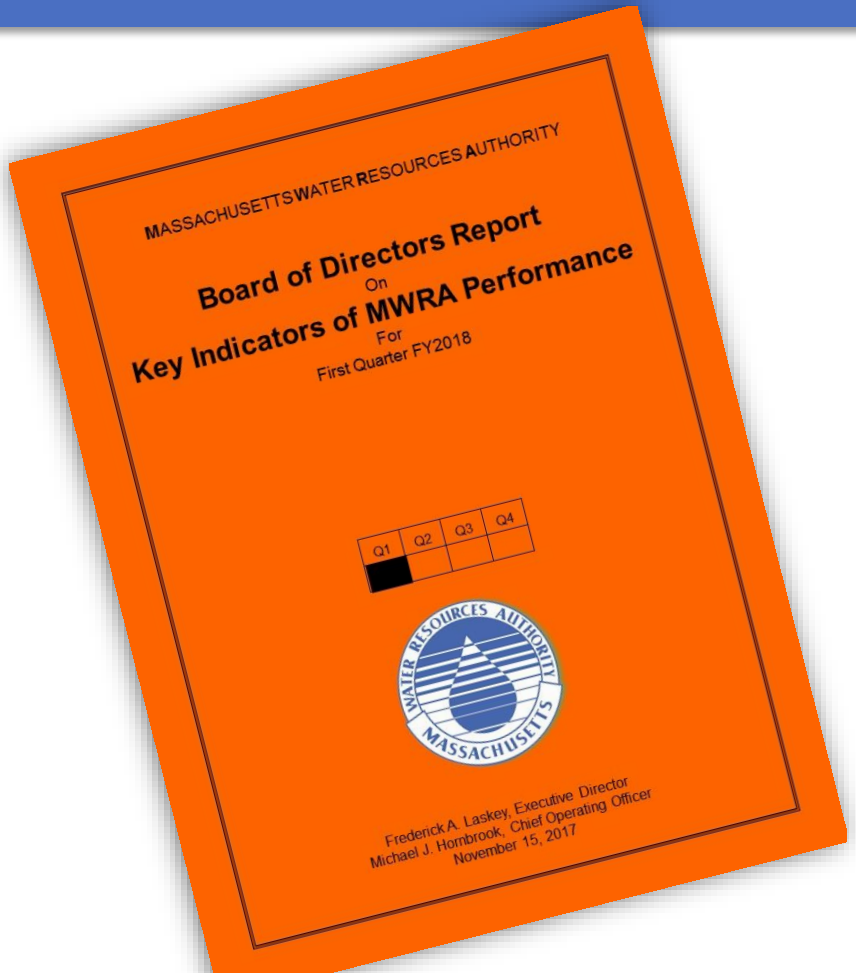
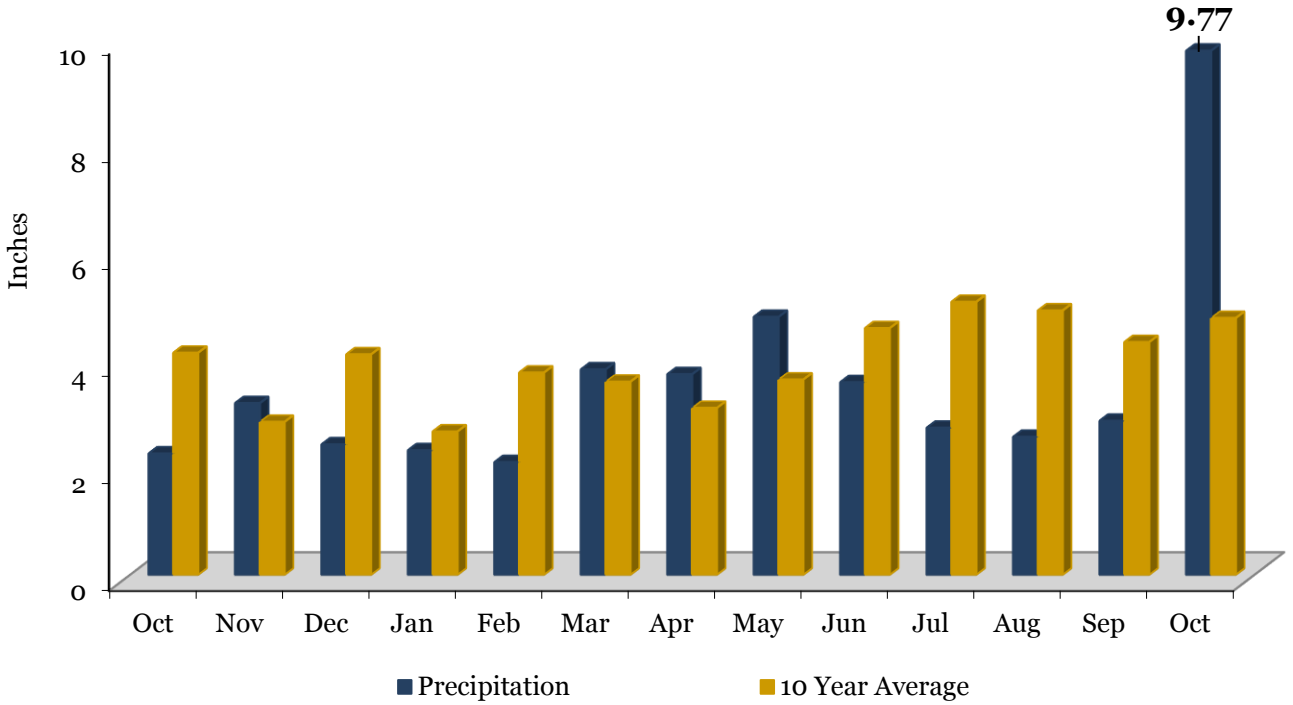
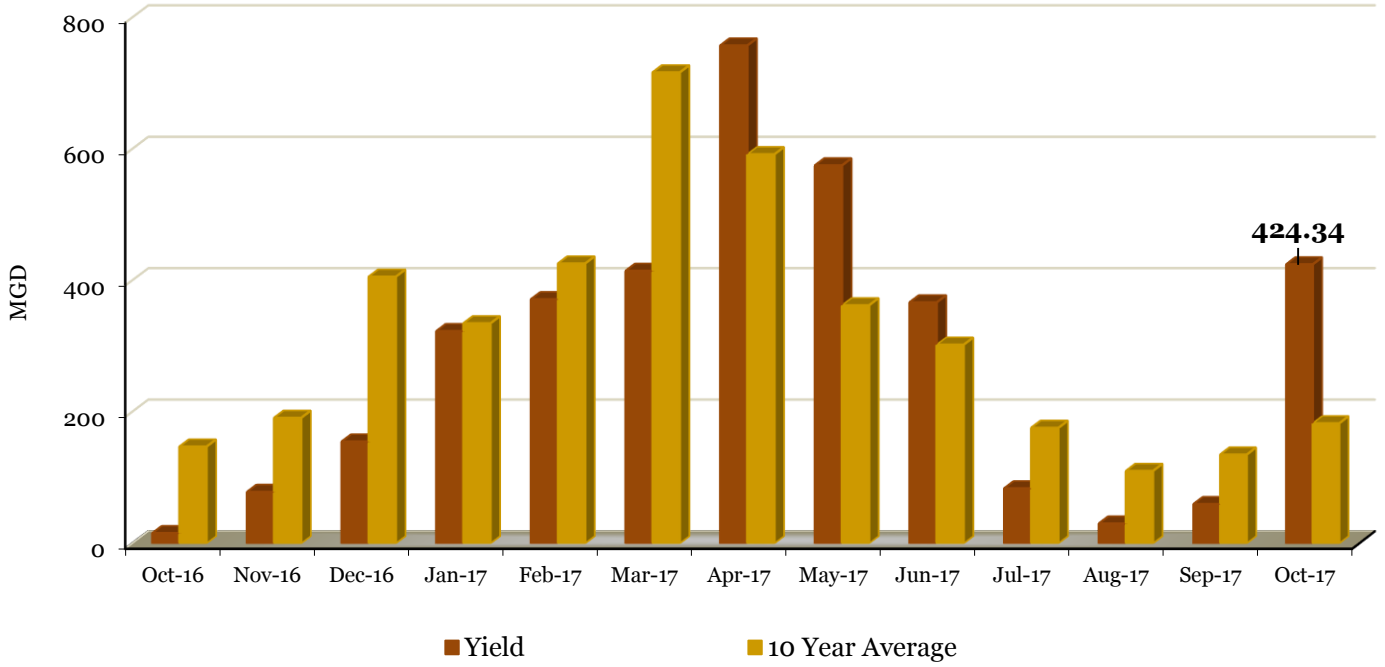
Massachusetts Water Resources Authority



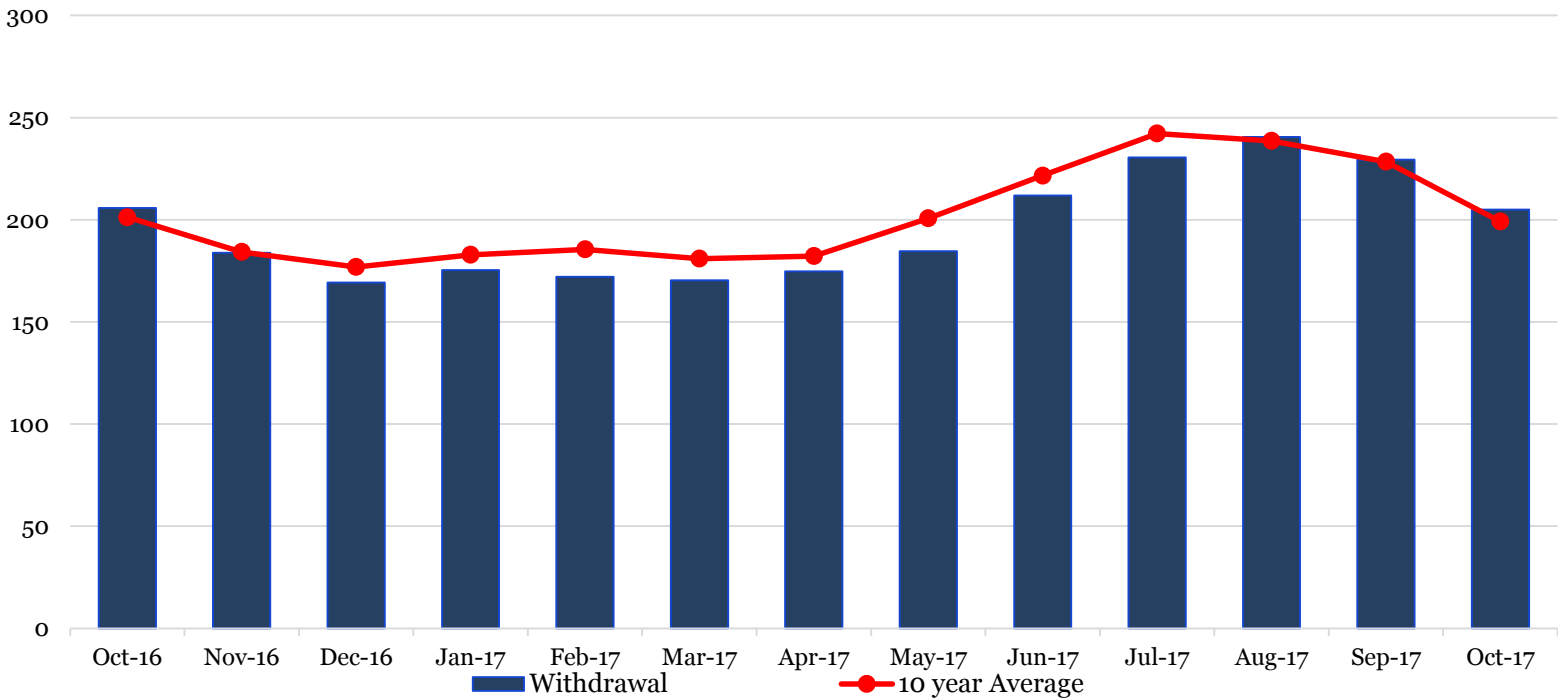
Quabbin Precipitation



System Yield - Quabbin and Wachusett



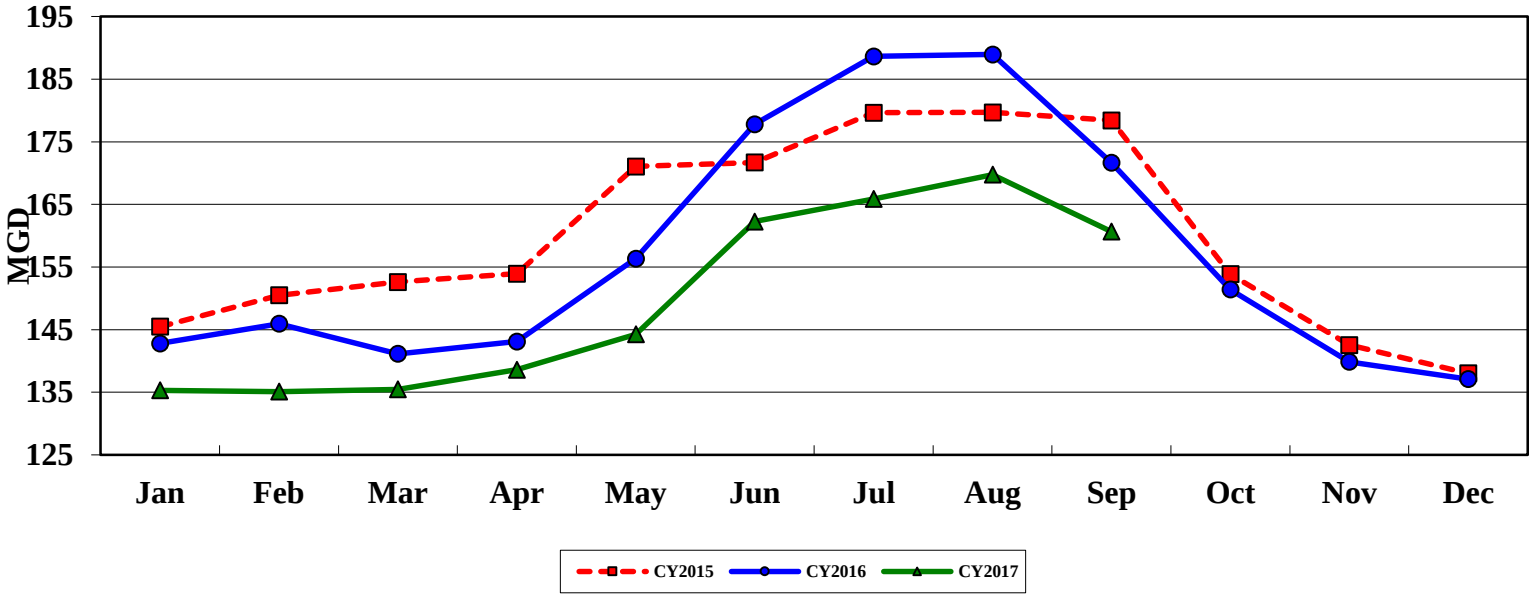
System Withdrawl



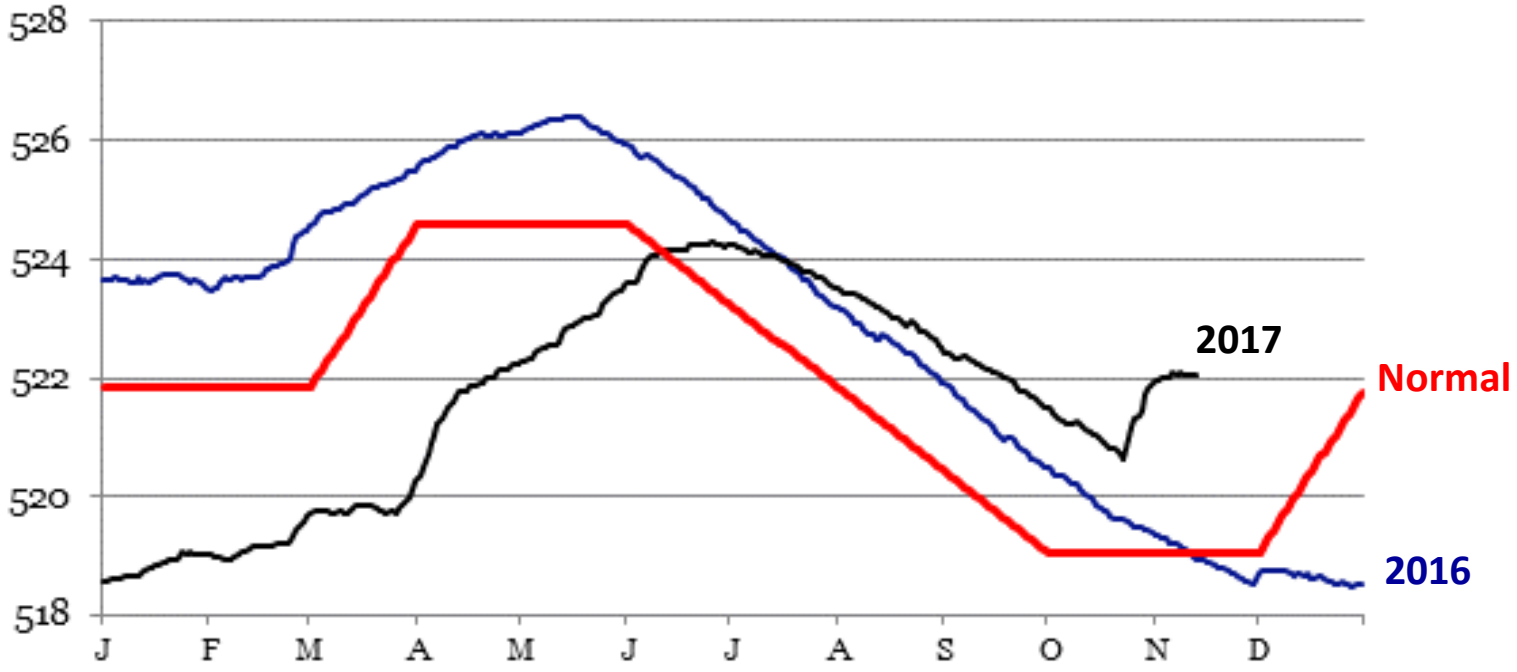
Water Use

Total Water Use: MWRA Core Communities

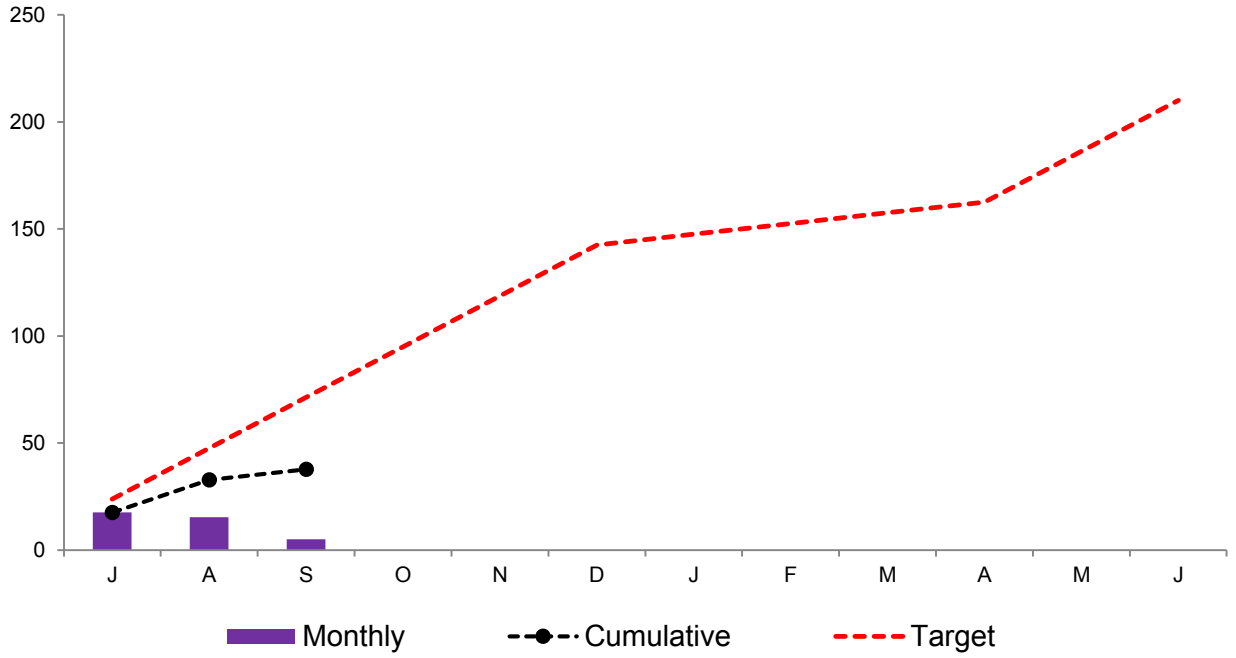
Arlington, Belmont, BWSC, Brookline, Chelsea, Everett, Framingham, Lexington, Malden, Medford, Melrose, Milton, Newton, Norwood, Quincy, Reading, Revere, Somerville, Stoneham, Waltham, Watertown, Winthrop



Quabbin Reservoir Level



Miles Surveyed for Leaks



During the 1st Quarter of FY18, 37.73 miles of water mains were inspected. Surveyed below target due to staff training and availability. Metering staff provided leak detection assistance to eight communities this quarter

Supply and Delivery of Ferrous Chloride to the Deer Island Treatment Plant WRA-4425

November 15, 2017

Supply and Delivery of Ferrous Chloride to Deer Island

- Used at Deer Island to:
  - Pretreat sludge to minimize hydrogen sulfide (H_2S) formation in digester gas
  - Prevent struvite in digesters and downstream pipes

What Is Struvite And Why Do We Have To Prevent It?

Struvite = Magnesium Ammonium Phosphate Hexahydrate Mg (NH_4) PO_4 $(H2O)_6$

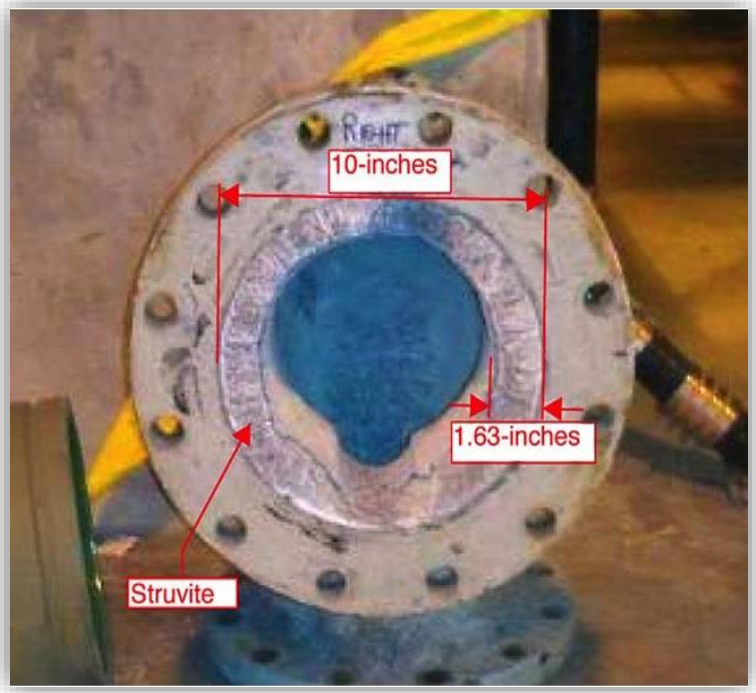
- A scale that forms in anaerobic digesters with secondary treatment processes
- Mostly limited to coastal plants (salt water is high in mg)
- Clogs lines increasing equipment downtime. Could take entire digester unit out for months or years

How Do We Have To Prevent Or Remediate?

1. Prevention:
   - Add iron salts like Ferrous Chloride ($FeCl_2$) to bind up PO_4

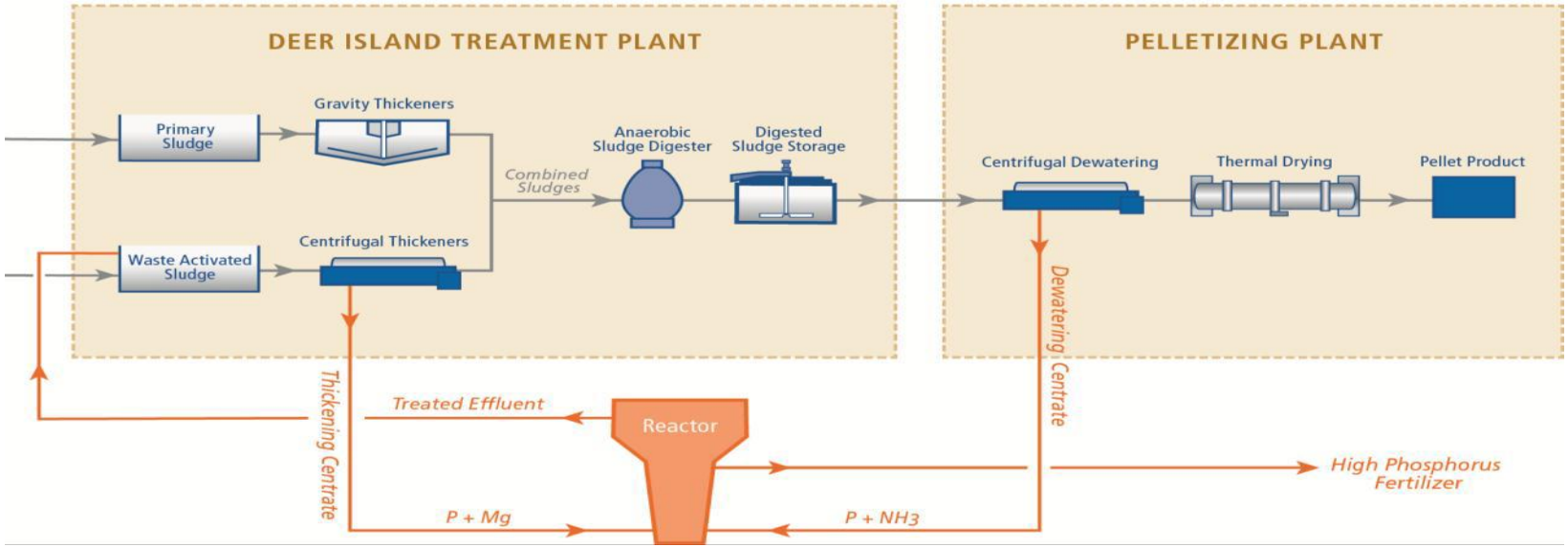
2. Remediate:
   - Mechanical cleaning
   - High pressure wash

Last resort:
   - Replace Pipe



Are There Alternatives? Innovative Technologies

- Residuals technology options assessment/recent staff investigation
  - OSTARA process
    - Forced struvite precipitation in controlled part of process
  - CALPrex Process
    - Similar to OSTARA, different end product – dicalcium phosphate



Recommendation/Conclusions

- Innovative technologies
  - Not fully proven, some may be pilot scale only
  - Require major process changes at Deer Island (costly)
  - Still require some iron salt addition to pretreat for H_2S in digester gas

- Pipe replacement too disruptive to operation, impacting ability to treat

- Chemical prevention and light remediation best combination

Clinton Wastewater Treatment Plant Phosphorus Reduction Design, CA/RE Contract 7377, Amendment 4

November 15, 2017

Clinton Wastewater Treatment Plant

Total Phosphorus Limits

Average Daily Flow: 3.0 MGD
Maximum Daily Flow: 8.0 MGD
Peak Hourly Flow: 12.0 MGD

Existing Total Phosphorus Limits:

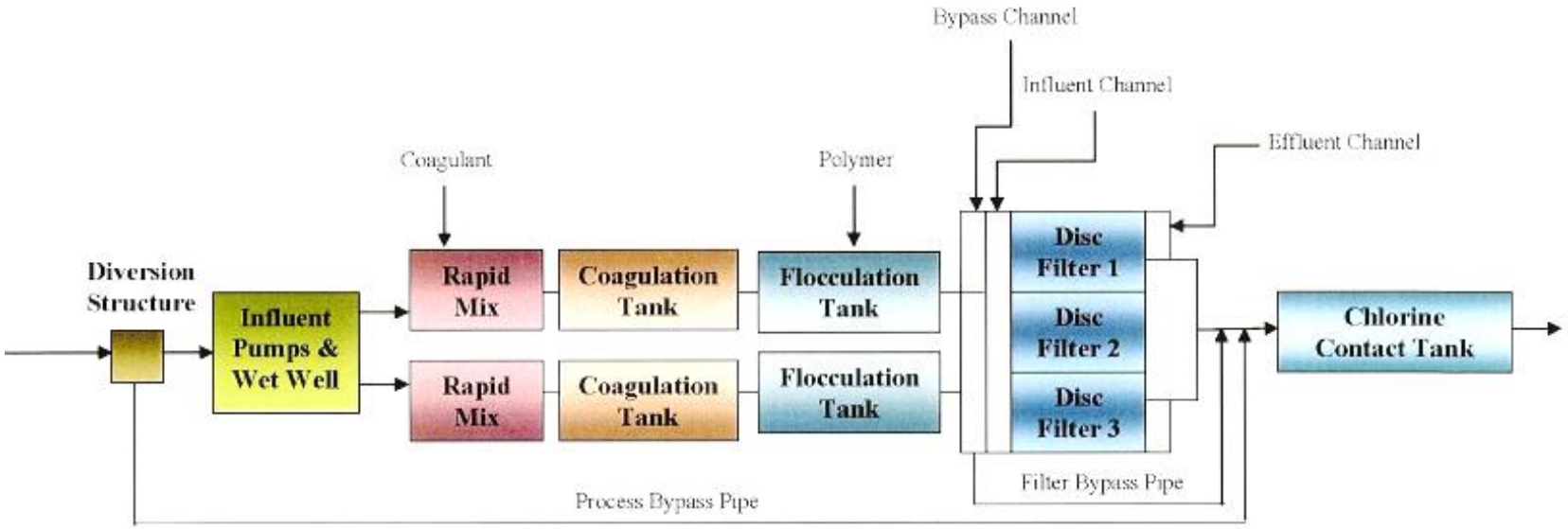
- 1.0 mg/l from May 1 to October 31
- No required limit from November 1 to April 30

Future Total Phosphorus Limits (April 2019):

- 0.15 mg/l from April 1 to October 31
- 1.0 mg/l from November 1 to March 31

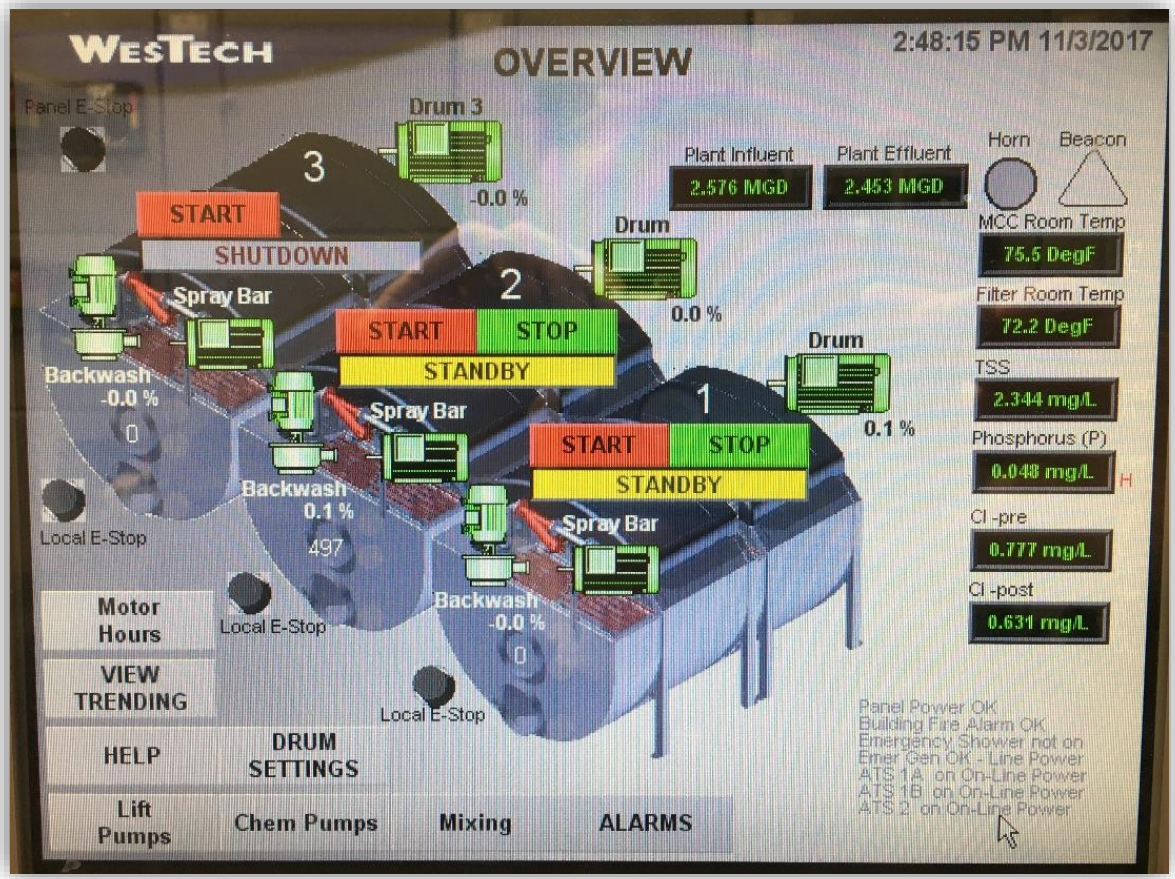
Phosphorus Reduction Facility

Process Schematic

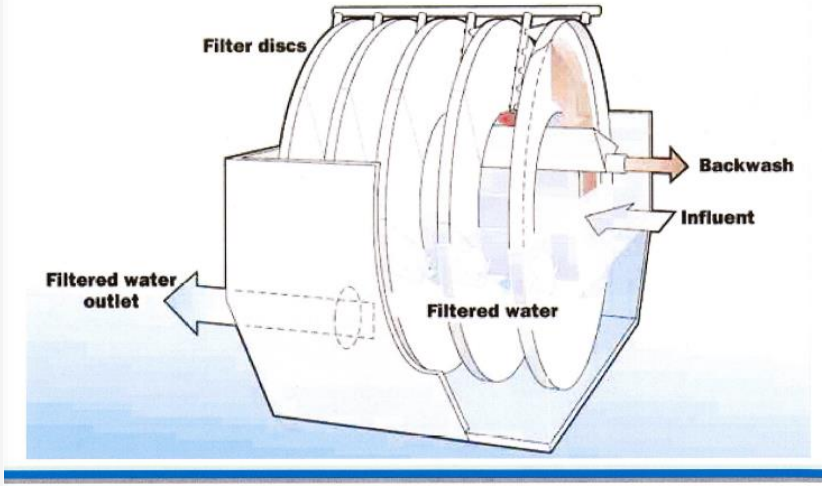


Mixers, Coagulation and Flocculent Tanks

Disk Filter and Phosphorus Operations Touch Screen



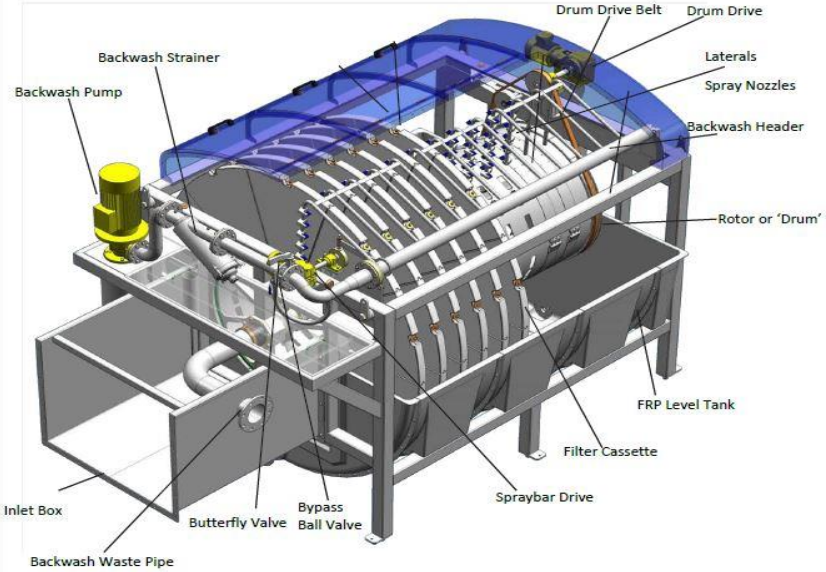
Disc Filter Process



Disc Filter Process

Disc Filters

Disc Filter Backwash Units



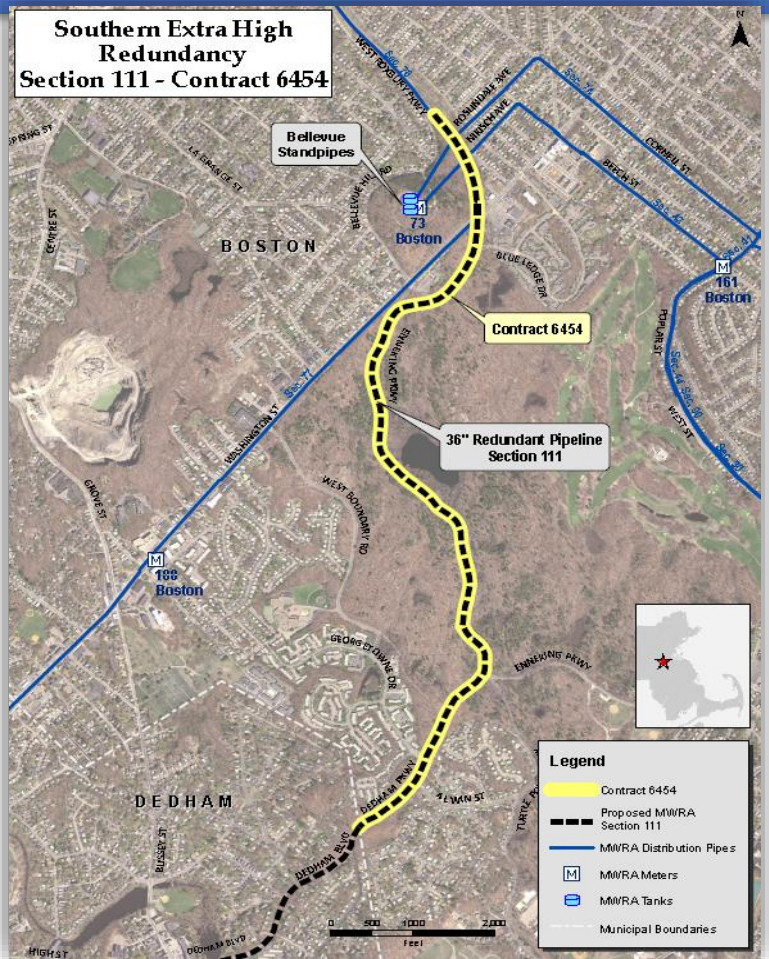
Amendment 4 Summary

- Six-month time extension due to contractor delays
- Increases Contract amount by $249,645.48
- Includes additional level of effort for:
  - six months of resident engineering services
  - additional on-site meetings/inspections/observations
  - construction advice/interpretation/clarification
  - review and processing of contractor submittals
  - additional start-up services

Southern Extra High Pipeline, Section 111 – Boston Contract 6454, Change Order 3

November 15, 2017

This Contract



36-inch Ductile Iron Pipe Being Installed Dedham Parkway, Boston

Existing Usiflex Pipe Joint On Section 42

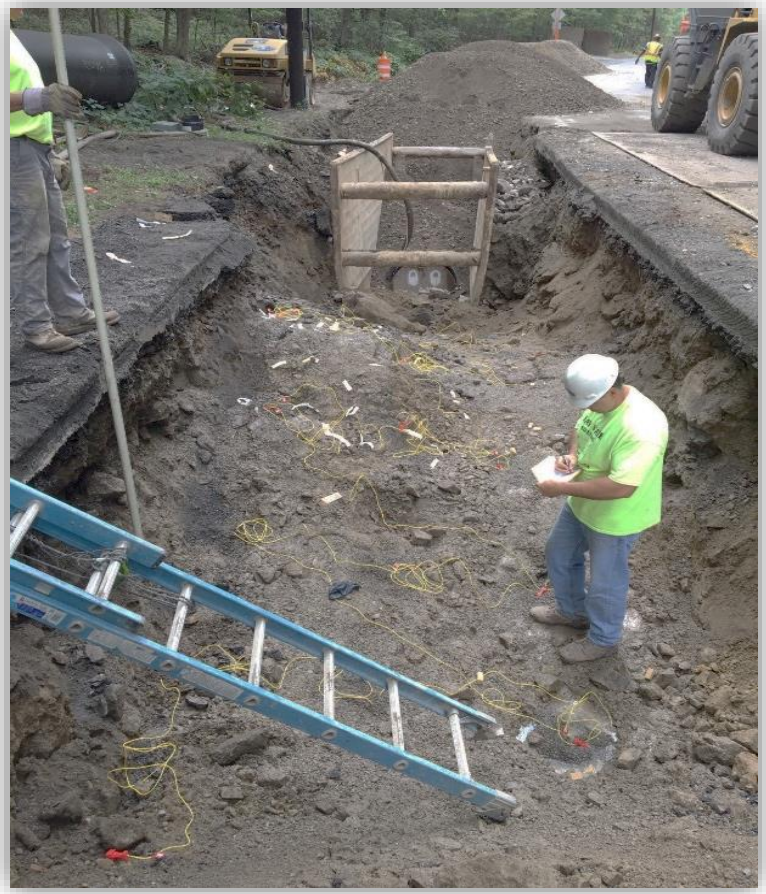
Tee Installed On Section 42

12-inch Drain Repair on Enneking Parkway

Typical Installation of Vertical Offsets

36-inch Gate Valve Vault

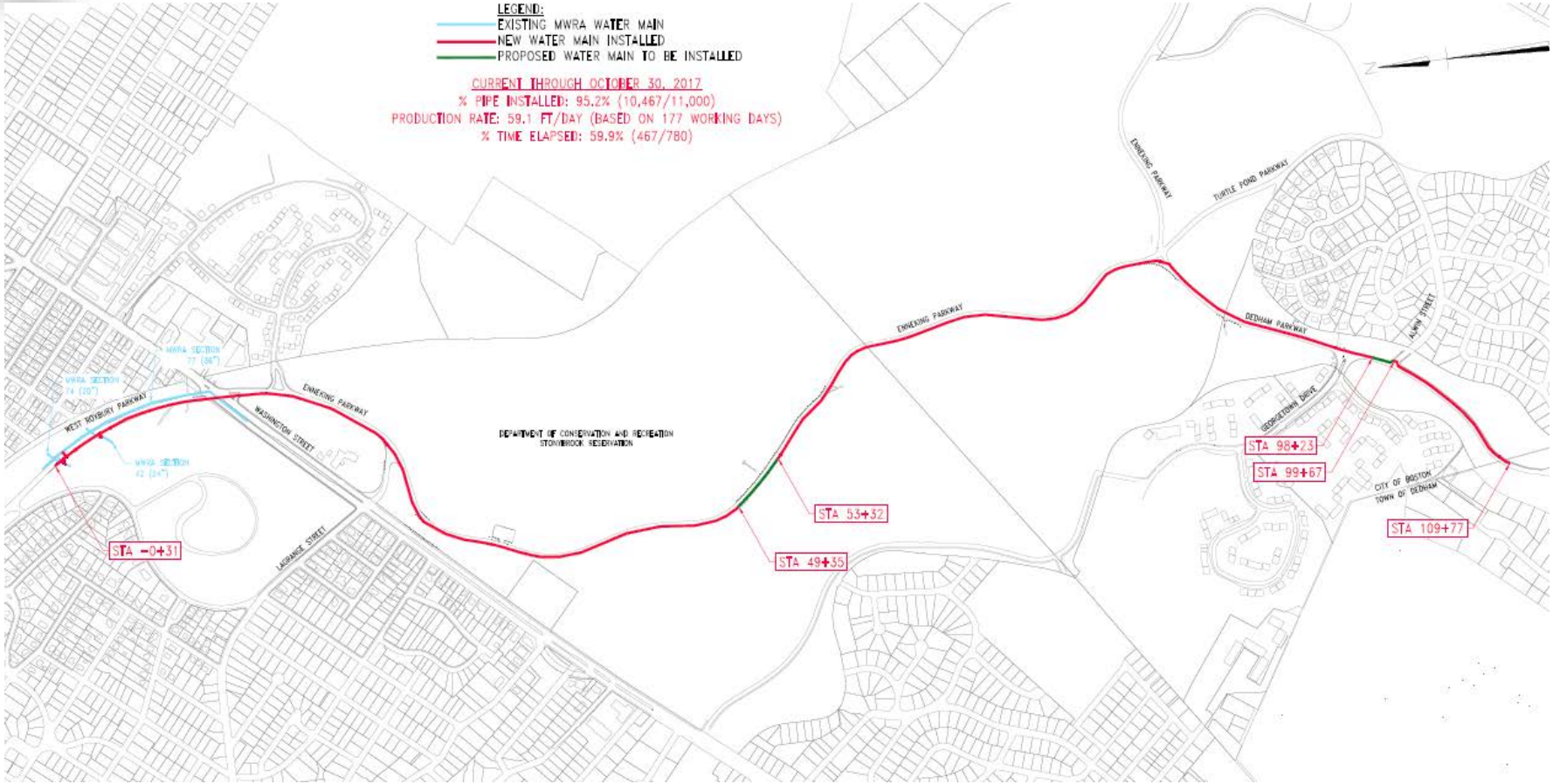
Blasting Preparation and Documentation



Ledge Removal on Enneking Parkway

Removing Rock

Pipe Installation Progress Plan



Wachusett Aqueduct Pump Station
Contract 7157, Change Order 25

November 15, 2017

Construction Update - Front Entrance

Construction Update - Pump Station

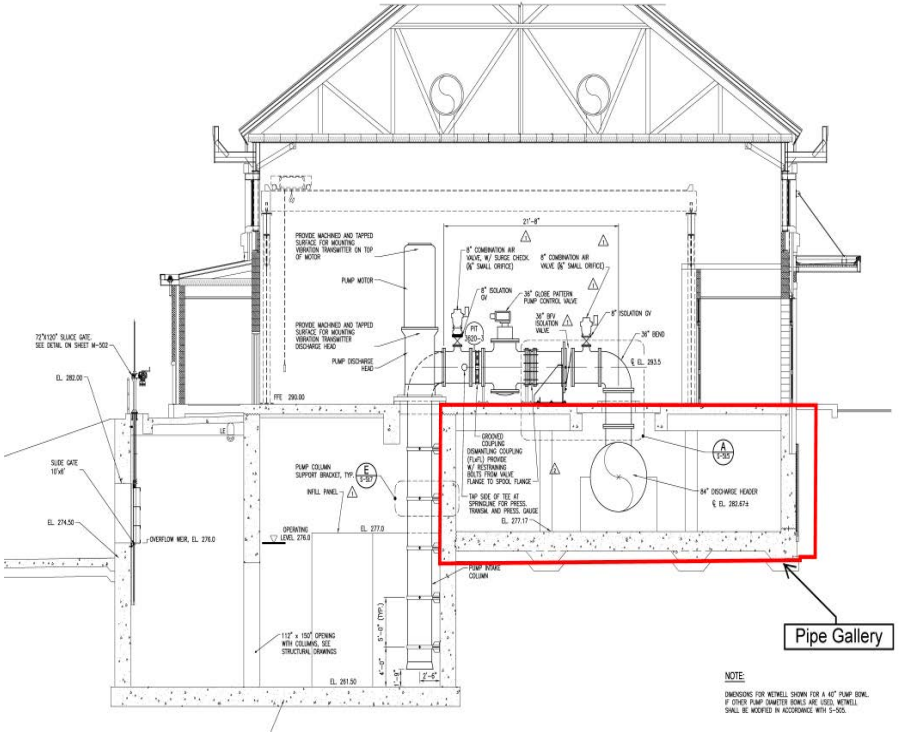
Construction Update – Wachusett Aqueduct Connection

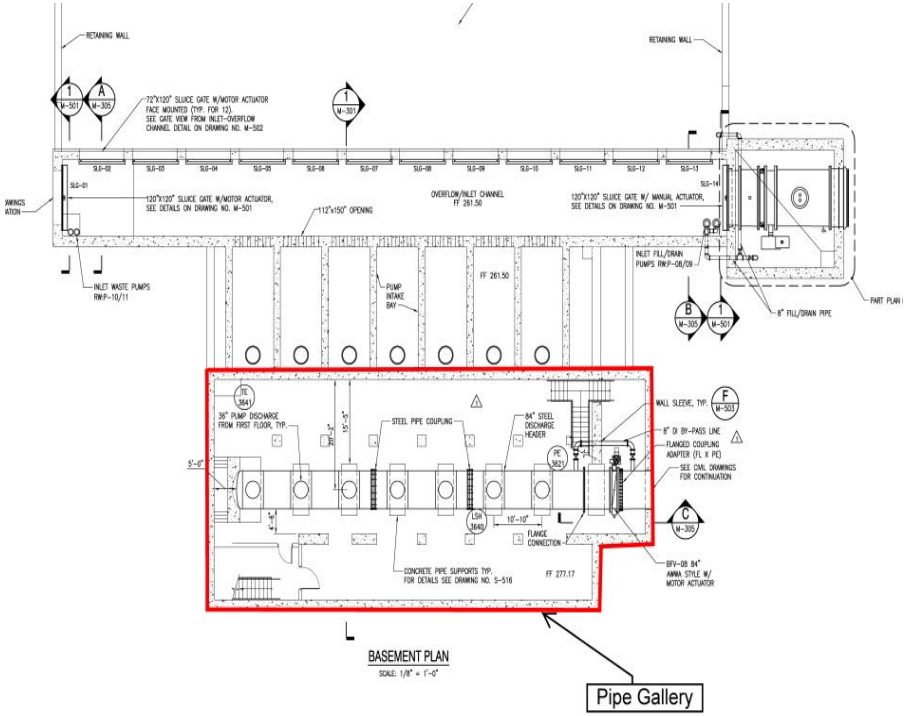
Construction Update – Wachusett Aqueduct Connection

Change Order 25 – Pipe Gallery Dehumidification

- Change to Desiccant System from Refrigerant Type System
- Refrigerant type dehumidification was recently installed in the Carroll UV Building
- UV dehumidifiers experienced operational problems during warm weather
- Led to re-evaluation of Pump Station dehumidification options
- Timing too late to modify bid documents

Change Order 25 – Pipe Gallery Dehumidification





Change Order 25 – Pump Power Fluctuation Ride Through

- Millisecond power fluctuations - pumps susceptible to shutdown
- Pump start-up – over 1 hour
- May experience several power fluctuations per day
- For power ride through:
  - Provide DC Battery Circuits in each MCC
  - Provide UPS for each Pump Control Valve

Change Order 25 – Summary

Item	Cost
Pipe Gallery Dehumidification	$184,456
Power Fluctuation Ride Through	$106,507
Total	$290,963

Wachusett Aqueduct Pumping Station