actively evaluating this option.

Keeping Up With Cyber Security

The downside of automated systems is that the underlying infrastructure is vulnerable to a wide range of risks stemming from both physical and cyber threats and hazards. Sophisticated cyber actors and nation-states exploit vulnerabilities to steal information and money and are developing capabilities to disrupt, destroy, or threaten the delivery of essential services.

A range of traditional crimes is now being perpetrated through cyberspace. This includes banking and financial fraud, intellectual property violations, and other crimes, all of which have substantial human and economic consequences. MWRA is focusing its attention on measures it can take to improve the Cyber Security of its systems and stay ahead of this rapidly evolving issue.

Metropolitan Tunnel Redundancy

Since MWRA's inception, there has been an ongoing effort to improve water system operation and reliability through the Capital Improvement Program and Master Planning process. Many of the projects that have been completed, that are underway, or that are proposed,

provide an improvement in system redundancy in part, if not in total. Chapter 1 described the most recent accomplishments toward this goal. Over the next five years, MWRA will be focusing on developing a plan for redundancy for the tunnels that deliver water into the metropolitan area - the City Tunnel, the City Tunnel Extension, and, to the south, the Dorchester Tunnel.

On average, over 60 percent of the water delivered by MWRA flows through the metropolitan tunnels, supply mains, pipes and valve chambers in and around the Chestnut Hill Reservoir footprint. Shaft 7 is the end of the City Tunnel and provides connection to supply the City Tunnel Extension to the north and the Dorchester Tunnel to the south. A failure of any of these tunnels or rupture of piping at surface connection points on any of the metropolitan area tunnel shafts would cause an immediate loss of pressure throughout the entire High Service area and would require difficult emergency valve closures and lengthy repairs.

This potential situation has elicited careful study on the part of MWRA to determine the best course of action. The CIP has several projects that have been contemplated to increase operational response capabilities to these failure scenarios. MWRA staff have planned a series of future briefings for its Board of Directors to specifically address this part of the water transmission system and discuss the merits of the various approaches to eliminating these single points of failure, while working closely with the MWRA Advisory Board to ensure that whatever alternative is chosen will work within the framework of predictable and sustainable future rate increases.

Commitment to Ongoing Maintenance

As facilities built by MWRA such as the Deer Island Wastewater Treatment Plant and the Carroll Water Treatment Plant's age, it can be expected that even with regular preventive maintenance, equipment and portions of the plant will require periodic rehabilitation through the capital budget.

For future maintenance needs, MWRA's 2013 Water and Wastewater Master Plans provided a 20 to 40-year look ahead for system rehabilitation and replacement needs, including specific projects in the near term



as well as appropriate asset and condition based allowances for more distant needs. The Master Plans document the investment needs of MWRA's regional water and wastewater systems over the next four decades (FY14-53) through the identification of 367 prioritized projects, most of which are maintenance projects. The Master Plans will continue to be used in determining each year's capital spending level.

Keeping Rates in Mind

MWRA and its Advisory Board have been successful in implementing a multi-year rates strategy that has resulted in the ability to keep combined water and sewer rate increases below 4 percent for the next several years.

As MWRA goes forward with increasing maintenance needs and important capital projects, MWRA must always be cognizant of its ratepayers' abilities to foot the bill.



MWRA's Management Team

Spot Pond Storage Tank, Stoneham

FORMER MWRA BOARD MEMBERS 1985-2015

Paul N. Anderson 1985–1989
Thomas B. Arnold 1985–1986
Rudolph H. Banks 2005–2007
Joel A. Barrera 2007–2015
Maeve Valley Bartlett, Chair 2014–2015
Michael Benullo 1995–1997
Ian A. Bowles, Chair 2007–2010
Robert J. Ciolek 1985–1995
William B. Coughlin 1985–1986
Trudy Coxe, Chair 1993–1998
Patricia A. Crutchfield 1991–1993
William A. Darity 1989–1991
John P. DeVillars, Chair 1989–1991
Lorraine M. Downey 1985–1997
Andrea d’Amato 1998–2000
Robert A. Durand, Chair 1999–2003
Anthony V. Fletcher 1985–1989
Robert W. Golledge, Jr., Chair 2006
Michael S. Gove 2007–2013
Ellen Roy Herzfelder, Chair 2003–2005
Lucile P. Hicks 1997–2007
James W. Hunt, III 2005–2012

James S. Hoyte, Chair 1985–1989
Norman P. Jacques 1989–2001
Charles Lyons 1985–1997
Joseph A. MacRitchie 1989–2009
Vincent G. Mannering 1995–2012
Donald A. Mitchell 1996–2005
Manuel A. Moutinho, III 1993–1996
Samuel G. Mygatt 1987–1997
Antonia M. Pollak 2000–2005
Stephen R. Pritchard, Chair 2005–2006
Thomas E. Reilly 1989–1996
Margaret A. Riley 1985–1989
Walter J. Ryan, Jr. 1986–1995
Jonathan Z. Souweine 1985–1989
Robert Spinney 1997–2002
Richard K. Sullivan, Jr., Chair 2011–2014
Brian R. Swett 2012–2014
Susan F. Tierney, Chair 1991–1993
Marie T. Turner 1996–2012

MWRA ADVISORY BOARD

Louis Taverna, Advisory Board Chair
Joseph E. Favaloro, Executive Director

FORMER ADVISORY BOARD CHAIRS 1985 - 2015

Walter Woods
Andrew M. Pappastergion
Norman P. Jaques
Robert Healey
Joseph C. Foti
Katherine Haynes Dunphy

FORMER MWRA EXECUTIVE DIRECTORS

Michael Gritzuk
Paul F. Levy
Douglas B. MacDonald



Frederick A. Laskey, Paul F. Levy, Douglas B. MacDonald



Katherine Haynes Dunphy, Louis Taverna, Joseph E. Favaloro

Dedications

This report is dedicated to the memory of three individuals who served the MWRA for many years, shaped the agency and were key to our success in different but equally important ways. All three dedicated their careers to public service and accomplished much with equal measures of intelligence, determination and humor.



Marie T. Turner

Marie Turner served four terms on the 11-member Board from 1996 to 2012 representing the Town of Winthrop. Even before her tenure on the MWRA Board, Marie was a passionate advocate for the Town during the planning and construction of the new Deer Island Wastewater Treatment Plant in the 1980s and 1990s.

As a member of the Board, her number one priority was to ensure the upkeep and maintenance of the plant so that it never again slid back into a pattern of neglect. She was a strong supporter of MWRA staff and they, in turn, held her in the highest regard.



Charles Button

Charlie Button had two careers at MWRA. From 1988 to 1998, he served as the Deputy Director of the Program Management Division during the construction of the Deer Island Wastewater Treatment Plant. He returned in 2005 as the Chief Engineer through 2011 and during that time, he saw completion of the East Boston and South Boston CSO control projects, among many others. In between, he held high-level management positions at engineering firms working on public projects. Prior to joining MWRA, Charlie served as the Chief Engineer for the Boston Water & Sewer Commission.

Charlie left his mark on nearly every water and sewer project built in greater Boston over the last 40 years, and on the many people who were lucky to know him as a colleague and a friend.



Michael D. Ralph

Mike Ralph served as MWRA's Director of Public Affairs from 1985 to 2008. The Board and staff relied heavily on his uncanny ability to look at every issue from every side. His guidance helped MWRA navigate through a sea of potential (and some very real) storms - from siting a sludge facility to drilling a tunnel under several communities to making the case for state and federal funding. His advice was always sound and usually came with a funny story.

Prior to MWRA, Mike served as a Legislative Aide to Speaker of the House Thomas "Tip" O'Neil. Like his famous boss, he believed that all politics is local, and made sure that MWRA always did right by its neighbors.

This report was prepared in-house.

Written by: Ria Convery

Designed by: Ed Whitaker



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This report can be made available in large print.