Massachusetts Water Resources Authority

Board of Directors Report
on
Key Indicators of MWRA Performance
for
Fourth Quarter FY2016

Frederick A. Lader, Executive Director
Michael J. Hombrook, Chief Operating Officer
September 14, 2016
Deer Island Operations: Wastewater Flow

Plant Flow

- Total Plant Flow, MGD
- 10 Yr Avg Flow, MGD
Deer Island Operations: Power Use and Electricity Pricing

### Total Power Use

- **Support**
- **Primary**
- **Secondary**
- **Residuals**
- **Pumping**
- **FY16 Target**

- **Power Use, MWh**
  - J: 16,000
  - A: 14,000
  - S: 12,000
  - O: 10,000
  - N: 8,000
  - D: 6,000
  - J: 4,000
  - F: 2,000
  - M: 0
  - A: 0
  - M: 0
  - J: 0

### Total Electricity Pricing

- **Unit Price ($/kwh)**
- **FY16 Energy Unit Price**
- **FY16 Energy Budget Unit Price**
- **FY15 Energy Unit Price**

- **Total Electricity Pricing** (includes spot energy price, ancillary costs, and NSTAR’s transmission & distribution costs)
Water Distribution: Pipeline Leak Detection and Repair

Miles Surveyed for Leaks

- Monthly
- Cumulative
- Target

J A S O N D J F M A M J

0 250
0 50 100 150 200 250
Memorandum of Agreement Between MWRA and the City of Somerville

September 14, 2016
Somerville Marginal Interceptors
Cambridge Branch Sewer Study
Contract 7511

September 14, 2016
Current Conditions
Services to be Provided

• Evaluation of Pipeline/Manhole Rehabilitation Methods

• Traffic and Environmental Assessments

• Hydraulic Capacity and Corrosivity Evaluations

• Recommended Rehabilitation Method(s) including limits of work, flow handling, access points, traffic mitigation and estimated costs
Procurement Process

- 3 Proposals Received
- Selection Committee Recommends Hazen and Sawyer, P.C.
- Contract Amount: $686,953.85
- Contract Duration: October 2016 – December 2017
Contract 7359 – Prison Point CSO Facility Improvements
Chelsea Creek Headworks Upgrade
Construction Contract Award

September 14, 2016
Chelsea Creek Headworks Upgrade

- Major upgrade of entire facility including:
  - Automation of screenings collection and conveyance
  - New odor control and HVAC systems with added redundancy
  - Replacement of emergency generator/fuel oil tank/transformer
  - Remediation of hazardous building materials
Chelsea Creek Headworks Upgrade

- Major upgrade of entire facility including:
  - New communication tower with communications building
  - Flood protection to 100 year flood plus 2 ½ feet
  - Upgrades for code compliance for egress and fire suppression
  - Exterior façade enhancements
Automated Screenings Collection
Replacing Climber Screens with Catenary Screens

Chelsea Creek
Climber Screens
Catenary Screens
Nut Island
Flood Elevations – Existing Facility
Exterior Façade Enhancement
Construction Challenges

• Project requires careful construction sequencing

• Facility must remain operational/staffed throughout construction

• Construction limited to one channel at a time - maintain full wet weather flow capacity

• Hazardous building materials must be remediated without impacting operations
Construction Challenges

• Maintain HVAC, odor control, and electrical service throughout construction
• Concurrent operation of old, new and temporary systems
• Start up and testing will occur sequentially to maintain uninterrupted service
General Bids were opened on August 25, 2016:

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineer’s Estimate</td>
<td>$69,000,000</td>
</tr>
<tr>
<td>BHD/BEC JV2015, A Joint Venture</td>
<td>$72,859,000</td>
</tr>
<tr>
<td>Daniel O’Connell’s Sons</td>
<td>$81,540,000</td>
</tr>
<tr>
<td>Walsh Construction Company</td>
<td>$83,482,395</td>
</tr>
</tbody>
</table>
• Staff determined that BHD/BEC JV2015, A Joint Venture is qualified and is the lowest responsible and eligible bidder

• Staff recommend the award of Contract 7161 to BHD/BEC JV2015, A Joint Venture in the amount of $72,859,000 for a contract duration of 1,460 calendar days
Construction Notice to Proceed  October 2016

Construction Substantial Completion  October 2020
Remote Headworks Upgrade
Amendment 4

September 14, 2016
Bidding Phase Services Level of Effort: $155,600

Extended duration
  • Bidder questions, site visits, addenda
  • Assignment of remediation work/odor control equipment supplier conflicts

Construction Administration Services: $614,000

Added complexity of project and additional 6 months of construction
  • Extended construction duration 6 months
  • Conformed documents and record drawings
  • Requests for information (RFIs), submittal review, change orders
  • e-Construction
Amendment 4 Summary

**Special Services During Construction:** $60,800
Periodic reporting requirements SRF funding, EPA required PCB inspection/sampling/reporting
Additional 6 months of construction

**SCADA Services:** $66,800
Additional level of effort associated with complexity of design and refinement of sequencing between old and new systems
Time Extension

- Extended design duration 26 months
  (Previous amendments provided funding but did not change contract end date)
- Extended bidding duration 6 months
- Additional construction duration 6 months
Valve and Piping Replacements
Various Facilities
Deer Island Treatment Plant

September 14, 2016
Contract 7275 Overview

- Contractor: Carlin Contractors
- Notice to Proceed: June 23, 2014
- Award Amount $16,960,425.00
- Replace the following equipment in pumping stations:
  - 41 valves ranging in size from 30” to 60” and 16 flowmeters in NMPS and WTF
  - 8 hydraulic dashpots in the SSPS
- Replace over 220 valves and 11,000 ft of scum/sludge piping in Primary/Secondary galleries
Contract 7275 Change Order No. 5

- CO No. 5: $136,884.01
- Scope of Work: Replace corroded coupling hardware (and selected gaskets) on Secondary scum piping system in Battery A & B
- Hardware material: existing (carbon steel) to be replaced with SS316
- Difficult to access: dewatering, disinfection, confined space, etc
- Was identified after construction started
- Battery C originally utilized SS316
- Total COs to date (including CO No 5):
  - $379,266.92 or 2.24%
  - Project 49% complete
Drought Status Update

September 14, 2016
Massachusetts Drought Status Designations

Massachusetts Drought Status
As of September 1, 2016

NOTE: The MWRA/DCR water system has an individual Drought Management Plan. Some partially supplied member communities are subject to regional drought status.
Quabbin Reservoir Volume

- Normal
- Below Normal
- Warning

84.3% Full on 9/9/2016

% Full

Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

60  70  80  90  100
Worcester’s Quinapoxet Reservoir, September 8th 2016

Capacity at 12%
Communities Which Could Potentially Be Assisted by MWRA
Communities Activating or Close to Activating Emergency Connections

[Map showing communities with different colors indicating supply status and potential for assistance.]
Supply to Partial Communities Has Increased

July and August Flows for Metropolitan Partially Supplied Communities
Driest Summer on Record

Inches of Precipitation at Logan Airport

<table>
<thead>
<tr>
<th></th>
<th>JAN</th>
<th>FEB</th>
<th>MAR</th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long-term Average</td>
<td>3.64</td>
<td>3.36</td>
<td>4.01</td>
<td>3.57</td>
<td>3.37</td>
<td>3.46</td>
<td>3.04</td>
<td>3.40</td>
<td>3.29</td>
<td>3.44</td>
<td>4.01</td>
<td>4.09</td>
<td>42.7</td>
</tr>
<tr>
<td>2016 Total</td>
<td>3.27</td>
<td>4.18</td>
<td>3.17</td>
<td>2.91</td>
<td>2.83</td>
<td>1.33</td>
<td>0.87</td>
<td>1.72</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Driest summer ever recorded. Total only 3.92 inches
It’s Been Dry for Over A Year

![Graph showing cumulative rainfall over two years, with a long-term bi-annual average and a two-year cumulative daily total.]

- 2015 and 2016
- Inches on the y-axis
- Months on the x-axis
- Long-term bi-annual average
- Two year cumulative daily total
### How Dry Has It Been At Quabbin?

Based on 68 years of Quabbin yield data from 1948 to 2016

<table>
<thead>
<tr>
<th></th>
<th>1 Month</th>
<th>3 Months</th>
<th>6 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAN</td>
<td>13th driest</td>
<td></td>
<td>27th driest.</td>
</tr>
<tr>
<td>FEB</td>
<td>57th driest</td>
<td></td>
<td>6th driest</td>
</tr>
<tr>
<td>MAR</td>
<td>18th driest</td>
<td>7th driest.</td>
<td>3rd Driest</td>
</tr>
<tr>
<td>APR</td>
<td>9th driest</td>
<td>3rd driest.</td>
<td></td>
</tr>
<tr>
<td>MAY</td>
<td>11th driest</td>
<td>3rd driest</td>
<td></td>
</tr>
<tr>
<td>JUN</td>
<td>2nd driest</td>
<td>5th driest</td>
<td></td>
</tr>
<tr>
<td>JUL</td>
<td>3rd driest.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AUG</td>
<td>26th driest</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Quabbin Historical Droughts

The chart illustrates historical droughts in Quabbin, including the 1960's drought, the 1989 drought, and the 2002 drought. The chart also indicates different stages of drought emergencies and the safe yield level.
October 13, 1966 -- 187 Billion Gallons, 45.3% Full
September 10, 2016 – 347 Billion Gallons, 84.3% Full
Drought Messaging

• Quabbin in Normal Operating Range

• Even if drought extends several years:
  - Can supply all fully and partially supplied communities
  - Able to provide assistance to neighboring communities

• Asking our customers to use water wisely and efficiently
Update on Lead Programs

September 14, 2016
## Communities that have Participated in the School Lead Testing Program

<table>
<thead>
<tr>
<th>Community</th>
<th># of Schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arlington</td>
<td>8</td>
</tr>
<tr>
<td>Boston</td>
<td>1</td>
</tr>
<tr>
<td>Brookline</td>
<td>19</td>
</tr>
<tr>
<td>Chelsea</td>
<td>10</td>
</tr>
<tr>
<td>Hanscom AFB</td>
<td>1</td>
</tr>
<tr>
<td>Lexington</td>
<td>10</td>
</tr>
<tr>
<td>Malden</td>
<td>2</td>
</tr>
<tr>
<td>Marblehead</td>
<td>9</td>
</tr>
<tr>
<td>Medford</td>
<td>3</td>
</tr>
<tr>
<td>Melrose</td>
<td>10</td>
</tr>
<tr>
<td>Milton</td>
<td>6</td>
</tr>
<tr>
<td>Needham</td>
<td>11</td>
</tr>
<tr>
<td>Newton</td>
<td>22</td>
</tr>
<tr>
<td>Northborough</td>
<td>6</td>
</tr>
<tr>
<td>Peabody</td>
<td>1</td>
</tr>
<tr>
<td>Reading</td>
<td>4</td>
</tr>
<tr>
<td>Revere</td>
<td>9</td>
</tr>
<tr>
<td>Stoneham</td>
<td>1</td>
</tr>
<tr>
<td>Wakefield</td>
<td>2</td>
</tr>
<tr>
<td>Waltham</td>
<td>12</td>
</tr>
<tr>
<td>Wilmington</td>
<td>9</td>
</tr>
<tr>
<td>Winchester</td>
<td>8</td>
</tr>
</tbody>
</table>

**22 Communities** | **164 Schools**
Number of Tests Completed

Cumulative Tests

Tests

0 1,000 2,000 3,000 4,000 5,000 6,000 7,000 8,000 9,000 10,000

Week Ending

4/1/16 5/1/16 6/1/16 7/1/16 8/1/16 9/1/16

Completed
Lead Samples Being Processed at Deer Island Lab
School Lead Testing Program Results

- 44 of 164 schools with one or more locations above the Action Level
- 5.8% of the 5,119 lead samples were above the Action Level
• Newton is scheduled to receive $4 million dollars in November 2016 for their program
• Four other communities have sent along applications: Peabody, Quincy, Winchester, and Woburn. Expected to receive funds in FY2017
Sampling protocol has been confirmed, and education materials have been developed.

MWRA and DPH will be training field staff next week.

First samples collected at homes expected this fall.
Chestnut Hill Emergency Pump Station

September 14, 2016
Chestnut Hill Reservoir

- Located at the intersection of Boston, Newton and Brookline
- A focal point of the water system since the 1870’s
- Initially supplied by the Cochituate Aqueduct and later by the Sudbury Aqueduct
Old Chestnut Hill Pump Stations

- High Service Station built 1887. Supplied south to Fisher Hill Reservoir in Brookline, Forbes Hill Reservoir in Quincy and later to Blue Hills Reservoir.

- Low Service Station built 1898. Supplied north to Spot Pond in Stoneham.

- Declared surplus in 2002.

- Currently the site of the Metropolitan Waterworks Museum and condominium residences.
• City Tunnel in 1950 reduced pumping by direct connection at Shaft 7B
• Blue Hills open reservoir on line in 1954; however, system could not maintain adequate water elevation
• Dorchester Tunnel completed in 1974:
  – Eliminated pumping all together
  – Blue Hills level recovered
Succession of Pump Strategies at Chestnut Hill

- Steam pump demolition began after Dorchester Tunnel was completed
- Subsequent leaks in the Dorchester Tunnel required shut down for repairs
- Gas turbine pumps were installed at Chestnut Hill. Operated until repairs complete in 1980
- Pumps retained for emergency back-up
- Construction of replacement Emergency Pump Station authorized in 1998
• Underground station adjacent to Shaft 7B
• 4 x 1,000 HP Constant Speed Pumps
• Ability to pump from Chestnut Hill Reservoir (~90 MGD) or Boston Low (~35 MGD)
• Pump to Dorchester Tunnel or surface mains
• Activated during Shaft 5A Water Main Break
• Operated during peak demand hours
• Required booster chlorination and boil order
• City Tunnel and Dorchester Tunnel remained in service, despite constrictions upstream
Operational Challenges Affect Reliability and Service

- Some failure scenarios result in Dorchester Tunnel off line
- Need higher-than-normal pressure to overcome surface pipeline deficiencies
  - Could result in surface main breaks
- Reduced pressure concerns when pumps shut down
- Other factors intensify pressure swings:
  - Downstream pump station operations;
  - Power failure
  - Starting/Stopping pumps
Potentially Inaccessible

Chestnut Hill Emergency Pump Station
• Use of the Chestnut Hill Emergency Pump Station without the Dorchester Tunnel creates operational challenges and affects reliability
• Some challenges can be mitigated with station modification and other improvements (if space allows)
• However, southern surface mains still have limited capacity and high head loss
• These concerns could influence strategic decisions about redundancy for Southern High and Southern Extra High service areas