



Massachusetts Water Resources Authority

**20 Year Valve Replacement at the Deer Island
Treatment Plant**

Ethan Wenger

Deputy Director, Deer Island Wastewater Treatment Plant

NEWEA 2017



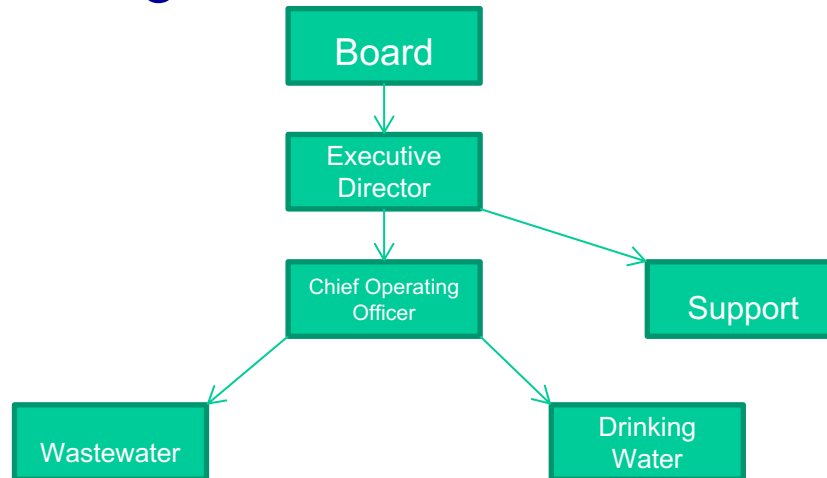
Agenda

- Overview of MWRA and Wastewater Process
- Project Background and Scope
- Project Challenges
- Test Shutdowns
- Summary of Completed Work
- Work to be Done
- Meeting the Permit
- Lessons Learned



MWRA Governance

- 11-member Board of Directors
- Executive Director runs the company
- Chief Operating Officer runs core business





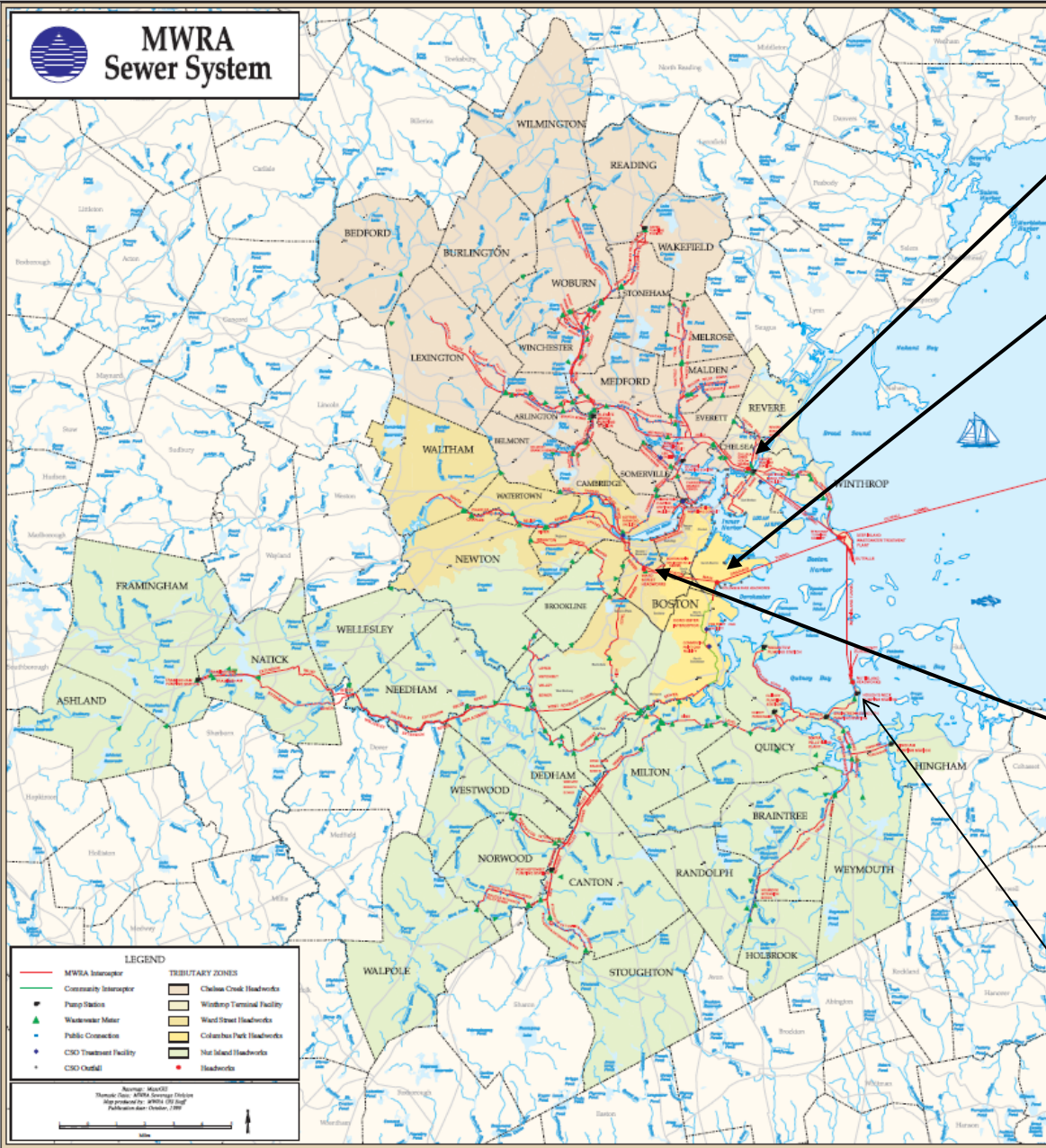
MWRA Service Area

- MWRA provides wholesale water and wastewater services to over 2.5 million customers in 61 communities (34% of population of MA)
- On average, MWRA delivers 215 million gallons per day to its water customers
- MWRA collects and treats an average of 350 million gallons of wastewater per day, with a peak capacity of 1.2 billion gallons





MWRA Sewer System



Chelsea Creek Headworks
Peak Flow 350 MGD

Columbus Park Headworks
Peak Flow 182 MGD

Ward Street Headworks
Peak Flow 256 MGD

Nut Island Headworks
Peak Flow 360 MGD

LEGEND	
— MWRA Interceptor	▭ Tributary Zones
— Community Interceptor	▭ Chelsea Creek Headworks
● Pump Station	▭ Woburn Terminal Facility
▲ Wastewater Meter	▭ Ward Street Headworks
● Public Connection	▭ Columbus Park Headworks
● CSO Treatment Facility	▭ Nut Island Headworks
● CSO Outfall	● Headworks

Source: MWRA
 Name: MWRA Sewerage Division
 Map prepared by: MWRA GIS Dept.
 Publication date: October, 2006



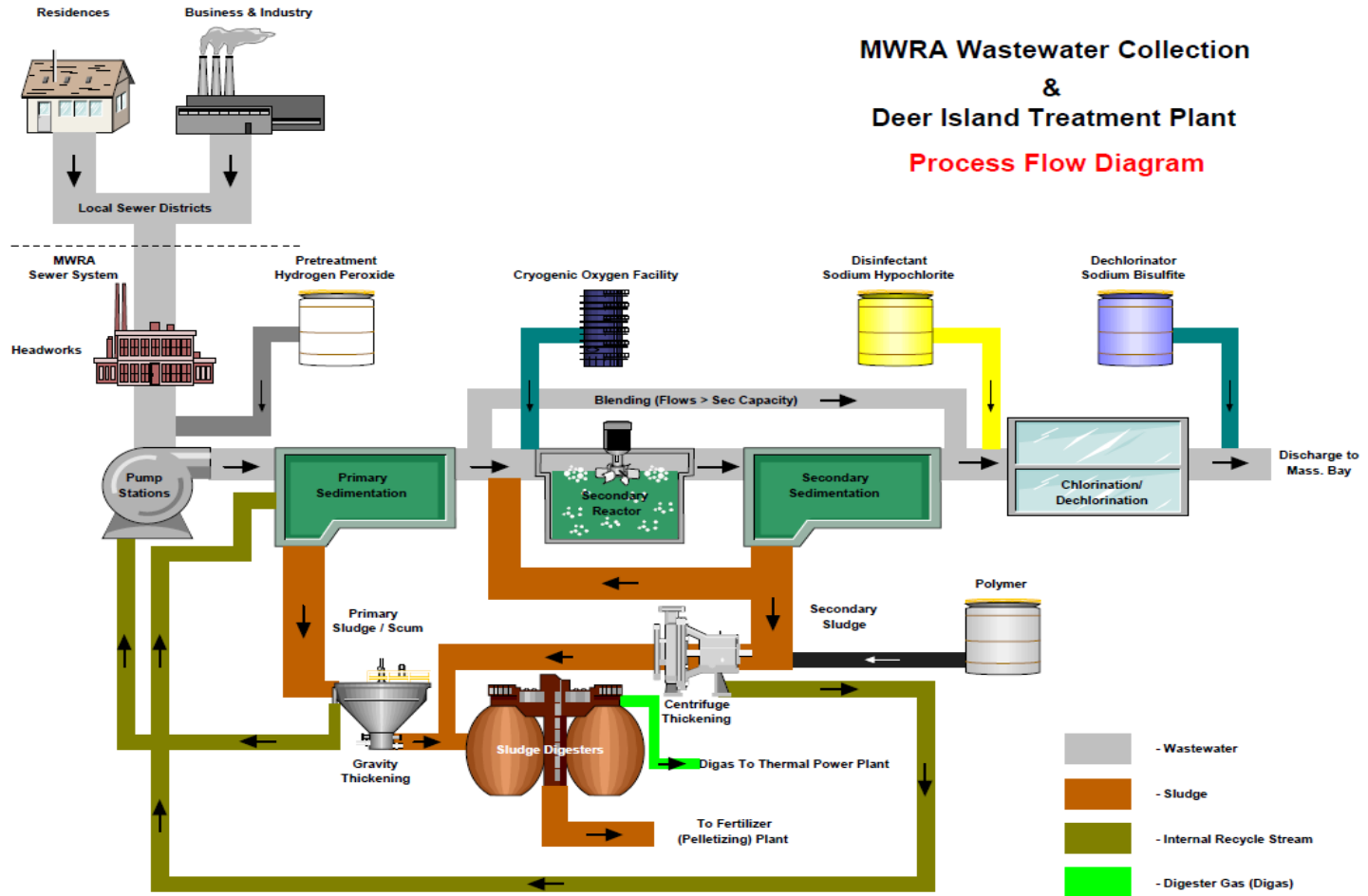
Deer Island Treatment Plant

- \$3.8 Billion to Build
- Treatment Capacity:
 - Maximum
 - 1.3 Billion Gal/Day
 - Up to 700 MGD by Secondary Treatment
 - Average Daily Flow:
 - 350 MGD





Deer Island Process Flow Diagram





Deer Island Flow Capacities

Facility	Capacity (ML/day)	Capacity (MGD)
Deer Island Treatment Plant	4,807	1270
Deer Island Secondary Process	2,650	700
North Main Pump Station	2,983	788
Winthrop Terminal Facility	473	125
Lydia Goodhue Pump Station	1,514	400



Primary Clarifiers



- 48 Stacked Clarifiers
- 72 Primary Sludge Pumps
- 14 Scum Pumps



Secondary Process



- 9 Reactor Trains with 72 Mixers/Aerators
- 54 Secondary Clarifiers
- Two 150 ton per day Oxygen plants
- 700 MGD Process Limit



Anaerobic Digestion



- 12 Digesters, 8 operated at a time
- 20 day solids retention time
- 3 million gallons each



Project Background

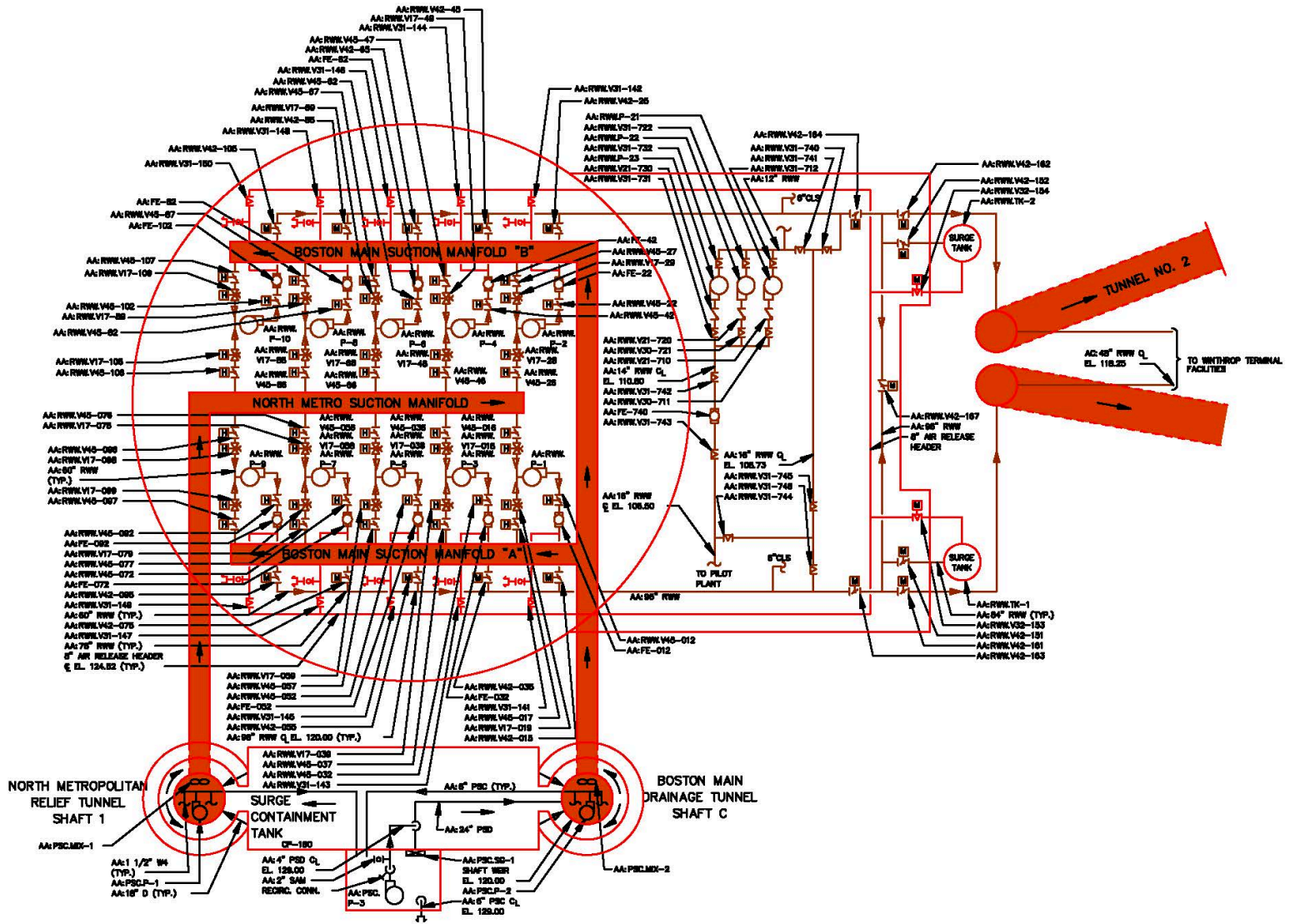
- Aging Infrastructure – Plant built in 1990s
- Pump Valves “leaking by”
- Replacing just one valve required major shutdown
- Decision made to replace them all to avoid multiple shutdowns





Valve Schedule

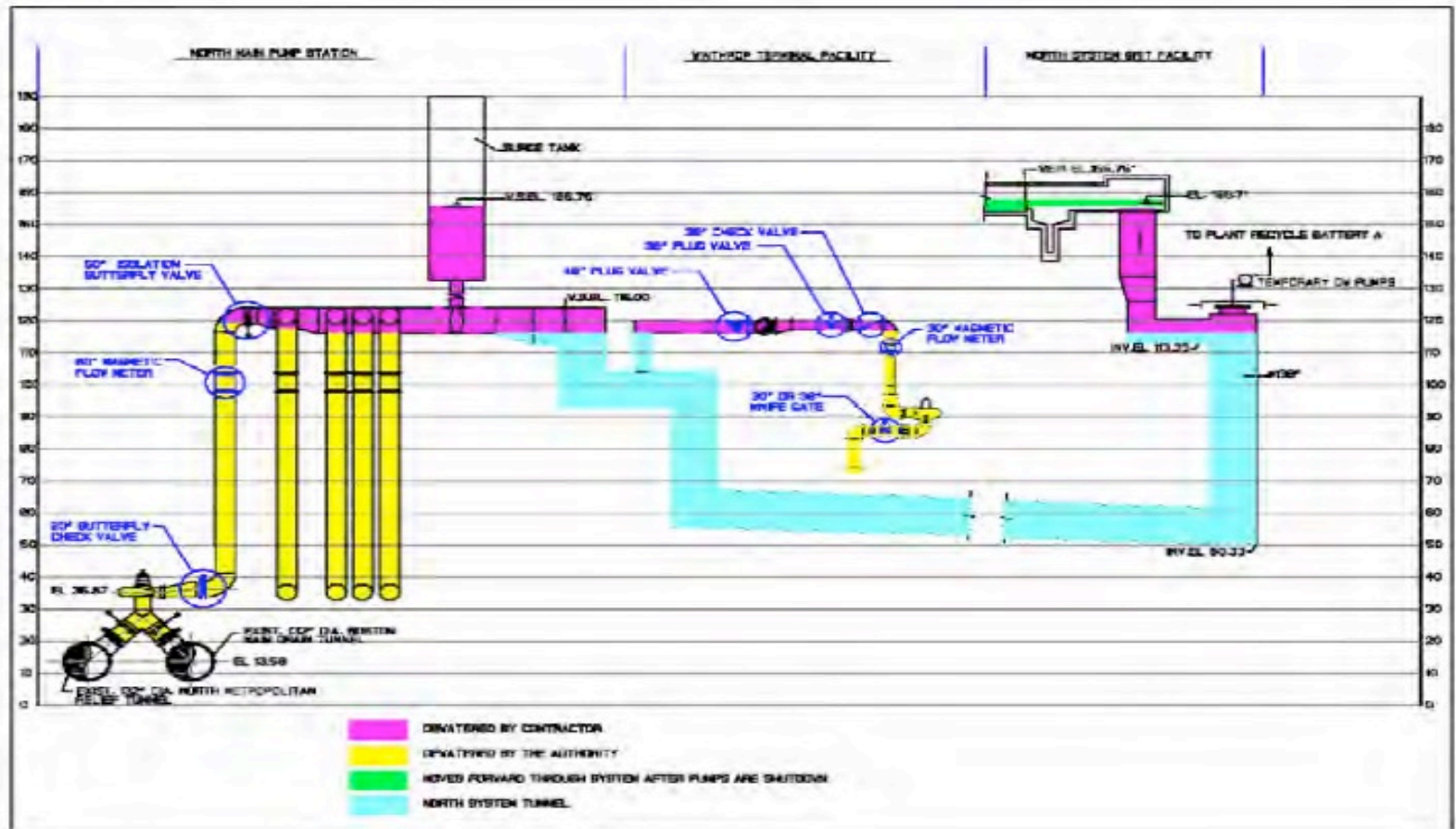
Number	Type	Diameter, inches	Service
20	Butterfly	60	Raw Wastewater
3	Plug	48	Raw Wastewater
6	Swing Check	36	Raw Wastewater
6	Knife Gate	36	Raw Wastewater
6	Plug	36	Raw Wastewater
72	Plug	6	Primary Sludge
81	Plug	16	Return Sludge



NORTH MAIN PUMP STATION



Deer Island North System Hydraulics





Project Challenges

- Complete Shutdown of North System
- Some shutdowns had to be at night
- Concerns about SSOs while shut down
- During pumping restart need to avoid dry weather blending
- Return Sludge Valve Replacement requires flow limitations





The Plan

- MWRA pulled together technical and communication experts from all parts of the company
- A document was prepared listing all appropriate staff and responsibilities
- Upper Management got involved early and bought into project
- Test Pumping Shutdowns planned
- Regulators notified well in advance



Hydraulic Model and Testing

- MWRA staff developed hydraulic model for North Collection System
- Calibrated model by running a series of test shutdowns
- Nighttime shutdowns involving over fifty staff stationed at over a dozen locations in the sewer system

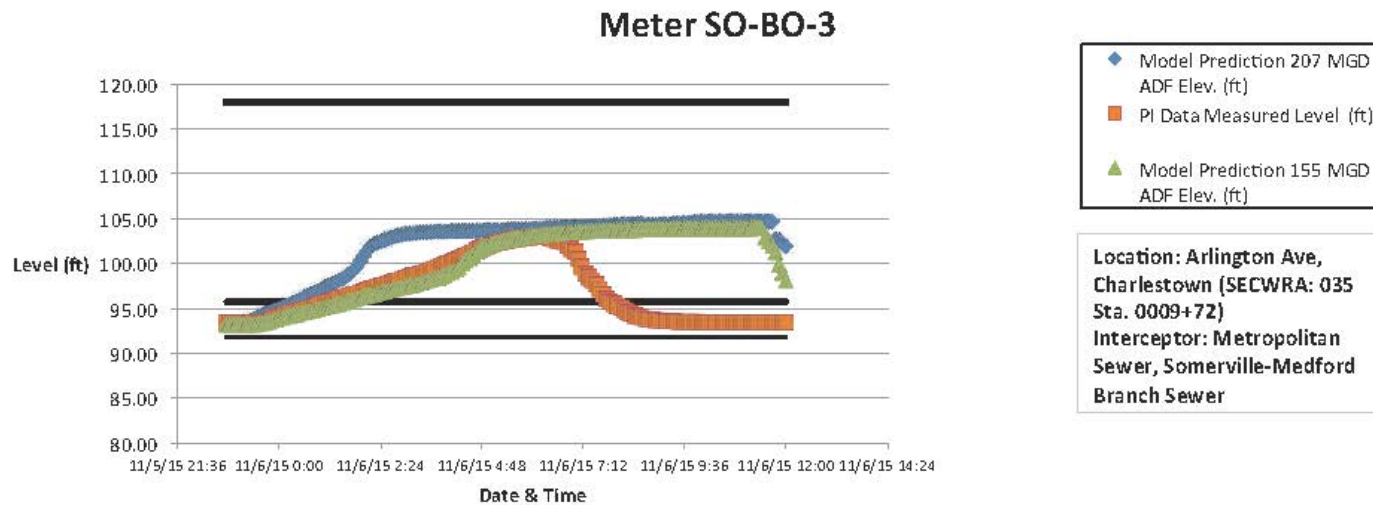


Test Shutdowns

Date	Facilities Off-line	Duration of Shutdown
5/20/15	Winthrop Terminal, Chelsea Creek	4 hours
6/11/15	Ward St, Columbus Park	4 hours
6/25/15	All North System	4 hours
7/23/15	All North System	8 hours



Trend of Sewer Level Elevation Data





The Contract

- Design by AECOM of Wakefield, MA
- Construction by Carlin Contracting Company of Connecticut
- \$17 million total cost
- Notice to Proceed given 6/23/14
- Duration of three years



Initial Work

- Dewatering System Installation, September 2015



- Winthrop Terminal 48 inch Valves, Nov 2015





Winthrop Terminal Shutdowns

- Replace suction knife gate, discharge plug, check valve, and magnetic flow meter
- 6 pumps, contractor was allowed 21 days per pump
- All work completed between November 2015 and March 2016





North Main Pump Station Valves

- Requires Shutdown of at least part of north system
- 60 inch Valves
- Started October 2016





Progress at North Main Pump Station

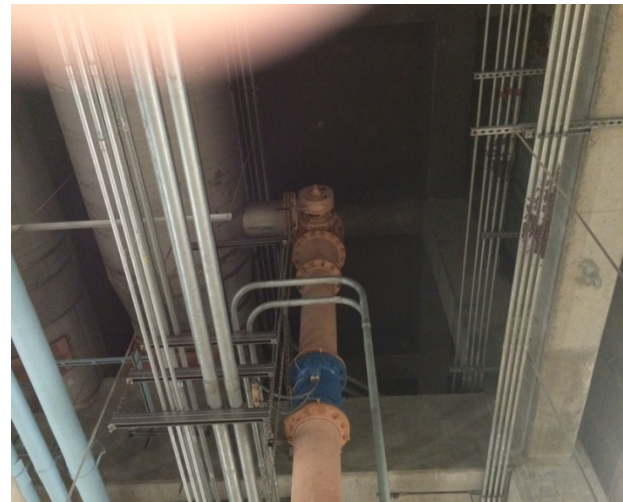
- Staff have been able to isolate one half of the station
- Valves on three pumps completed
- Contractor working on pump 8 now





Return Sludge Valves

- Requires shutdown of one battery of secondary process
- Work around the clock to get battery back in three days
- Work will be done in dry weather only





Regulatory Compliance

- Letter sent to regulators to notify them of work
- MWRA committed to avoiding blending during dry weather
- Member Communities Notified in advance of Work
- No permit violations to date





Conclusion and Lessons Learned

- No permit violations
- Change orders less than 3% of contract
- Cooperation among MWRA departments
- Thorough planning
- Improve strategies as we learn



Acknowledgements

Coauthors: Brian Kubaska, David Duest, Richard Adams,
Stephen Cullen, Michael Hughes

Thanks to: Lisa Wong, Tracy Survilas, Tim Beaulieu, Charles Tyler, Wendy Leo, Wenley Kilbride, Ria Convery, Stephen Abner, Charles Ryan, Ted Regan, John Colbert, Marty McGowan, William Harris, John Vetere, Carolyn Fiore, Michael Hornbrook and Frederick Laskey.