





***Metropolitan Tunnel Redundancy Program Update
Hydraulics
and
Program Support Services Organization***

April 17, 2019



Hydraulic Model Update

- Adding all proposed CIP Water Projects
 - New pipelines
 - Rehabilitated pipelines
- Population and Employment Projections
 - 2040 and beyond
- Potential System Expansion
- Temporary Loss of Local Sources (Drought/Emergency)
- Water age/quality



Redundant Tunnel – Existing Tunnel Offline – High Day 265 mgd East of Norumbega





Redundant Tunnel – Existing Tunnel Offline – High Day 265 mgd East of Norumbega



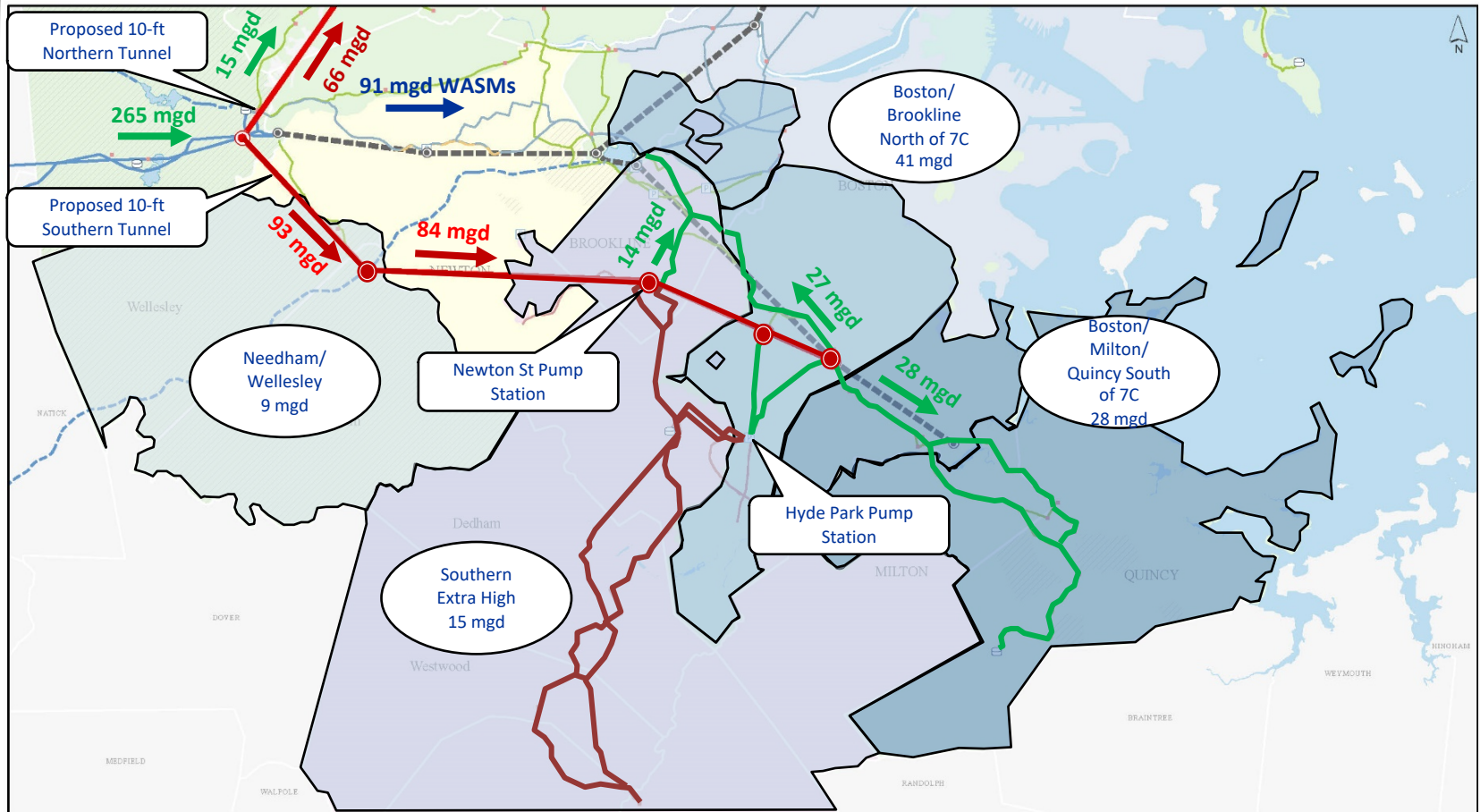


Redundant Tunnel – Existing Tunnel Offline – High Day 265 mgd East of Norumbega



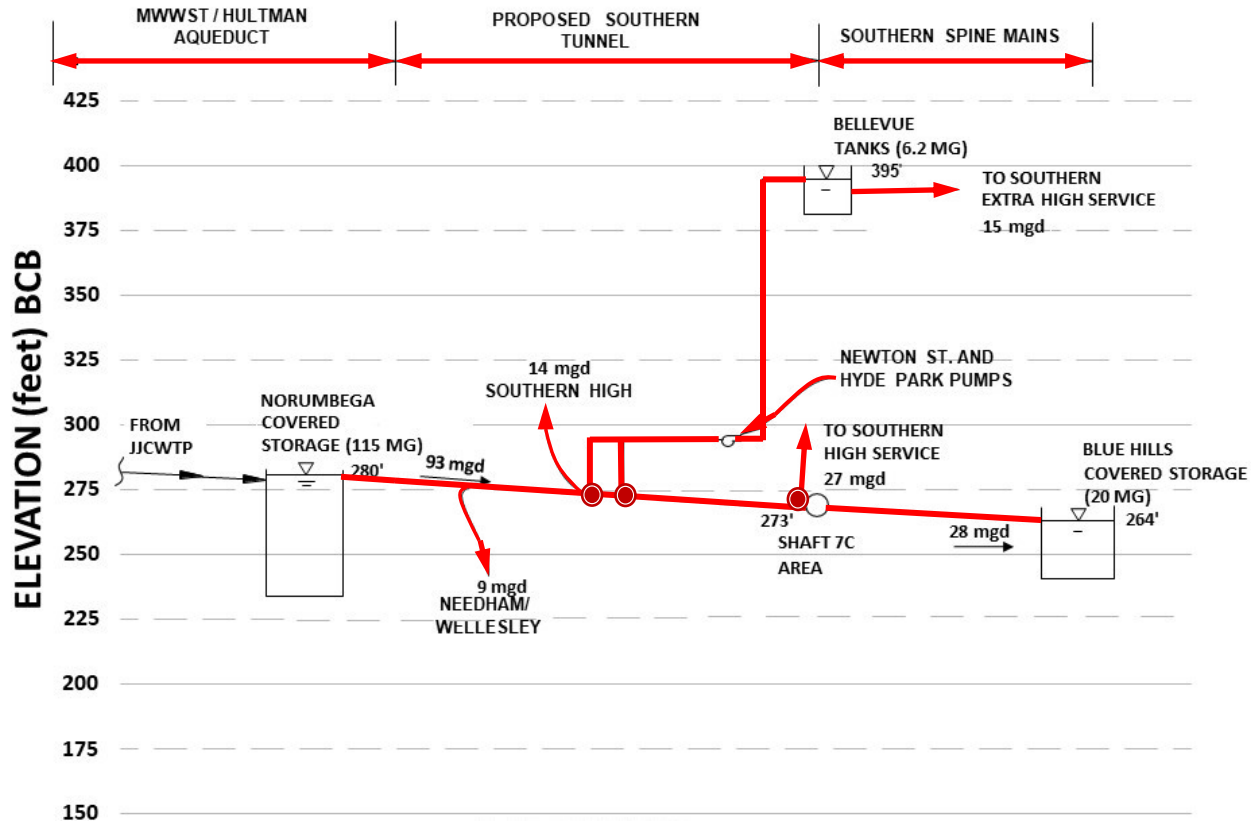


Redundant Tunnel Supply to the South – Existing Tunnel Off Line



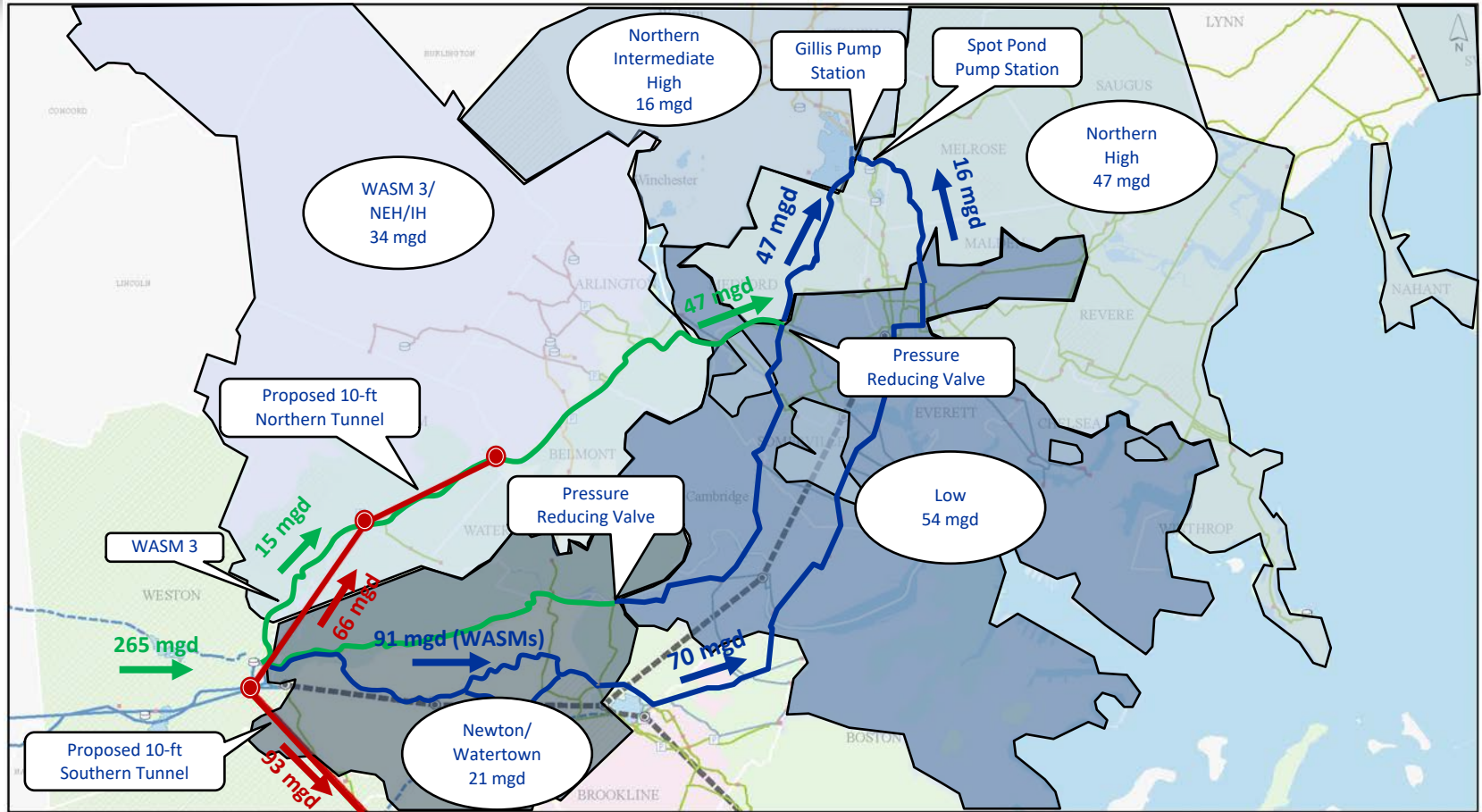


Hydraulic Profile – Southern Tunnel



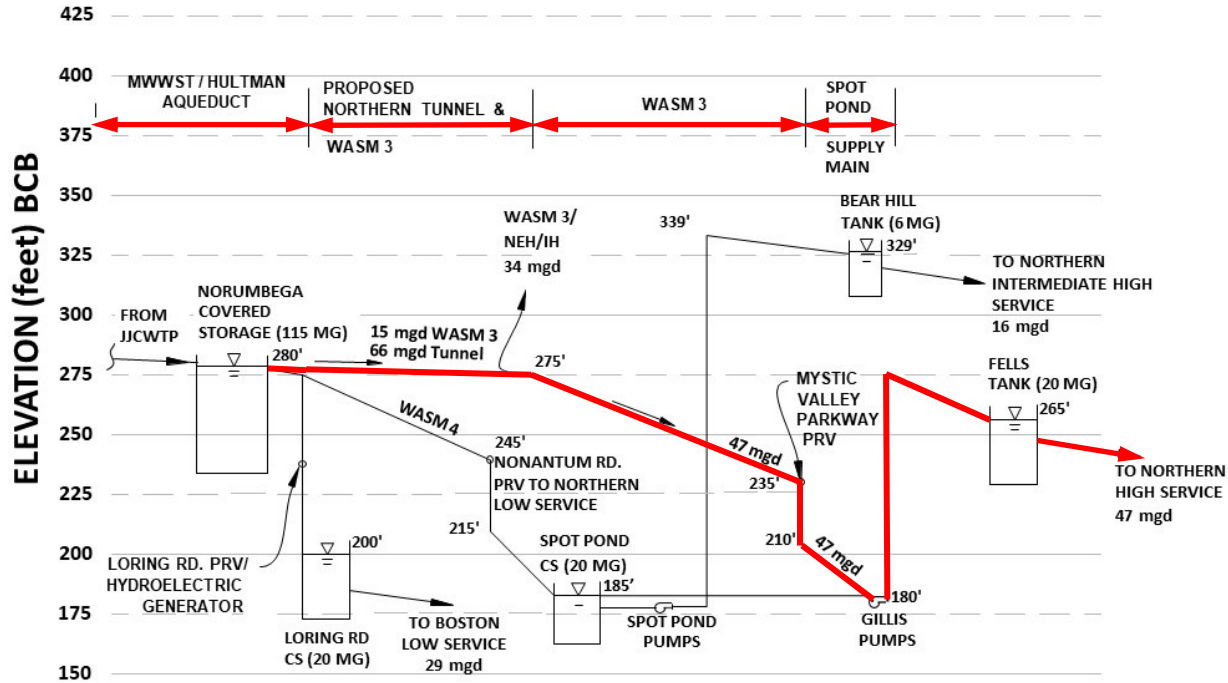


Redundant Tunnel Supply to the North – Existing Tunnel Off Line



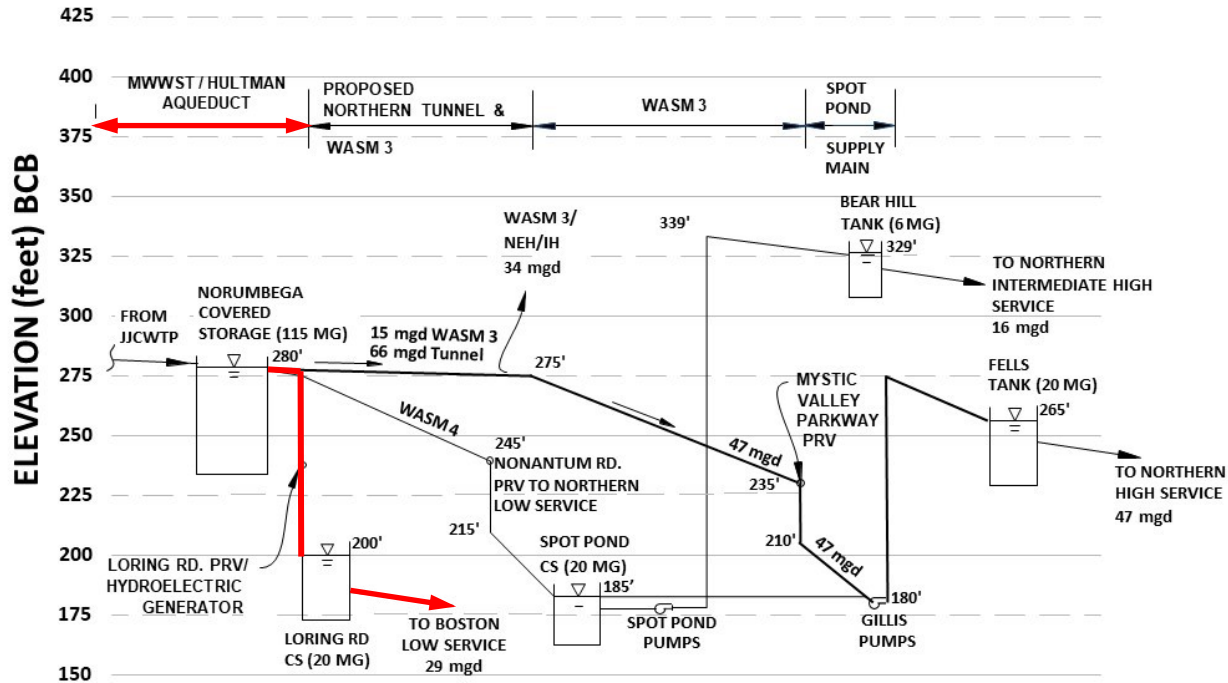


Hydraulic Profile – Northern Tunnel



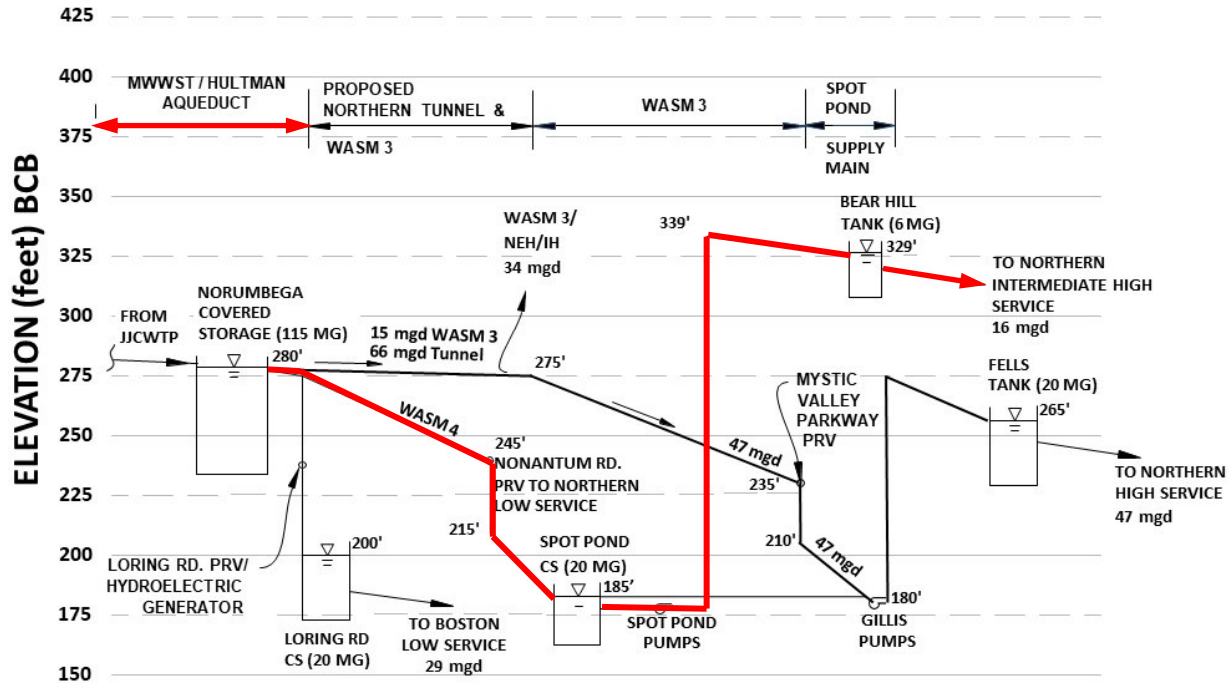


Hydraulic Profile – Northern Tunnel





Hydraulic Profile – Northern Tunnel



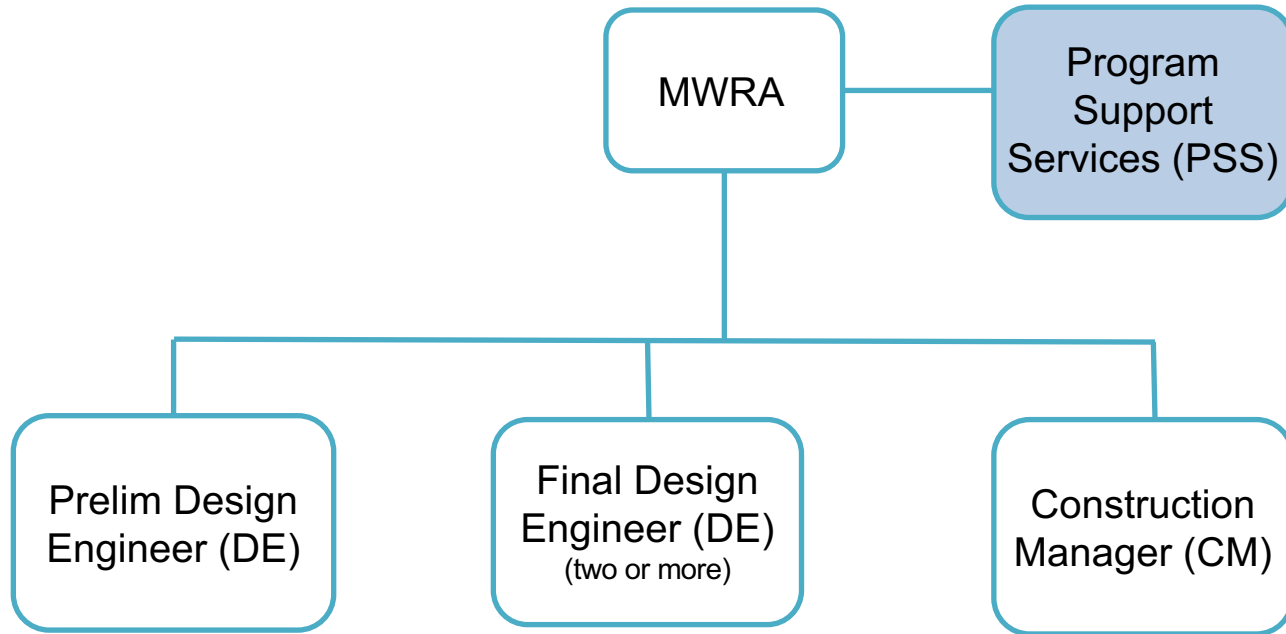


Next Steps – Preliminary Design Phase

- Evaluate future demands and drought/emergency scenarios
- Determine potential refinements to tunnel concept
 - Diameter
 - Connection Points
- Evaluate future improvements to accommodate potential demands



Program Support Services Contract Organization





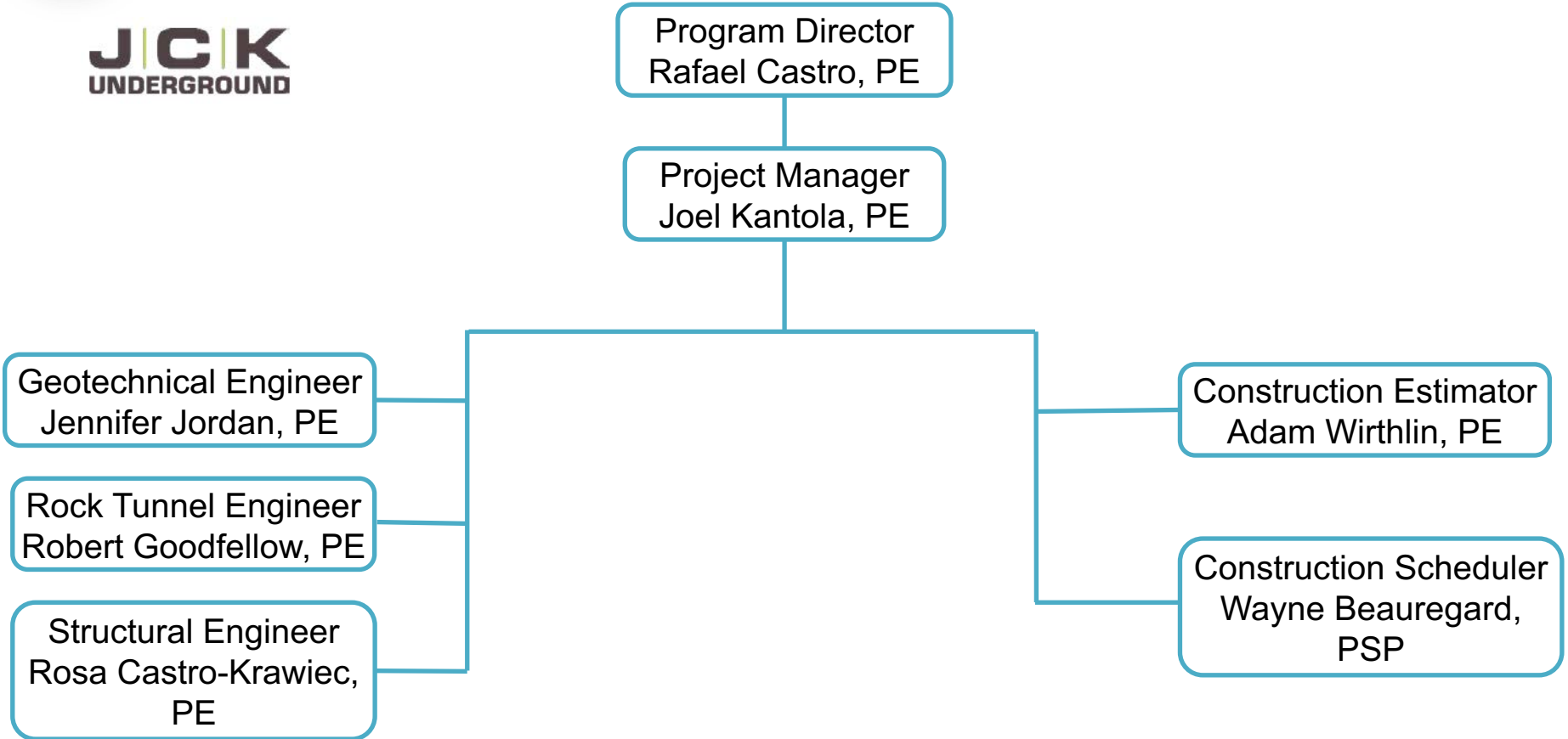
Program-Wide Support Services

- Program-wide planning
- Risk management planning
- Quality management
- Design criteria and standardization
- Independent design review
- Design and Construction package planning
- Critical path scheduling, and
- Budget planning and management





Program Support Services Contract Organization





Key Personnel

- Industry leaders in....
 - Risk management
 - Project delivery for large complex tunnel programs
- Most have over 25 years of experience and master's degrees
- Locally based
- Past MWRA Tunnel experience includes...
 - Boston Harbor Project
 - MetroWest Water Supply Tunnel
 - Braintree-Weymouth Tunnel





***Resident Engineering and Inspection Services for
Towable Generator Docking Stations
Contract 7024***

April 17, 2019



Purpose

- Towable generator for back up power during extended utility outage
- The docking stations enable quick connection
- Currently it requires a facility power shutdown and a crew of four 6 hours to connect



Project Location

Wastewater Facilities	Water Pump Stations
1. Braintree-Weymouth PS in Quincy, MA	7. Brattle Ct. in Arlington, MA
2. Caruso PS in Boston, MA	8. Commonwealth Ave. PS in Newton, MA
3. Framingham PS in Framingham, MA	9. Hyde Park PS in Boston, MA
4. New Neponset PS in Canton, MA	10. Newton St. PS in Brookline, MA
5. Nut Island Headworks in Quincy, MA	
6. Quincy PS in Quincy, MA	



MWRA's 1 Megawatt Towable Generator





Docking Station, to be wired to the Electrical Switchgear



New Panel to be installed with Plug In Wire Connections



Direct Wiring to Switchgear



Contract 7024 – Procurement

- Provide for Resident Engineer services to support construction

PROPOSER	FINAL RANKING	PROPOSED CONTRACT COST
Arcadis U.S., Inc.	1	\$209,063.30
Engineer's Estimate	-	\$189,784.00

- Staff Recommend Award of Contract 7024 to Arcadis U.S., Inc. in the amount of **\$209,063.33**
- Construction Contract Awarded to Fall River Electric, Inc. via delegated authority





MWRA Retirement System Update



April 17, 2019



Introduction

- Retirement System was created in MWRA's Enabling Act in 1984
- Three members expanded to five in 2006
 - Secretary of MWRA Board of Directors – Andrew Pappastergion
 - Appointment by MWRA Board of Directors – Thomas Durkin
 - Elected by membership – James Flemming
 - Elected by membership – Kevin McKenna
 - Non-member elected by four – Frank Zecha



Number of Retired participants and beneficiaries	582
Number of Inactive vested participants	42
Number of inactive participants due a refund of employee contributions	64
Number of active participants	1,100

as of 1/1/2018

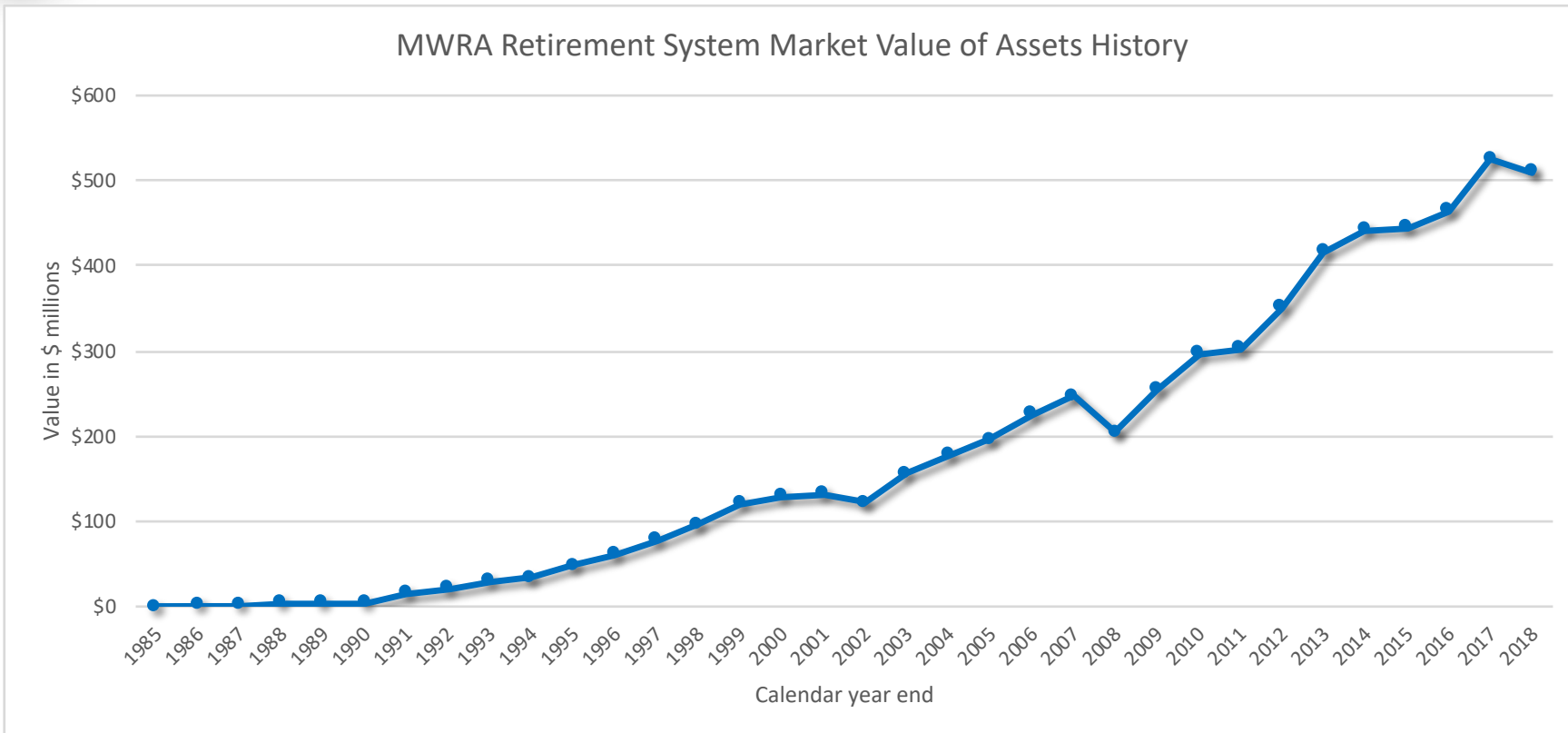
Number of MWRA employees in State (MDC) Retirement System	43
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as of 3/11/2019



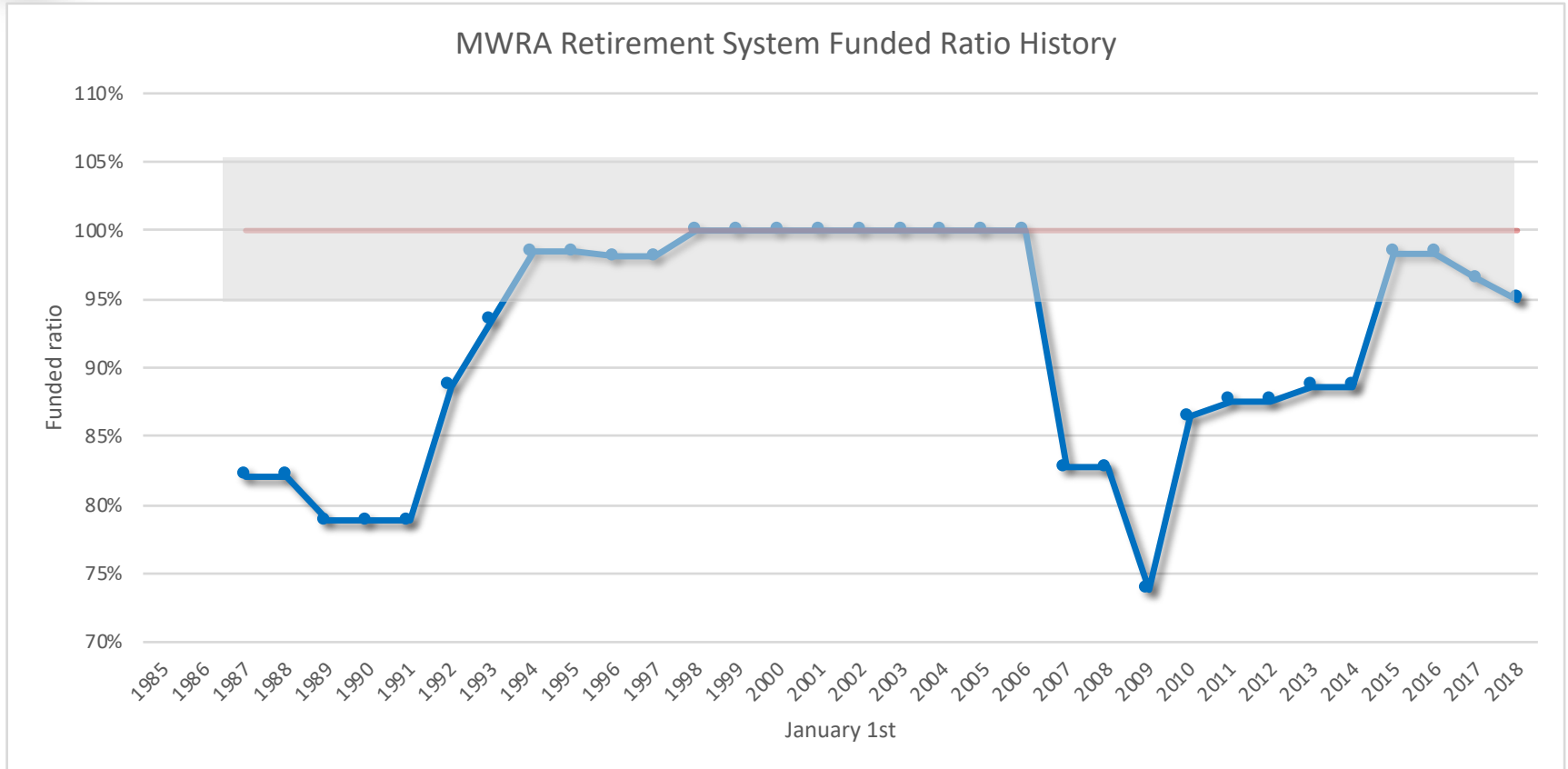
Market Value

MWRA Retirement System Market Value of Assets History





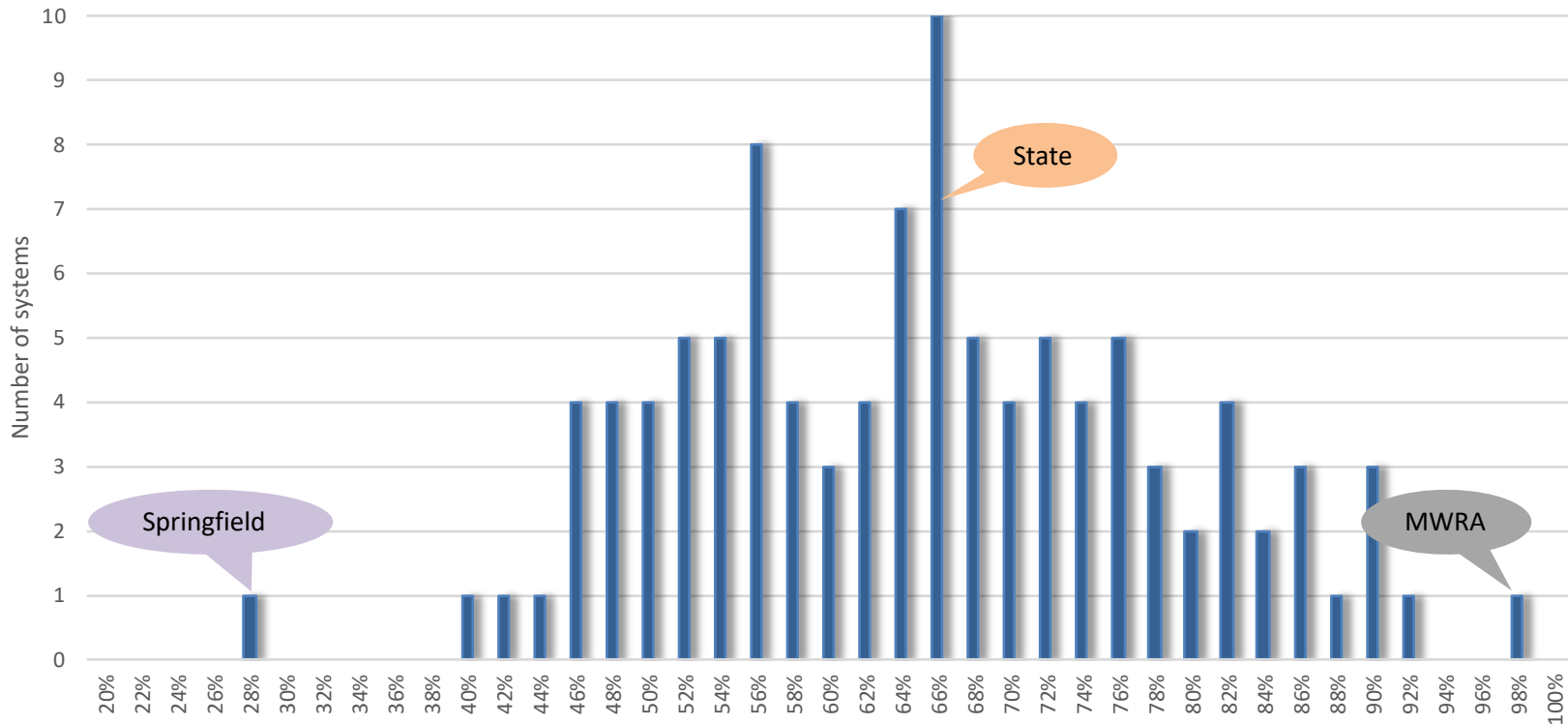
Funded Ratio





Funding Ratio

Funding Ratios of Massachusetts Retirement Systems
based on PERAC Investment report 2017

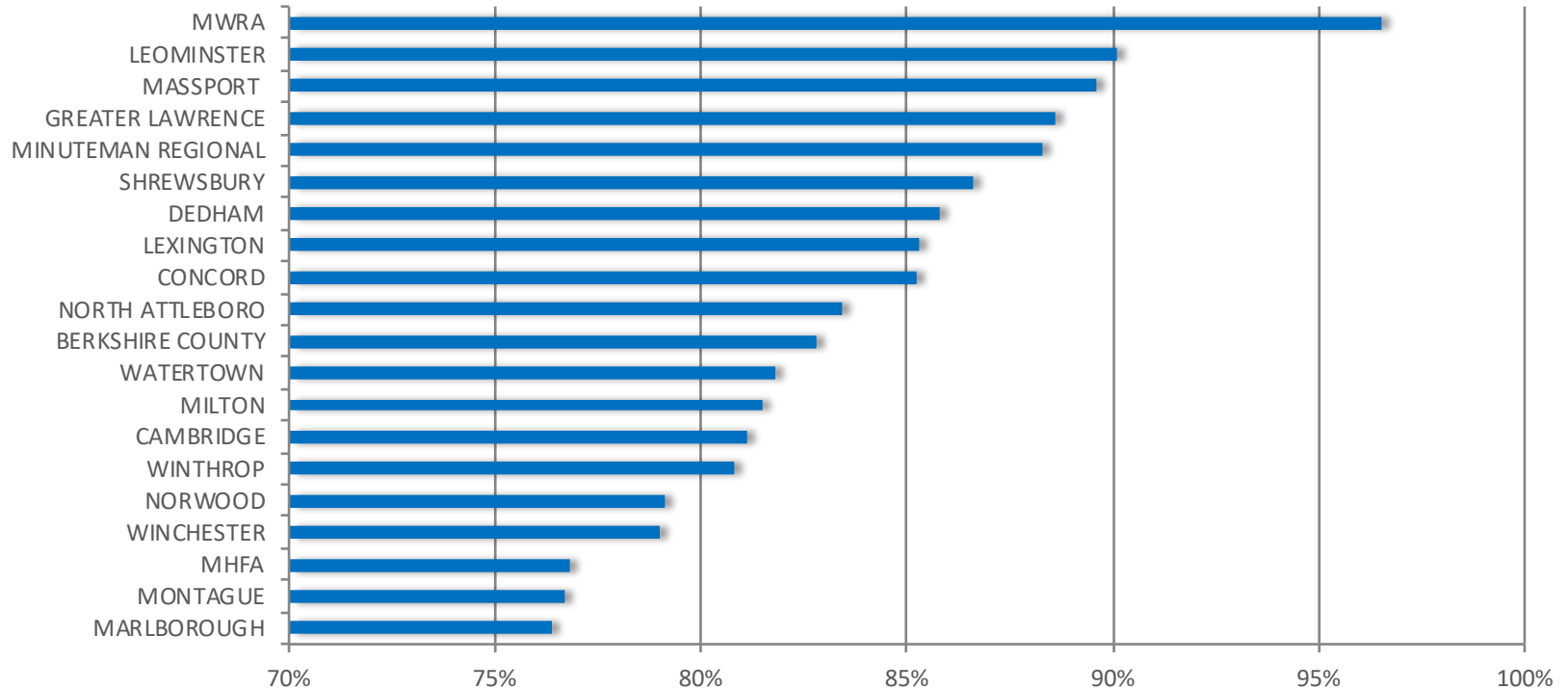




Funding Ratio

Top 20 Funded Massachusetts Retirement Systems

based on PERAC Investment report 2017





- New England Pension Consultants
 - Makes recommendations on asset allocations
 - Facilitates competitive procurement of investment manager services
 - Monitors and reports on investment performance





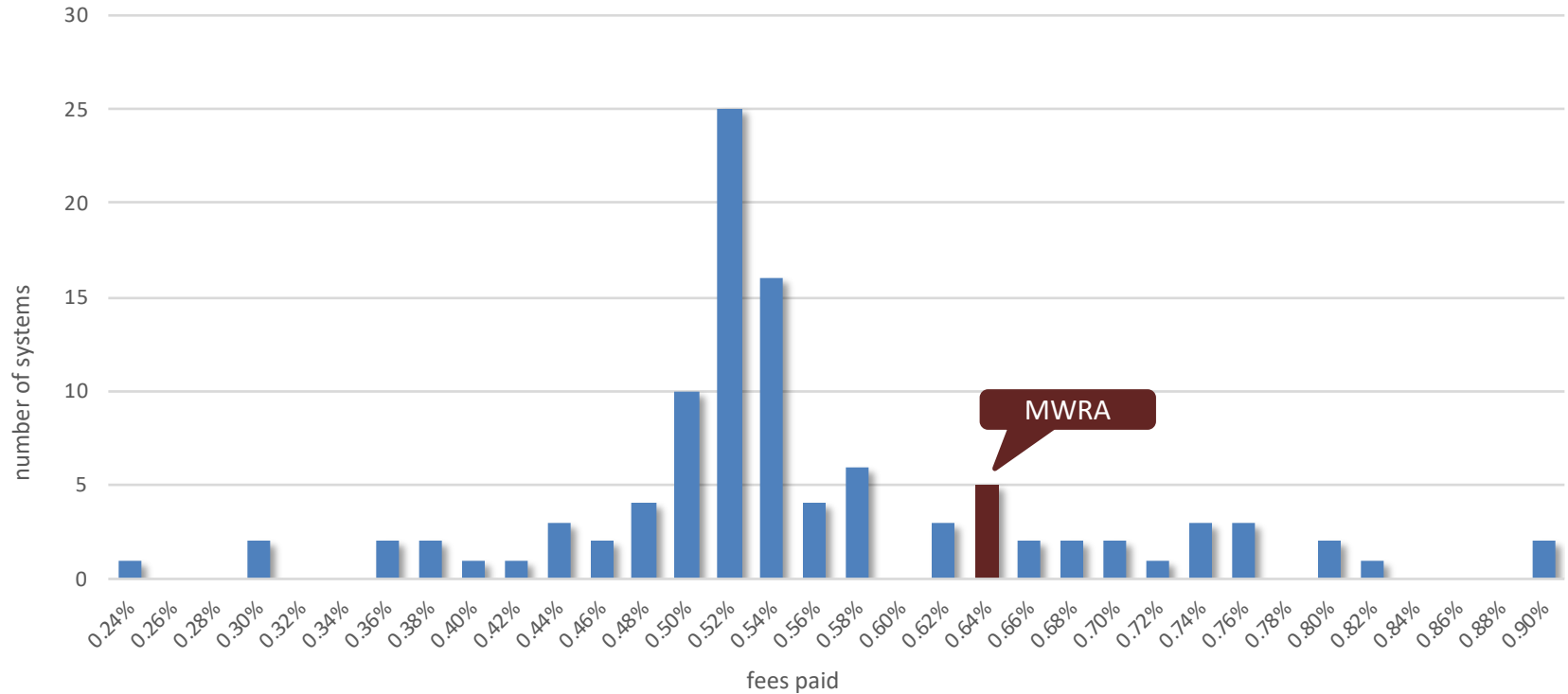
- Fees are paid to the investment managers based on complexity
 - Index Fund Manager e.g. Rhumblin S&P 500 Index Fund
 - Replicate index
 - 0.05%
 - Private Equity Manager e.g. Foundry Venture Capital 2007, L.P.
 - Develop expertise in specific industry
 - Search for opportunities to invest
 - Mentor entrepreneurs / serve on corporate board
 - 2.0% plus 20% on profit after 8% return hurdle





Frequency Distribution of Retirement Systems' Fees Paid

based on 2016 PERAC Schedule 7 report





- Domestic Equity

- Large Cap

- *S&P 500, Russell 1000 Value, Russell 1000 Growth*
-



POLEN | CAPITAL

- Small Cap

- *Russell 2000 Value, Russell 2000 Growth*



LOOMIS | SAYLES



- International Equity

- *MSCI ACWI ex USA, MSCI EAFE Small Cap*



BAXTER INVESTMENT MANAGEMENT

Trusted Investors Since 1924



- Emerging Markets Equity
 - *MSCI Emerging Markets*
-

L M C G



- Fixed Income

- *BBgBarc US Aggregate TR and BBgBarc US High Yield TR, BBgBarc US TIPS TR*



LORD ABBETT®



LOOMIS | SAYLES



- Hedge Funds
 - *HFRI Fund of Funds Composite Index*
-

CORBIN
Capital Partners



En**T**rustPermal



- Real estate

- *NCREIF Property Index*

Morgan Stanley



Mesirow Financial[®]



CERBERUS
CAPITAL MANAGEMENT, L.P.



TA Realty



- Private Equity

- *Cambridge Associates US All PE and NASDAQ W/O Income*





- **Private Equity Cont.**

- *Cambridge Associates US All PE and NASDAQ W/O Income*

Kayne Anderson

Capital Advisors, L.P.



PINEBRIDGE[®]
I N V E S T M E N T S

J.F. Lehman
& Company

Park
Square



IRONSIDES Partners LLC



- **Balanced**
 - *65% MSCI ACWI (Net) / 35% BBgBarc Aggregate, PIMCO All Asset Index, 60% MSCI ACWI (Net) / 40% FTSE WGBI and ICE BofAML 91 Days T-Bills TR*
-

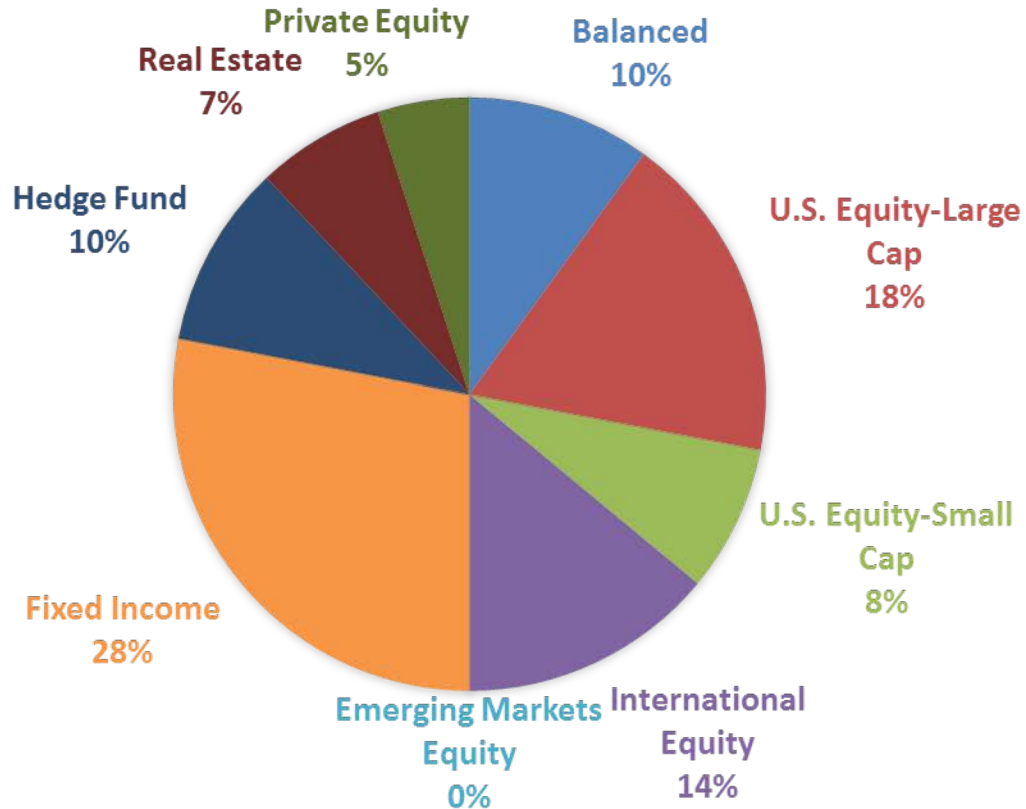


P I M C O



Asset Allocation

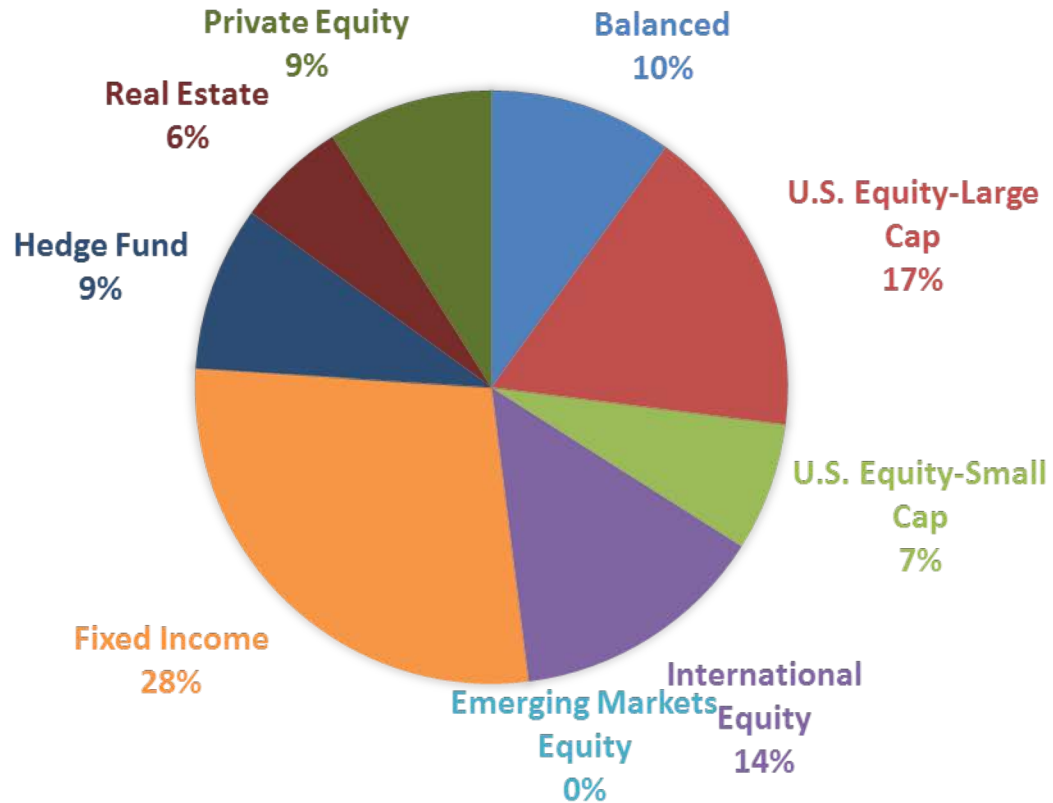
2012





Asset Allocation

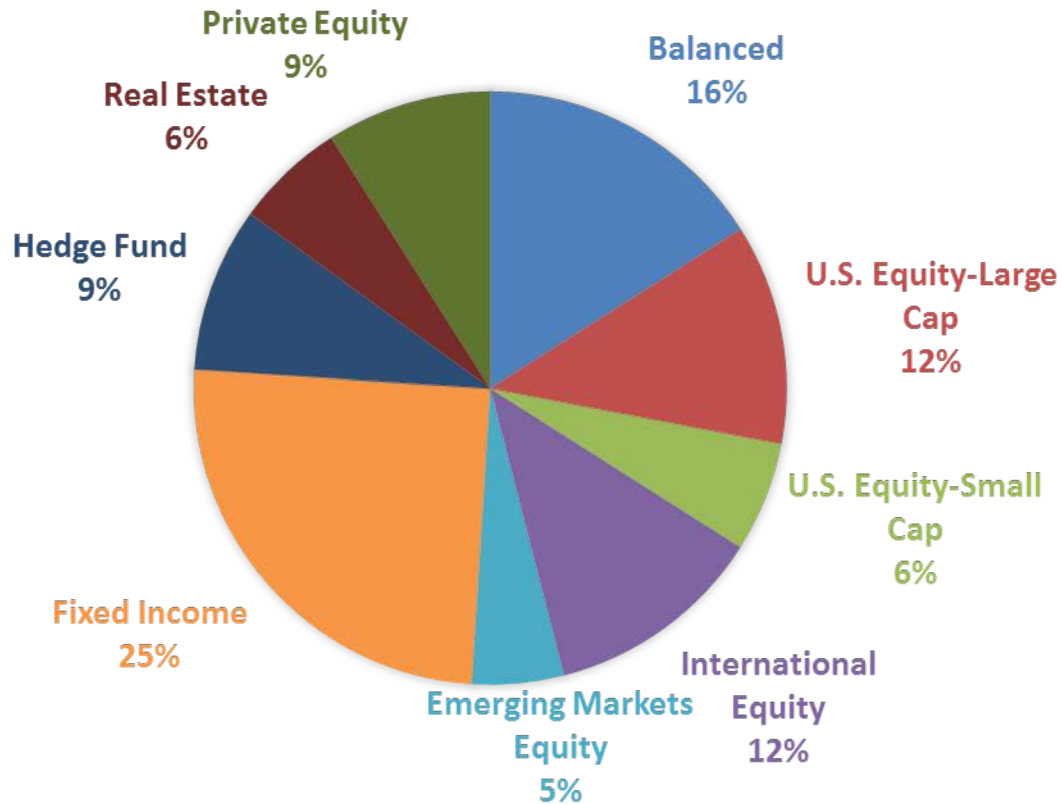
2013





Asset Allocation

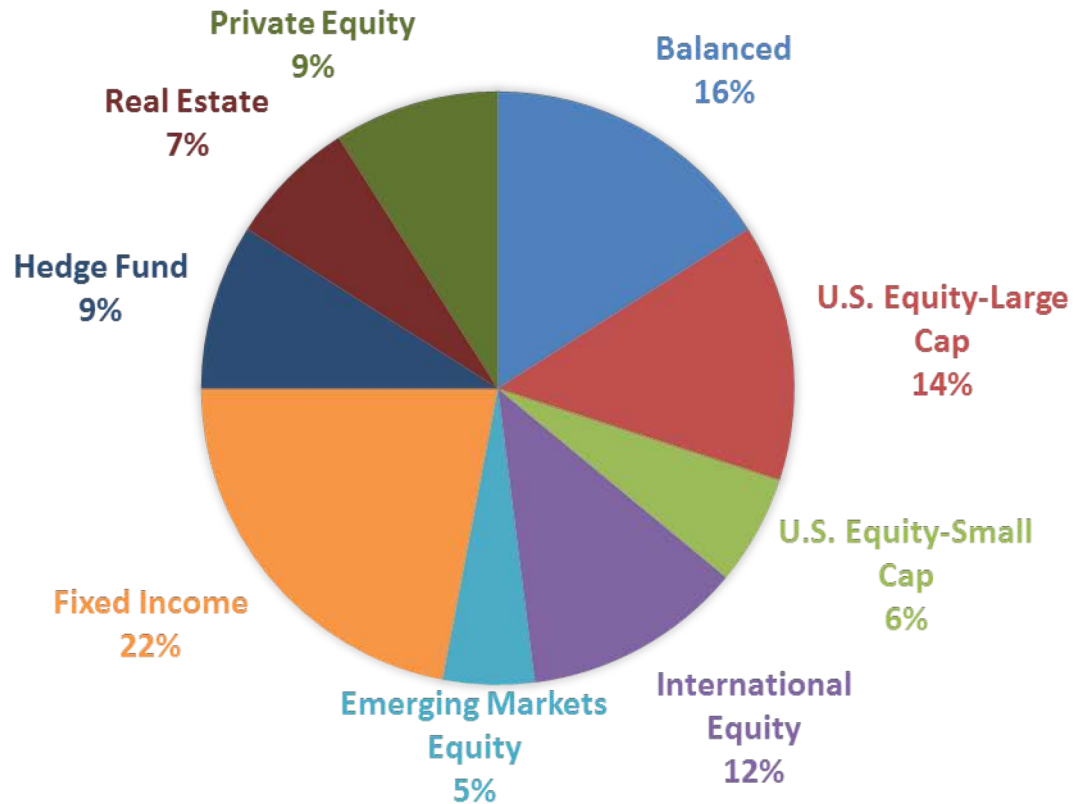
2014





Asset Allocation

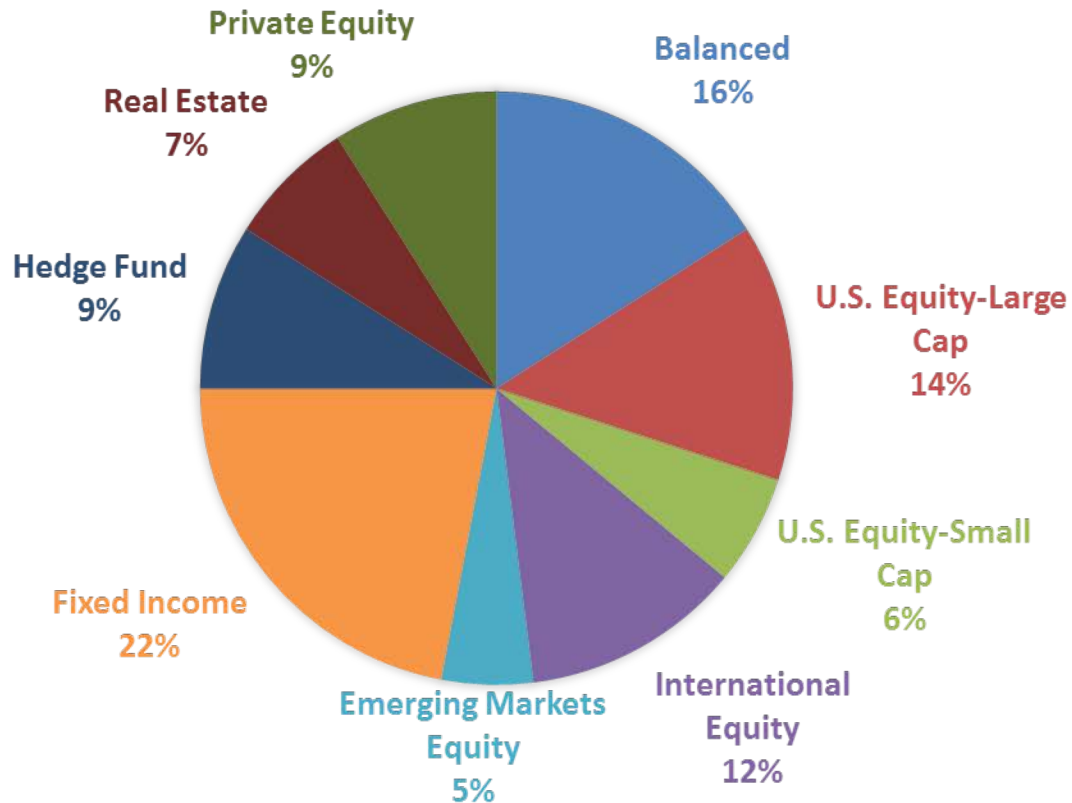
2015





Asset Allocation

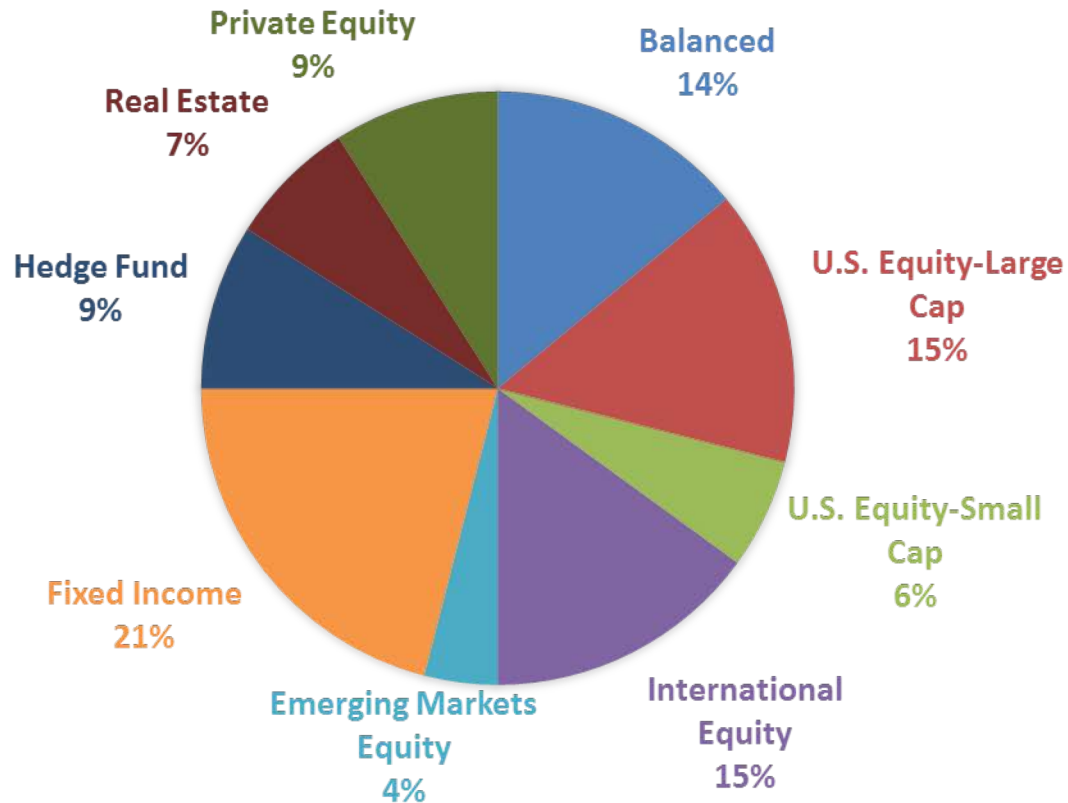
2016





Asset Allocation

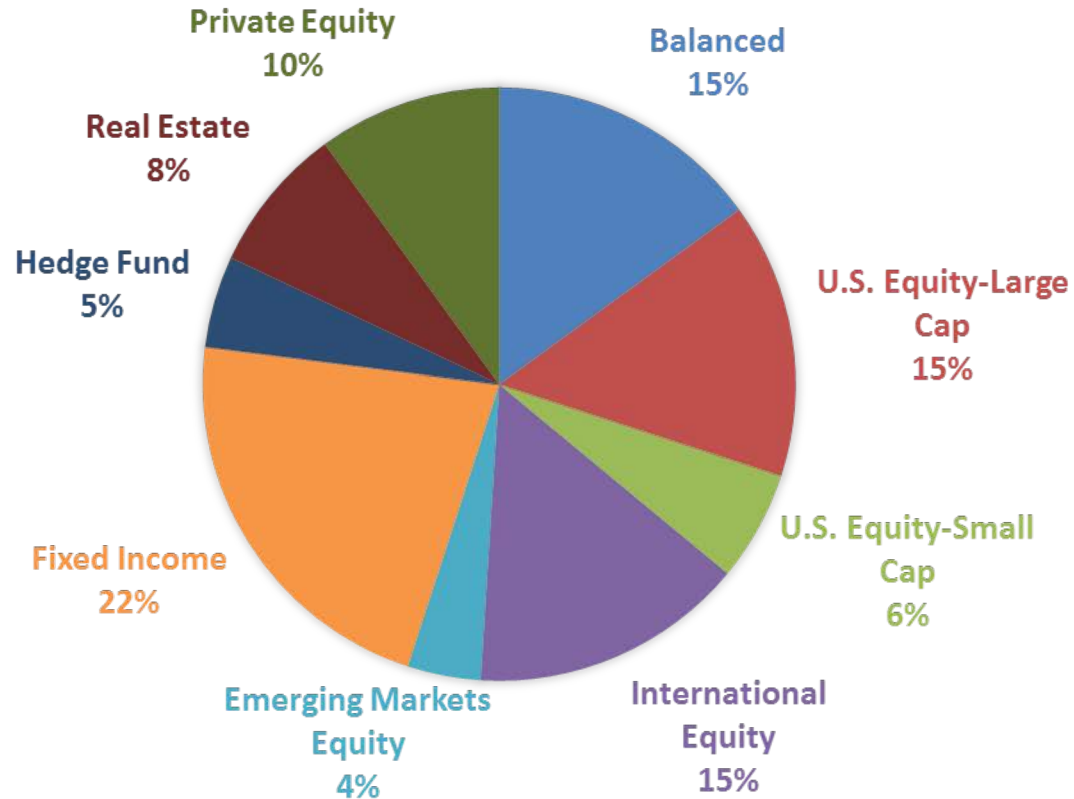
2017





Asset Allocation

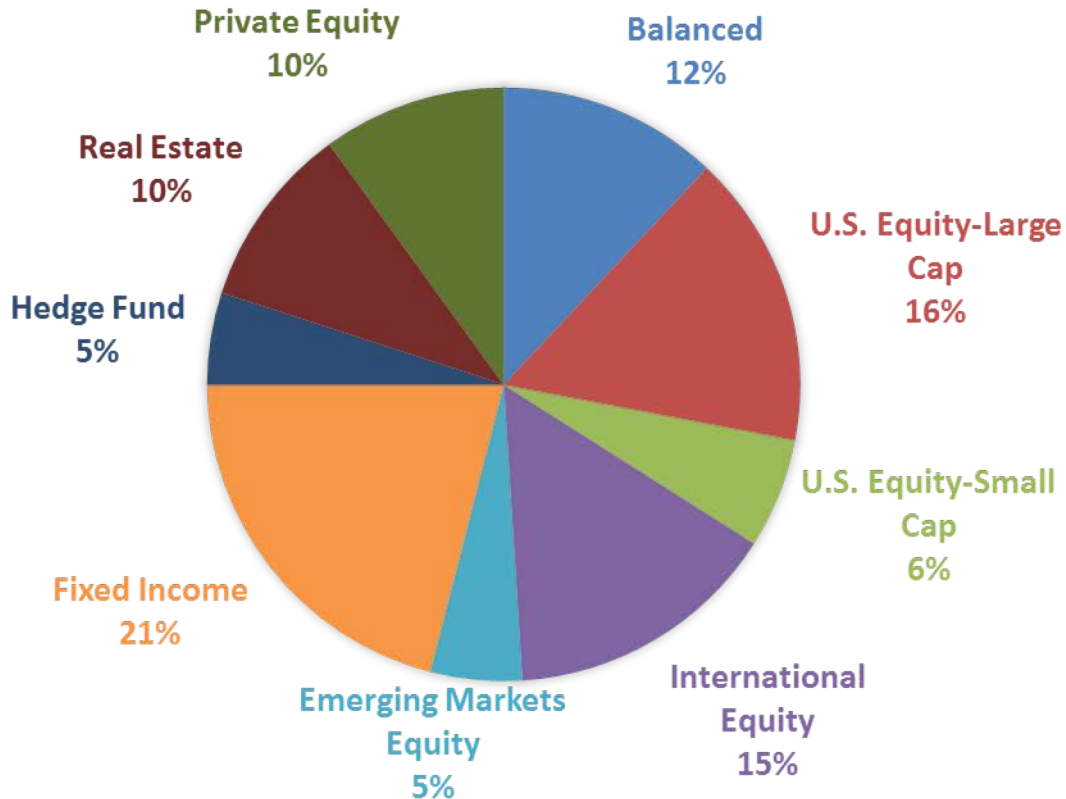
2018





Asset Allocation

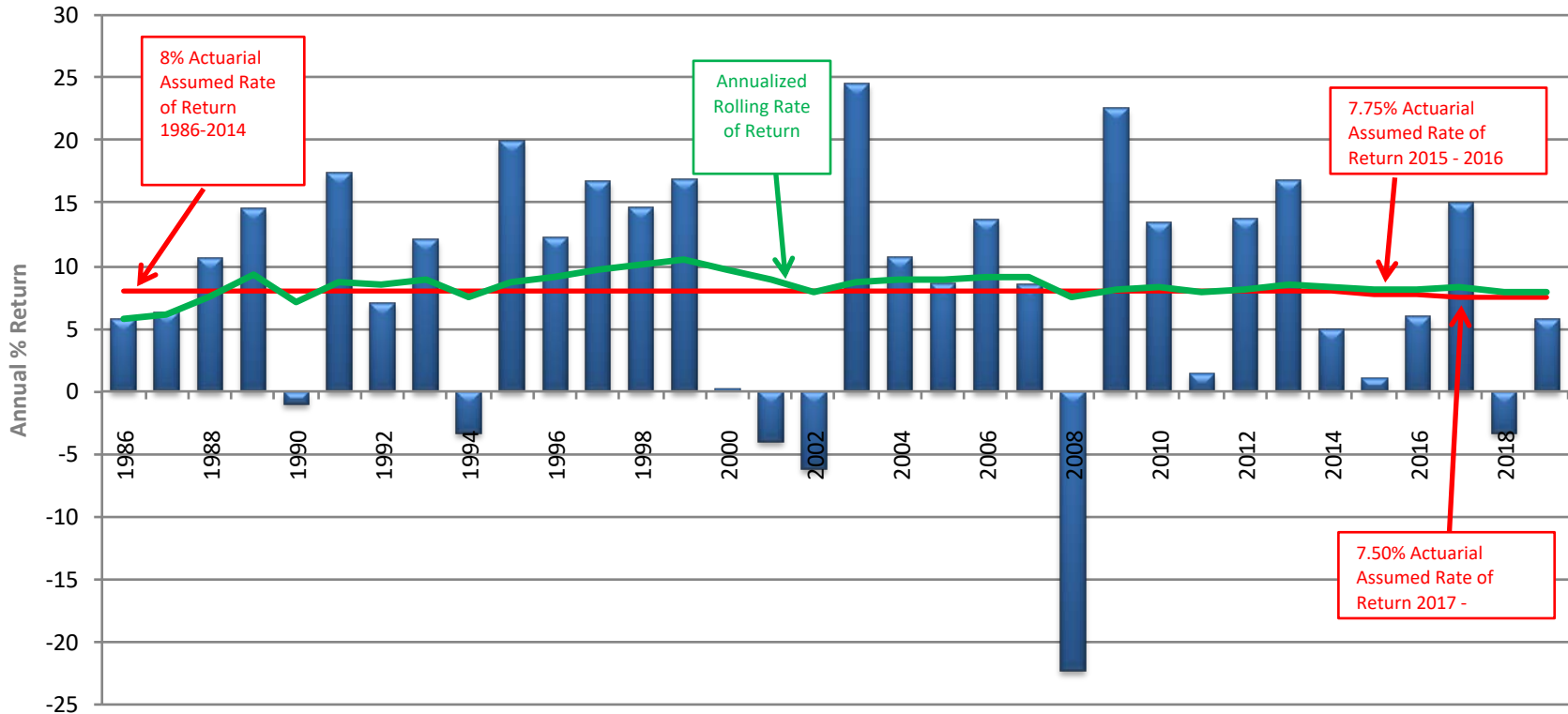
2019





Historic Performance

MWRA Retirement System Investment Performance Review





Relative Performance *as of 2017 PERAC annual report*

System	1yr	5yr	10yr	32yrs
 MWRA Employees' Retirement System	15.05%	8.60%	6.54%	8.27%
 PENSION RESERVES INVESTMENT MANAGEMENT BOARD	17.69%	9.89%	5.57%	9.69%



Sharpe Ratio

Measures how an investor is compensated for the risk taken

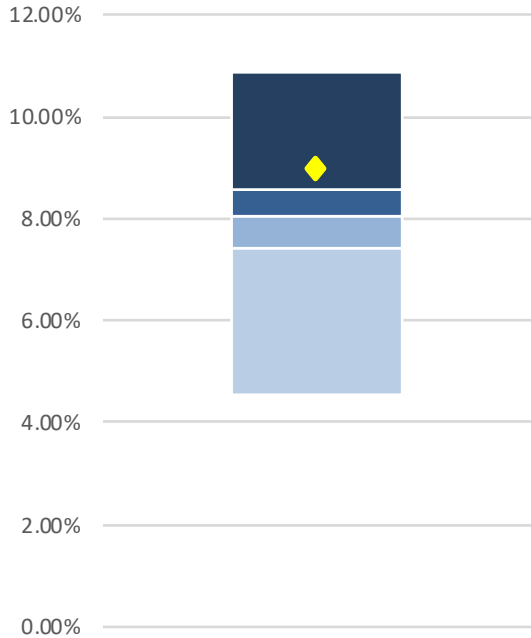
	Investment A	Investment B
Average Return in Excess of Risk-Free return	4.8%	6.5%
Volatility measured by Standard Deviation	8.0%	12.0%
Sharpe Ratio	.594	.542

Preferred



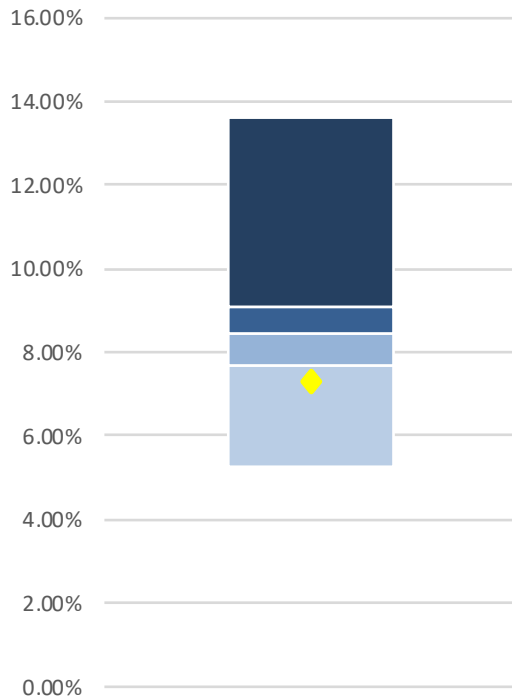
Performance among peers

10yr Return



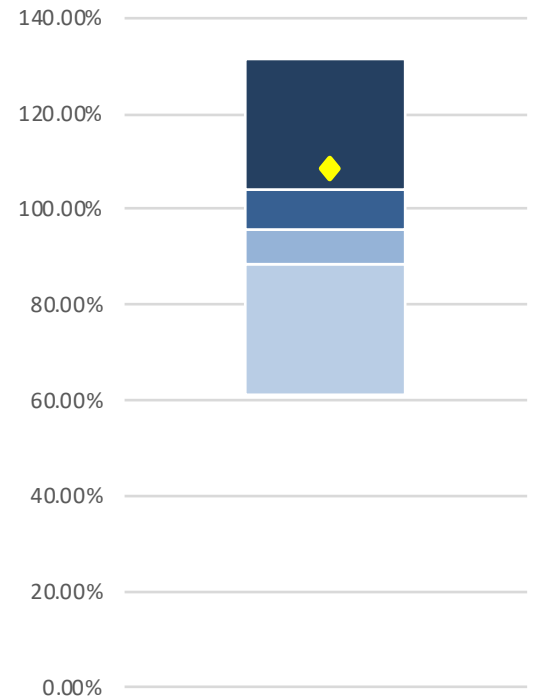
■ Quartile 1 ■ Quartile 2 ■ Quartile 3 ■ Quartile 4

10yr Standard Deviation



■ Quartile 1 ■ Quartile 2 ■ Quartile 3 ■ Quartile 4

10yr Sharpe Ratio



■ Quartile 1 ■ Quartile 2 ■ Quartile 3 ■ Quartile 4

◆ MWRA



Performance among peers

10 Years Ending December 31, 2018



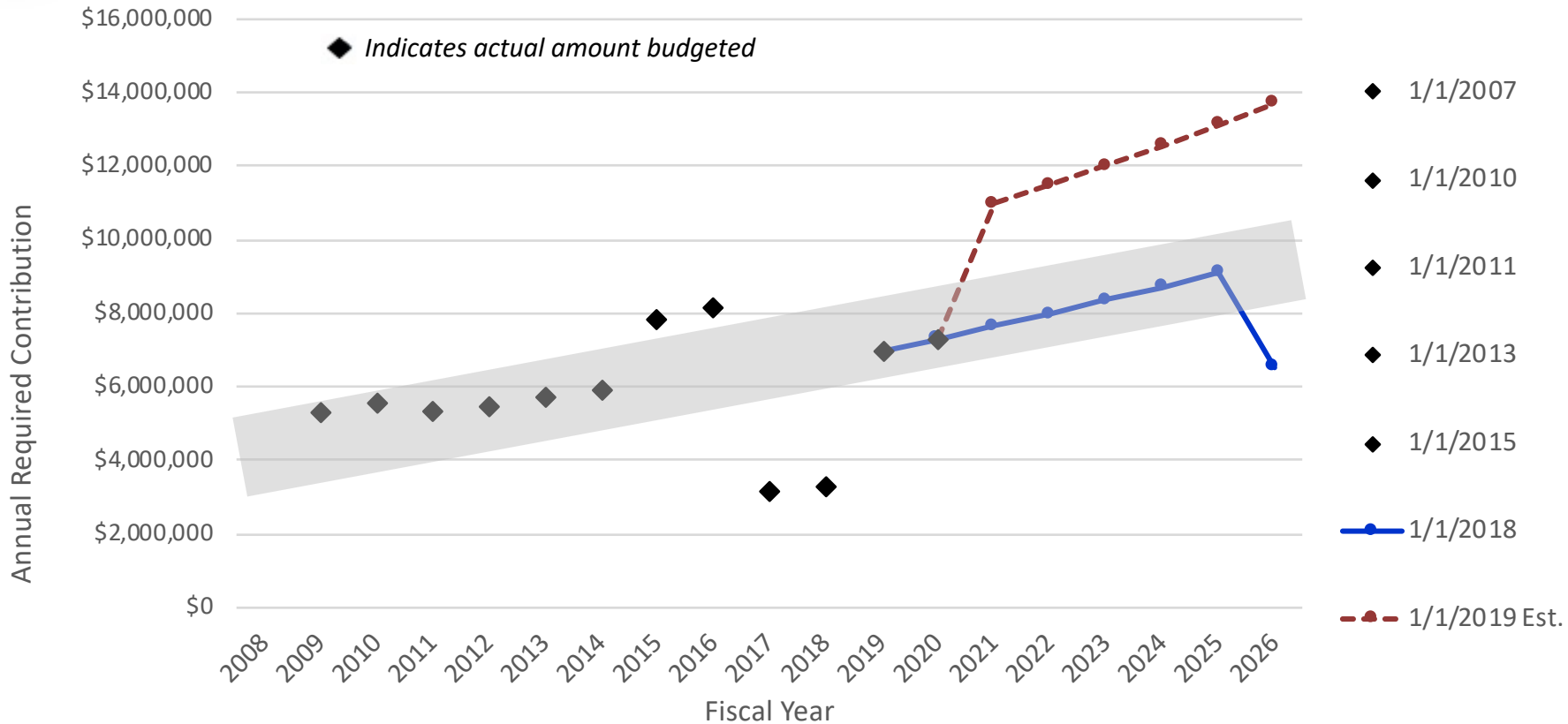


January 1, 2019 Valuation Report Expected

- Assumed Rate of Return 7.50%
- COLA Base \$13,000
- Time to Full Funding 2026

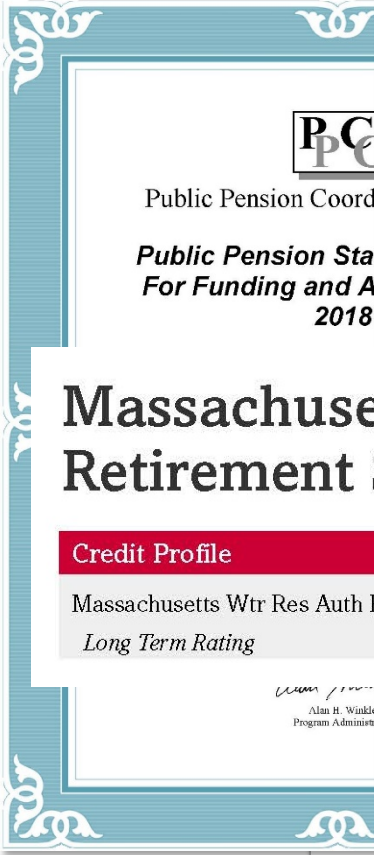
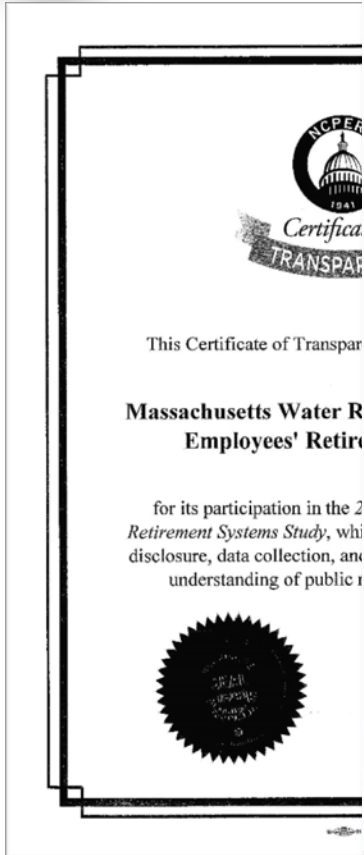


History of Retirement System Funding Schedules





Conclusion



Certificate of Achievement for Excellence in Financial

STANDARD & POOR'S

Massachusetts Water Resources Authority Retirement System; Water/Sewer

Credit Profile

Massachusetts Wtr Res Auth Retirement Sy
Long Term Rating

AAA/Stable

med

Alan H. Winkle
Program Administrator

Christopher P. Morrell
Executive Director/CEO





***Compliance with New NPDES Permit
Phosphorus Limits
Clinton Wastewater Treatment Plant***

April 17, 2019



Clinton Advanced Wastewater Treatment Plant

- Serves Town of Clinton and Lancaster Sewer District
- Design Capacity: 3.01 MGD
- Peak Capacity: 12 MGD
- Designed for Advanced Treatment
 - Nitrogen and Phosphorus removal
- New Phosphorus Limits
 - Effective April 1, 2019
 - Summer: 0.15 mg/L
 - Winter: 1.00 mg/L



New Phosphorus Building



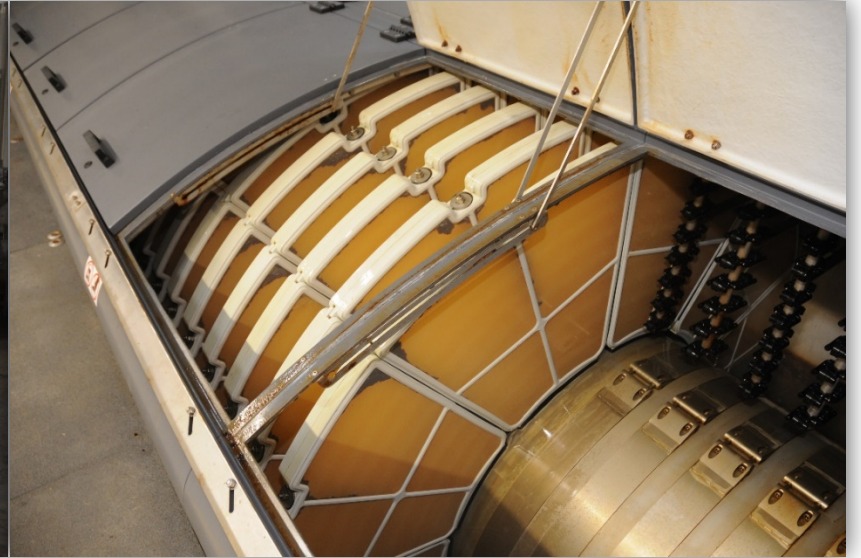
Clinton Phosphorus Reduction Facility

- Designed by Stantec
- Constructed by Daniel O'Connell's Sons
- Utilizes chemical flocculation and filtration using disc filters
- Substantially complete May 2018
- Optimization / Testing





Disc Filters





Performance to Date

- Effective April 1, 2019
 - Summer limit: 0.15 mg/L
 - Performance: 0.03-0.09 mg/L range
0.05 mg/L average
- Effective November 1, 2019
 - Winter: 1.00 mg/L





***Operation and Maintenance of the
Fore River Pelletizing Plant***

April 17, 2019



MWRA Pellet Plant, Quincy

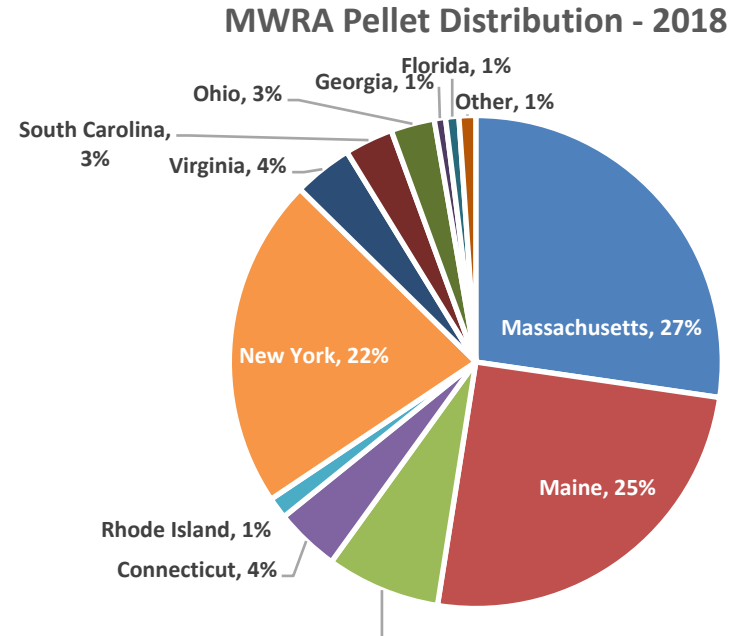
- Located in Fore River Shipyard
- Designed, constructed and owned by MWRA
 - Total cost - \$133 million
- FY19 annual budget - \$13,292,288
- Contract operation and maintenance
 - Contract 1: 1991 – 2001 Competitive Bid – NEFCo
 - Contract 2: 2001 – 2015 Competitive Bid – NEFCo
 - Amendment 1 Negotiated Extension





Contract O&M Since 1991

- Responsible for developing markets for pellets
 - Land Application
 - Fertilizer Blenders
 - Alternate Fuels
 - Bay State Fertilizer Program
- Maintain Facility and Equipment
 - Returning fully operable plant at the end of contract





Contract Renewal Preparation

Step 1: Condition Assessment

- Facility is in excellent condition
 - 20+ year life remaining
 - No major capital replacements planned

Step 2: Residuals Technology Assessment

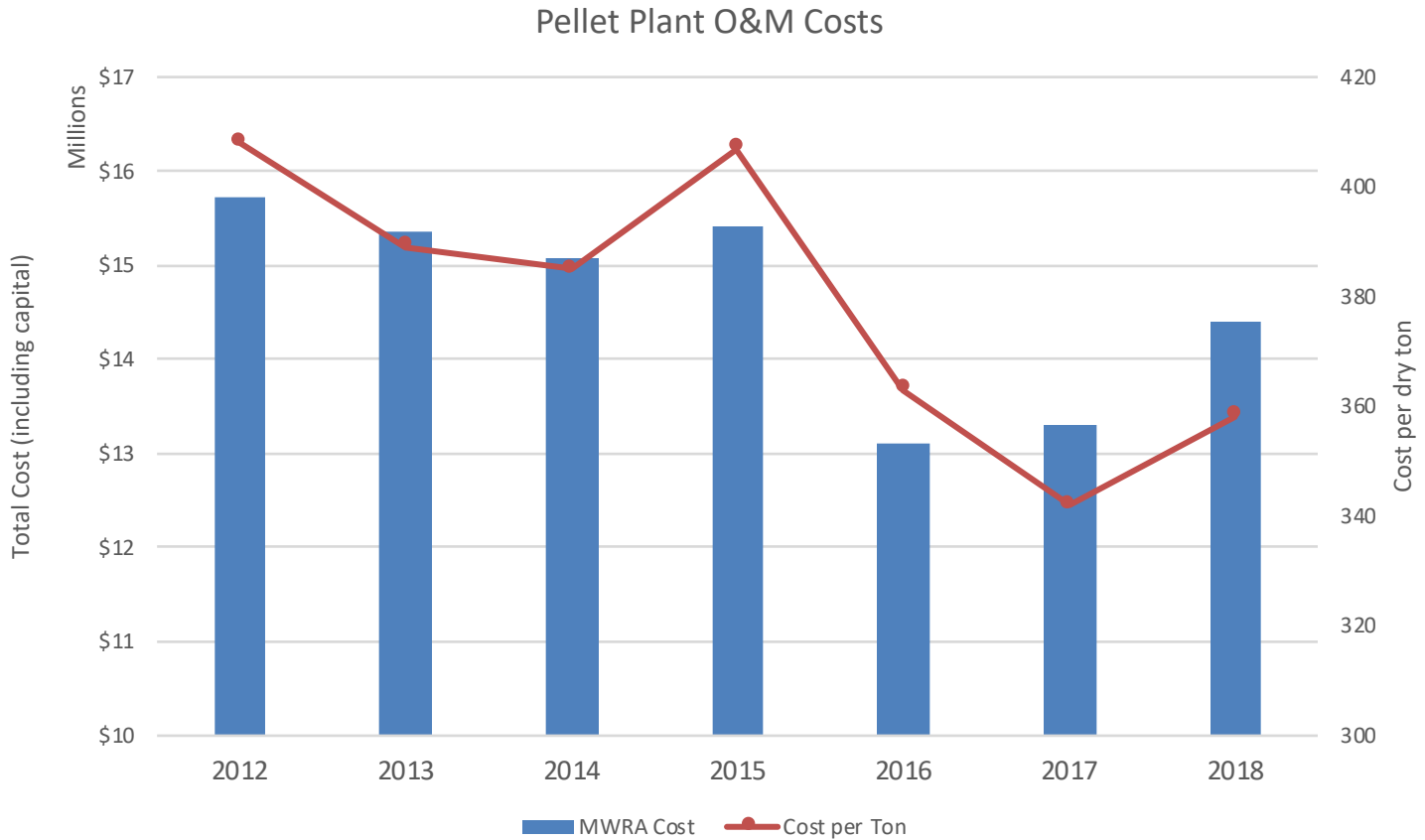
- Changes in technology/equipment not recommended

Step 3: Review of contract terms at other facilities





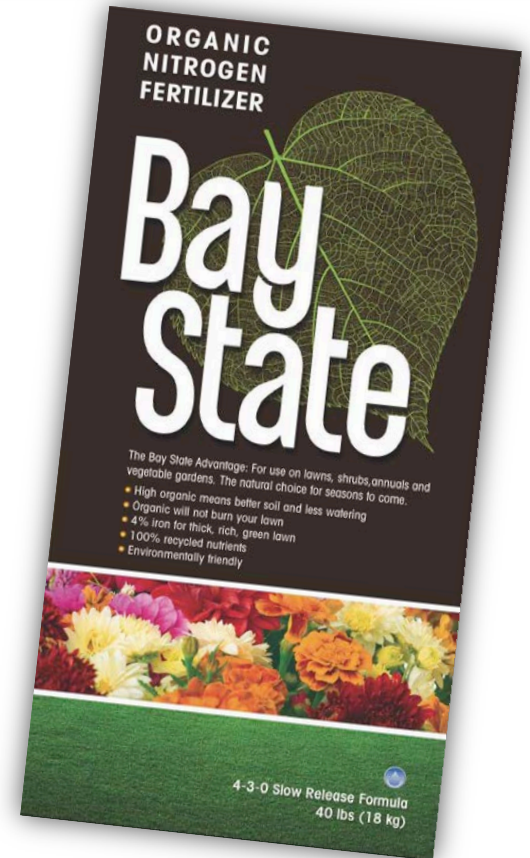
Existing Contract With NEFCo





Contract Provisions

- 15-year term
- 92.5 dry ton per day baseline for fixed fee
 - additional fee for excess quantities
- 90% solids capture
- Specific line items subject to market indices
- Quarterly maintenance summary reports
- Staffing – minimum wage and licensing requirements





Contract Provisions (cont.)

- Capital Program
 - Initially identified by MWRA, Long term – contractor defined
 - Contractor responsible for Design, ESDC, and REI
- Company threshold requirements
 - Financially stable
 - Proven past experience and performance
 - Excellent safety record



Regulatory Challenges

- Mass Dept of Agriculture: Plant nutrient regulations
 - Restrict land application of phosphorous-containing fertilizer
 - May impact future sales of MWRA pellets
- Per- and polyfluorinated substances (PFAS): emerging contaminants
 - 70 parts per trillion limit in drinking water
 - No limit in biosolids, but gathering data
 - MaDEP: including data gathering in permit requirements
 - Maine DEP: moratorium on land application while gathering data
 - Suggested “screening concentrations”





***Technical Assistance Consulting Services
Deer Island
Contract 7503***

April 17, 2019



Consultant Activities

Contract 7503 has provided the following services:

- Internal and external chemical tank inspections
- Mechanical/Electrical system upgrades
- Roof replacement for multiple buildings
- Corrosion evaluation on various process equipment
- Miscellaneous upgrades at the Clinton Wastewater Treatment Plant
- *Engineering Services During Construction For Contract 7428 Gravity Thickener Rehabilitation*



Contract 7428 Project Overview

- Fiberglass dome covers
- Replace mechanical Mechanisms
- Concrete remediation and coating





Project Overview (continued)



Collapsed Fiberglass Dome Cover



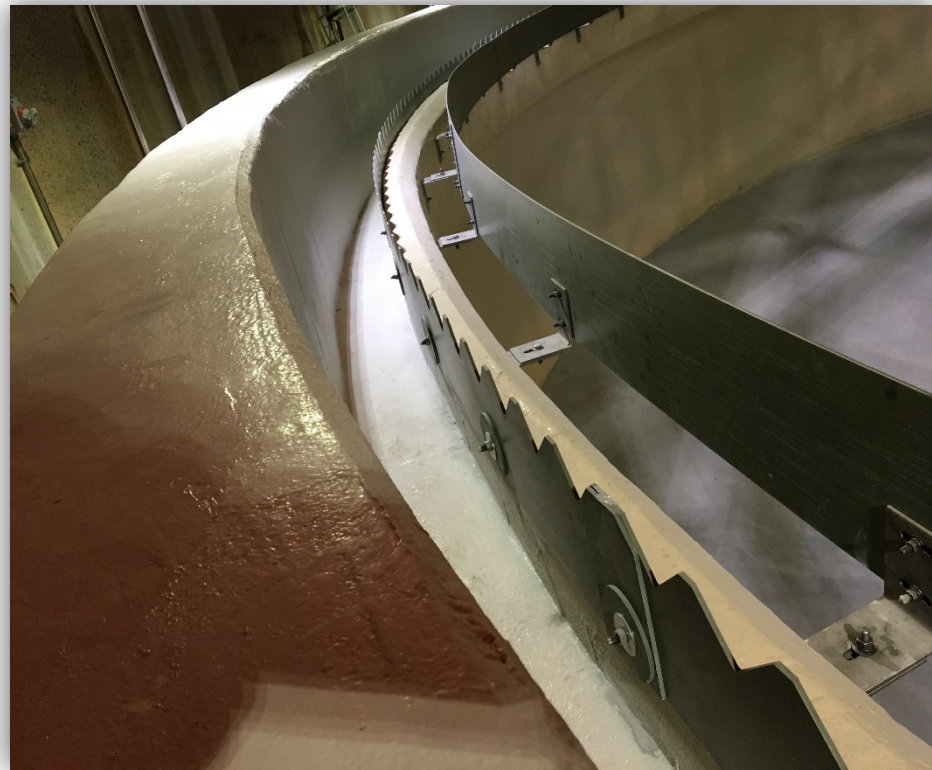
New Fiberglass Dome Cover



Project Overview (continued)



Existing Interior GT Walls



Repaired Walls



Project Overview (continued)



Mechanical Equipment



Interior of GT



Evolving Scope

- Initially scope included six identical units and standard details
- After design commenced several highly technical complexities arose:
 - Fiberglass dome design required specialized technical disciplines (e.g. complex Finite Material Element Analysis, Changes in the fiberglass industry)
 - Specialized coatings and concrete preparation
 - Welding techniques and inspections
- Increase in scope (walkways, additional valves to Digested Sludge/Gas tank, controls, etc.)



This Amendment

Contract 7503 – Technical Assistance Consultant Services

- Extend Contract Term by 639 days
- No additional cost to contract
- Estimated cost to complete Engineering Services During Construction is \$279,000
- There are sufficient funds remaining in the contract for this work





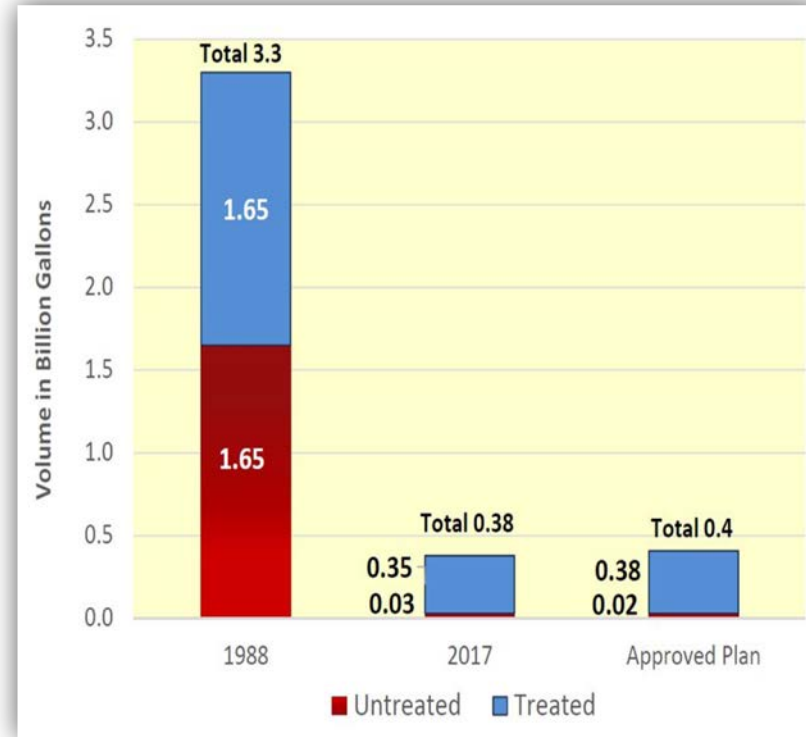
***CSO Post-Construction Monitoring and
Performance Assessment
AECOM Technical Services, Inc.
Contract 7572, Amendment 1***

April 17, 2019



Contract 7572 Purpose

- Demonstrate whether CSO activations and volumes are consistent with the Long Term Control Plan
- Demonstrate whether Water Quality Standards are met at remaining CSOs to the Charles River and Alewife Brook/Upper Mystic River





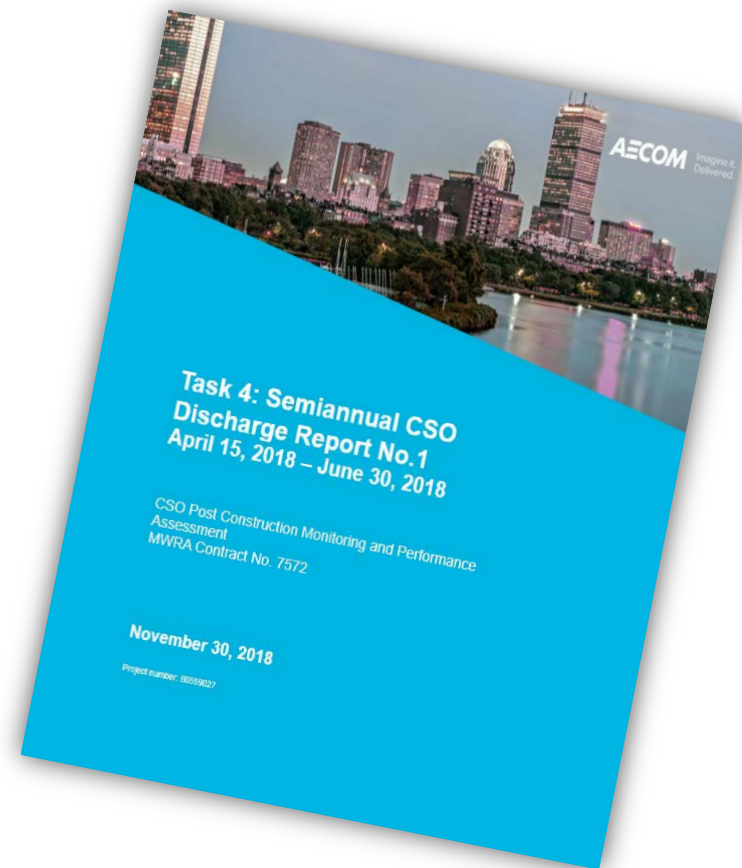
Completed and Continuing Work

- CSO structure inspections
- Temporary metering at all potentially active CSO regulators
- Collection of rainfall data
- Quantification of CSO discharges from meter data, and correlation to rainfall
- Site specific CSO discharge investigations
- Hydraulic model updates and improved model calibration using 2018 meter data
- First of five planned semiannual progress reports issued November 2018



Coordination with Regulatory Agencies

- EPA and DEP
 - Meetings
 - Submission of Semiannual Reports
 - Submission of Draft WQ Analysis Plan





Water Quality Standards Compliance

Receiving Water	Water Quality Standard	Required Level of CSO Control	MWRA's Progress to Attainment
North Dorchester Bay	SB	Prohibited	Achieved - CSOs eliminated
South Dorchester Bay	SB	Prohibited	Achieved - CSOs eliminated
Neponset River Estuary	SB	Prohibited	Achieved - CSOs eliminated
Constitution Beach	SB	Prohibited	Achieved - CSOs eliminated
Boston Inner Harbor	SB(cso)	Approved LTCP*	Verification of attainment of LTCP levels of control is now underway
Muddy River	B(cso)	Approved LTCP*	
Charles River Basin	B(variance)	Approved LTCP**	
Alewife Brook/Upper Mystic River	B(variance)	Approved LTCP**	

* Approved Level of Control. Remaining CSO discharges comply with Class B or SB ("fishable/swimmable") standards at least 98% of the time (Typical Year).

** Minimum Level of Control. Remaining CSO discharges comply with Class B or SB ("fishable/swimmable") standards at least 98% of the time (Typical Year)



Water Quality Compliance

- The performance assessment shall include an evaluation of impacts to Water Quality from remaining CSOs in Variance waters
- Remaining CSOs shall not preclude attainment of Massachusetts Water Quality Standards



Receiving Water Quality Assessment

- AECOM Amendment Services (Water Quality Modeling)
 - Update and calibrate receiving water quality models
 - Assess updated water quality conditions, including remaining CSO impacts
 - Run model simulations of CSO control scenarios
- MWRA In-House Activities (Water Quality Data Collection)
 - Continue in-stream sampling, with emphasis in Charles and Alewife/Upper Mystic
 - Conduct updated CSO and stormwater sampling
 - Coordinate data and data collection with communities and USGS



Contract 7572 Amendment 1

- Add Receiving Water Quality Modeling of Charles River and Alewife Brook/Upper Mystic River - **\$558,363**
- Extend Temporary CSO Metering at 36 Locations - **\$317,109**
- Purchase CSO Meters Associated with MWRA Outfalls - **\$56,018**
- Time extension of 12 months
- Total amendment: **\$931,490** (from \$2,921,215 to \$3,852,705)

