



MASSACHUSETTS WATER RESOURCES AUTHORITY

Charlestown Navy Yard
100 First Avenue, Building 39
Boston, MA 02129

Frederick A. Laskey
Executive Director

Telephone: (617) 242-6000
Fax: (617) 788-4899
TTY: (617) 788-4971

November 14, 2018

Deborah McGuire, Acting Director
U.S. Environmental Protection Agency
Water Enforcement
OES4-SMR
5 Post Office Square, Suite 100
Boston, MA 02109-3912

Lealdon Langley
Division of Watershed Management
Massachusetts Department of
Environmental Protection
1 Winter Street
Boston, Massachusetts 02108

RE: NPDES Permit Number MA0103284
O&M Annual Report/Status Sheets

Dear Ms. McGuire and Mr. Langley:

Enclosed please find the MWRA's annual status sheets on plant performance and maintenance for the period covering July 2017 – June 2018. This submittal fulfills the requirements of MWRA's NPDES Permit MA0103284 - Section 1.18.f and 1.18.g that states in part:

...The permittee shall report on the [operations and maintenance] plan's implementation and results to EPA and the MADEP on a yearly basis....An annual maintenance update shall be published in the MWRA's Annual Report. The MWRA shall submit an annual status sheet to EPA and the MADEP on plant performance, using key indicators for maintenance and providing detailed information on any necessary equipment replacement. The annual status sheet shall be placed on the MWRA web page for public information purposes.

Annual status sheets are posted at <http://www.mwra.com/harbor/html/archive.htm#maintenance>.

If you have questions or need additional information, please feel free to call Betsy Reilley at (617) 788-4940.

Sincerely,

David W. Coppes
Chief Operating Officer

Enclosures:

- Annual Report on Operations and Maintenance, FY2018
- Status Sheets with key indicators of maintenance, FY2018
 - Deer Island Treatment Plant
 - Wastewater Transport System
 - Fore River Pellet Plant

cc: T. Borci, US EPA
K. Brander, DEP
C. Vakalopoulos, MA DEP
F. Laskey, MWRA

MWRA Annual Report on Operation & Maintenance

July 2017 - June 2018

This report fulfills the requirements of MWRA's NPDES Permit MA0103284, Section 1.18.f which states:

“Within ninety (90) days of the effective date of this permit, the permittee shall develop and implement a long-range operations and maintenance plan that will maximize the life of the treatment facility. The permittee shall report on the plan's implementation and results to EPA and the MADEP on a yearly basis.”

Also included with this submittal are the annual status sheets on plant performance and maintenance as required in section I.18.g.

1. SYSTEM OVERVIEW

MWRA's Metropolitan Boston wastewater system consists of the Deer Island Sewage Treatment Plant, the wastewater collection system, and the Pelletizing Plant, described below.

Deer Island Sewage Treatment Plant

The Deer Island Sewage Treatment Plant (DITP) is the centerpiece of MWRA's \$3.8 billion program to protect Boston Harbor against pollution from Metropolitan Boston's sewer systems. The DITP's purpose is to remove human, household, business, and industrial pollutants from the wastewater that is collected and transported through 5,400 miles of pipes, community owned sewer lines, and approximately 240 miles of Authority owned interceptors and tunnels.

DITP is a state-of-the-art wastewater treatment facility and one of the most automated in the country. The MWRA has made a considerable capital investment in the DITP and is fully committed to ensuring that this valuable public asset is maintained in the best possible manner. The MWRA's Board of Directors, Executive Director, management team, and staff are dedicated to providing the highest quality of asset management. The MWRA has assembled a highly skilled and qualified staff that will ensure that the treatment plant is operated and maintained to the satisfaction of the regulatory agencies and the public.

Wastewater Transport System

The Field Operations Department (FOD) operates and maintains MWRA's wastewater transport system, which transports wastewater from MWRA member communities to the Deer Island Treatment Plant. This system includes a network of 240 miles of interceptor sewer lines and related appurtenances, a screen house, 13 pumping stations, 4 remote headworks facilities, 3 combined sewer overflow (CSO) treatment facilities and 2 CSO storage facilities. The primary goal is to operate the system in a manner that will provide uninterrupted wastewater transport service in a safe, cost-effective, and environmentally sound manner.

Fore River Pelletizing Plant

The operation and output of the Fore River Pelletizing Plant is regulated, in part, by the terms of the federal NPDES permit, 40 CFR 503 regulations, and state sludge regulations in Massachusetts (310 CMR 32.00) and the states to which the pelletized product is shipped. Other important external factors that influence operation of the pellet plant include an extensive residuals management facilities plan developed as part of the permitting process as well as commitments to local communities.

Under the terms of the current operating agreement between New England Fertilizer Company (NEFCo) and MWRA, NEFCo budgets for and performs all necessary predictive, preventive and routine maintenance at the pellet plant. NEFCo's agreement contains a plan for the maintenance, repair and operation of the facility. At this time, NEFCo performance meets the necessary standard for proper operation and maintenance. Since the inception of the agreement in March of 2001, there has not been an incident requiring an interruption in service.

The operating agreement requires NEFCo to provide a letter of credit for \$1,000,000 (adjusted for inflation) that MWRA may draw on in the event that there is a material breach of the operating agreement, such as failing to adequately maintain the facility.

2. PERMIT VIOLATIONS

There were no violations at MWRA facilities due to inadequate maintenance efforts.

3. FACILITIES ASSET MANAGEMENT PROGRAM

The goals of the MWRA multi-year maintenance plan include coordinated, consistent asset inventory; condition assessment; maintenance scheduling and long-term replacement planning. The MWRA has developed and implemented, the Facilities Asset Management Program (FAMP). This asset management program addresses the goal of becoming more efficient by developing consistent best practices and cost-effective operations and maintenance procedures.

MWRA had been conducting its maintenance on a calendar-based schedule in accordance with the original equipment manufacturers' (OEM) recommendations. This approach to maintenance was primarily driven by contractual obligations of the OEM warranties. MWRA's management team believed that it was important to modify its existing program with the goal of achieving a more rational approach to maintenance management. MWRA management acknowledges the importance of asset management and developed FAMP to meet the long-term demands of facility maintenance. The main objective of FAMP was to develop a sound maintenance strategy that would ultimately lead to better overall asset management, extended equipment life and increased reliability.

MWRA expanded its efforts in the areas of condition monitoring utilizing Reliability Centered Maintenance (RCM). This program focuses on asset replacement prioritization and capital improvements, and training of staff. DITP is continuing to build the program, this year upgrading the maintenance management software Maximo to version 7.6, and continuing to use the methodology of RCM, consolidating the tool database into Maximo, expanding condition

monitoring oil analyses by using on site testing equipment, and continuously reviewing our metrics to ensure we are at or above industry benchmarks.

4. COMPUTERIZED MAINTENANCE MANAGEMENT SOFTWARE

Maximo is the computerized maintenance management software (CMMS) used by MWRA. In 2018, MWRA upgraded to Maximo version 7.6. Maximo CMMS includes job plan and safety features allowing MWRA to document hazardous areas and materials at DITP. Maximo can develop Lock-Out Tag-Out (LOTO) tasks and generate associated work orders for field personnel. Maximo's document management function streamlines maintenance and regulatory functions and workflow capabilities for synchronizing operations. Maximo applications can be fine-tuned to suit specific work processes or interface with other software programs. Maximo's mobile application, Maximo Anywhere, allows field personnel to gather asset information, check for spare parts in our warehouses and report labor and failure information in real-time, or upload entered data into Core Maximo when the device reconnects to MWRA's data management system.

Maximo gives operations and maintenance staff the ability to plan, prioritize and assign work, based on labor and required spare parts availability. Maximo's data analytic and reporting tools analyze failure trends in equipment, enabling staff to optimize preventive maintenance tasks and budget and plan asset replacement projects.

The upgrade of Maximo to version 7.6 project added additional functionality to track labor, material, service, service contract, spare part costs and usage for over 130,000 assets.

This upgrade has already provided MWRA with updated technology, increasing functionality for maintenance and improving reporting. The upgrade allowed MWRA to combine two separate instances of Maximo – DITP and FOD – into a single-organization, multi-site application, which increases productivity. Release 3 of the project incorporated Management Information Systems (MIS) Information Technology (IT) assets along with MIS's Helpdesk and workflow management into Maximo, further streamlining MWRA's overall CMMS operations under one software program. In addition, the project added Maximo Calibration for instrumentation and Maximo Spatial for buried assets and pipelines. The final phase of the project will incorporate Clinton Advanced Wastewater Treatment Plant assets and workflows into Maximo 7.6.

NEFCo has its own computerized maintenance management software, "E-maint." E-maint is used for work order management including preventive and corrective maintenance work.

5. SERVICE CONTRACTS

MWRA's maintenance program is supplemented by a series of service contracts. These contracts are intended to provide specialized services beyond the resources of the MWRA maintenance staff. Tables 1 and 2 below shows the service contracts currently used by MWRA.

TABLE 1
DEER ISLAND CURRENT SERVICE CONTRACTS
Laser alignment
Boiler maintenance
CCTV maintenance
Centrifuge maintenance
Combustion Turbine Generator maintenance
Continuous emissions monitoring
Catch Basin Contract
Copier/fax maintenance
Crane maintenance
Cryogenics facility maintenance
Digester Mixer overhauls
Electrical testing
Elevator maintenance
Facilities coatings
HVAC chemical treatment (Legion Ella testing)
Fire Sprinkler Repair Contract
Hydro turbine generator maintenance
Hydraulic maintenance
Janitorial services
Lab hood certification
Locksmith services
Lube oil analysis
Oil separator cleaning
Overhead door maintenance
Pest control
Plant and Public access landscape services
Plant instrumentation and control system (PICS) maintenance
Pratt Whitney Preferred service
Reactor Mixer gearbox rebuild
Recycle contract (Scrap/Paper)
Security
Steam turbine generator maintenance
Trash removal
Vibration analysis

**TABLE 2
FOD CURRENT SERVICE CONTRACTS**

Elevator Maintenance
Crane Maintenance
Hydraulic Equipment Maintenance
Instrumentation Maintenance
Fuel Storage Tanks
Fire Alarm and Sprinkler
Air Compressor Service
Boiler and Water Heater
Pest Control Services
Trash Removal
Electrical Testing
Groundskeeping
Lube Oil Analysis
Union Park Station Operation and Maintenance
Generator Maintenance
Overhead Door Maintenance
Vibration Monitoring

The attached pages constitute the annual status sheets on plant performance, using key indicators for maintenance. There are status sheets for Deer Island, Wastewater Transport (Field Operations Department), and the Fore River Pelletizing Plant.

Status Sheets
Deer Island Treatment Plant
July 2017 - June 2018

Deer Island Maintenance reporting on Key Performance Indicators for FY18.

- Preventive Maintenance - Maintenance is working to reach a work order completion rate goal of 100%. The average Preventive Maintenance (PM) percentage completion rate is 99.9%; 18,886 PM work orders were initiated this year. Incomplete PMs that are not completed in one month are rolled over into the workload of the following month, and given a high priority to complete first.
- Work Order Kitting - The first step to increase wrench time is to have all parts available for work orders. Kitting is a task where the maintenance planner identifies the specific parts required for a task on the work order and electronically sends the information to warehouse personnel to assemble the parts in one location (kit) for the technician to pick up and install. Deer Island met its goal of 55% in FY18.
- Predictive Maintenance - Extending the useful life of equipment, by monitoring and trending equipment characteristics, allows for better planning for equipment replacement. 6,987 work orders were completed for vibration, acoustic ultrasonic, ultrasonic thickness, and oil analysis. Deer Island exceeded its FY18 goal of 23%, with 24% of all work orders being categorized as predictive maintenance.
- Maintenance Backlog in Hours - Backlog is determined by totaling the planned craft hours on open work orders and comparing them to craft resources, which are available. The average backlog in FY18 was 16,052 hours, equaling 5.7 weeks of work for the entire Maintenance workforce. This backlog falls within the industry standards of 8,730 hours to 17,460 hours or 4 to 6 weeks. DITP monitors these metrics very closely to ensure the backlog does not adversely impact equipment availability.
- Maintenance Overtime - The goal is to maintain maintenance overtime at or below 5% of total wages and salaries. DITP met the benchmark of 5%.

Critical Equipment Availability: 12-Month Average — 99.7%

An equipment availability report is generated daily that details the critical equipment required to treat the maximum flow of approximately 1.3 billion gallons per day. Higher maintenance priority is given to equipment that drops below the number required. No operational impact has occurred in the past year from a 99.7% versus 100% availability because the plant normally operates at approximately one-third of the design flow capacity.

Average Craft Hours and Work Orders per Month:

Preventative Maintenance	3332 hours	29%	1920 work orders	60%
Predictive Maintenance	107 hours	1%	777 work orders	25%
Corrective Maintenance	6760 hours	59%	378 work orders	12%
Emergency Maintenance	46 hours	1%	1 work orders	1%
Project Work	234 hours	3%	4 work orders	1%
Other Work	690 hours	7%	28 work orders	1%
Total	11,169 hours	100%	3108 work orders	100%

Total Work Orders:

37,297 work orders initiated in FY18

34,197 work orders completed/closed in FY18

Maintenance Projects and Equipment Replacement:

- Reactor Aerator/Mixer Gearbox Rebuilds: \$236,283
 The secondary reactor aerators and mixers have large gearboxes that have started to fail. Six large gearboxes were refurbished in FY18 with new gears, seals, and bearings.
- Boiler, STG and Hydro Plant Maintenance: \$1,012,091
 A maintenance contract was established for annual boiler preventive maintenance including necessary repairs. This contract was combined with similar contracts for the Hydroelectric plant and steam turbine generator (STG). The intention of combining three contracts under one was to save money on like equipment and on mobilization costs. Maintenance spent additional money on repair work in Hydro.
- Cryogenic Facility Repairs: \$771,726
 The Cryogenic facility has an annual maintenance contract to handle preventive maintenance and some project maintenance work. The maintenance work includes two shut downs per year and scheduled projects. The scheduled projects completed were installing the new chemical system for the cooling water system. Replacing pressure reducing valves on the make-up water line and replacing lube oil cooler on #2 compressor.
- Grinder Rebuilds: \$72,288
 The Residuals Complex at Deer Island has small Muffin Monster grinders, installed "in-line" to provide continuous grinding of sludge into uniform, homogenized slurry. The sludge, which travels through these in-line grinders, is transported from Primary and Secondary treatment processes. The in-line grinders in Residuals are used after pre-treatment solids and rags are removed. In-line grinders are smaller than the larger channel grinders in size due to the composition of sludge entering them. Normal wear and tear to the grinders caused by constant operation wears the gears and seals requiring periodic service to re-build the grinders or cutter blocks. Staff replaced ten in-line grinders this year.

- Roller Gates Rebuilds: \$112,549

The primary function of roller gates is to isolate channels or chambers. Isolation of flow is necessary for maintenance tasks to be performed. Stop logs are fabricated of structural steel and have specifically designed rubber fittings on the tops and bottoms that mate with the units above and below them to provide a watertight seal. As part of the overhaul, the stop logs were dismantled, removing all existing wheels, axles, bushings, retainers and seals. The stop logs were then be cleaned, shop blasted, and repainted to the original specifications. All new wheels, bushings, retainers, and seals, per the original manufacturer's specifications were installed. Nine (9) stop logs were refurbished in FY18.
- Slide Gates: \$25,331

There are forty-eight (48) primary clarifiers on Deer Island that remove floatable scum and settleable solids, or sludge. Each clarifier has a set of eight (8) 14-inch diameter influent sluice gates that isolate the flow of raw wastewater from the primary influent channel into each clarifier and one (1) 18-inch dewatering sluice gate used to dewater the clarifier through the dewatering system to the Winthrop Terminal Facility. These sluice gates serve to both isolate and dewater the clarifiers for corrective or preventive maintenance is necessary. The gates operate on a continuous basis in submerged raw wastewater, which contains rags, grit, organic and inorganic solids, and high concentrations of corrosive compounds commonly found in raw wastewater. Over time, these solids and the corrosiveness of wastewater affect the ability of the gates to provide leak-free isolation of the clarifier or a tight seal on the dewatering gates. Staff has replaced four sluice gates in Primaries.
- Electric Vehicles: \$147,541

Deer Island Treatment Plant staff perform multiple job-related activities and tasks all around the large expanse of the DITP and its numerous buildings and facilities on a daily basis. The expansive nature of DITP's terrain requires use of electric vehicles to ensure the most efficient transport of staff, tools, equipment, and supplies. Electric Vehicles save countless staff hours throughout the year. Utilizing these smaller electric vehicles is less costly than conventional vehicles, in addition to being significantly more environmentally friendly. Deer Island purchased fifteen new electric vehicles.
- Norwalk Compressor 102 Rebuild: \$34,004

DITP uses three Norwalk custom horizontal straight-line gas compressors to pressurize the digester gas prior to the boilers. Typically, two compressor required being on line and one is stand-by mode or out for maintenance work. After a detailed inspection of Compressor 102, which showed excessive wear internally and with valves, Maintenance performed a rebuild, which includes rebuilding suction valves, discharge valves, piston actuators and pressure rings. An assortment of gaskets and new packing was installed.
- Butterfly Valves: \$29,597

Deer Island utilizes a primary heating loop to provide heat to all buildings and processes, including the sludge digesters. The heat loop is heated with steam generated from the combustion of digester gas in the Thermal Power Plant's high-pressure steam boilers. The hot water in the loop is then pumped around Deer Island, where it travels through numerous heat exchangers. The heat exchangers provide heat to secondary heat loops, which provide building heat, process heat (such as digester heat) and local hot flushing water service around Deer Island. Four heat exchanger butterfly valves were purchased and installed.

This will help maintenance staff isolate the system as well as resolve a leaking issue. The heat exchangers themselves are located on the basement level of the Gravity Thickener Complex.

- Hydro Plant Circuit Breaker: \$49,917

Two existing, medium voltage, vacuum circuit breakers are located in the Deer Island Hydro Power Plant switchgear serving turbine generators No. 1 and No. 2. These two breakers are tested on a regular basis by a third party vendor to ensure operational reliability. Results from a recent test showed a high contact resistance value on phase 'A' of the breaker serving turbine generator No. 2. The breakers were out of tolerance and were removed, refurbished and reinstalled.

Capital Projects

In addition to the maintenance projects listed above, the following Capital Improvement projects included work in FY18:

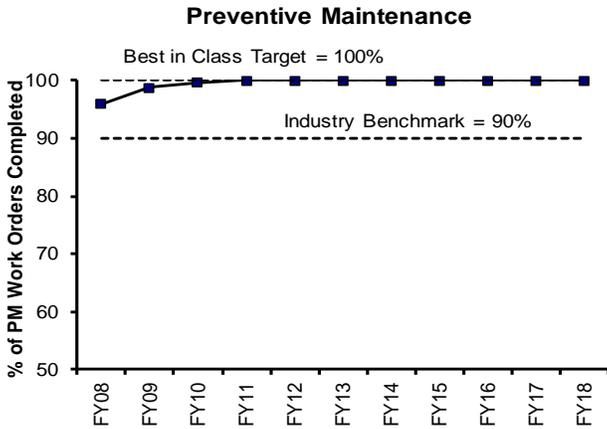
- Secondary Battery A & B Valve Replacements, Contract 7275
- Winthrop Terminal Facility Valve Replacement, Contract 7275
- Rehabilitation of Gravity Thickeners #5 and #6, Contract 7428

The following pages adapted from MWRA's quarterly performance report to the Board of Directors, the "Orange Notebook", summarize key indicators relating to Deer Island maintenance. The full Orange Notebook can be found at <http://www.mwra.com/quarterly/orangenotebook/orangenotebook.htm>.

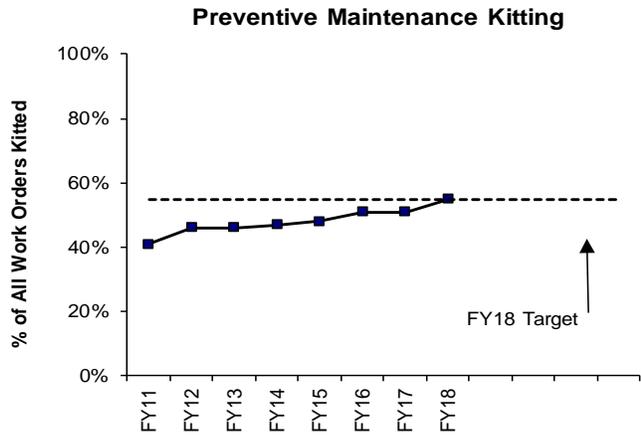
Deer Island Yearly Maintenance Metrics

FY18

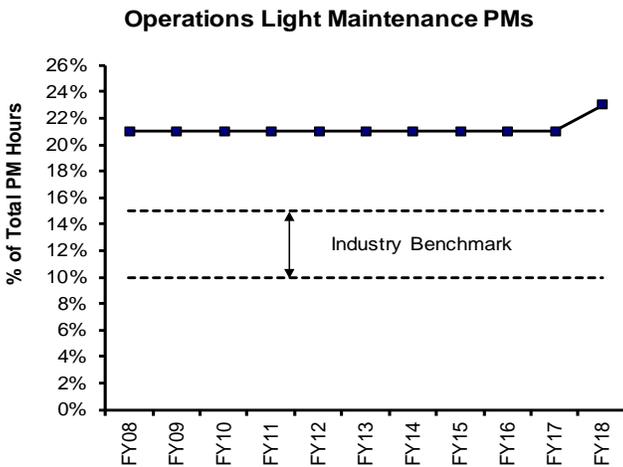
Proactive and Productivity Measures



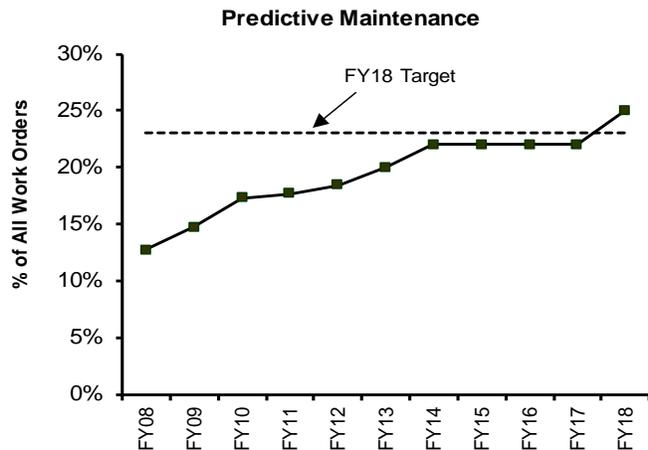
The industry benchmark is 90% for Preventive Maintenance completion. Upon reaching the 90% goal in FY05, the target goal was increased to the "Best in Class" Target of 100% PM completion. Since then, the percentage of PM work order completion has been at 99% or higher. Reliability-Centered Maintenance (RCM) and PM optimization efforts have continued since FY01. PM completion rate was 99.9% in FY18.



Preventive Maintenance inventory items were loaded into Maximo to assign spare parts for equipment to PM work orders. DITP reached the PM kitting goal of 100% in FY10. In FY11 a new graph (above) was developed to track kitting of all maintenance work orders in an effort to increase wrench time. Staff continues to fine-tune the process to "kit" all maintenance work orders. Kitting is considered a best practice by maintenance and reliability professionals. It entails staging parts necessary to complete maintenance work. Kitting allows maintenance staff to spend more time "turning the wrench" and less time waiting for parts at the stockroom window. Kitting for FY18 was 55% of all work orders, equalling DITP's new goal of 55%.



The percentage of preventive maintenance work order hours completed by Operations staff (not maintenance staff) increased from less than 1% in January 2002 to the current level of 23% in FY18. DITP reached the industry benchmark range of 10-15% in April 2003 and has exceeded the goal through FY18. Operations completes approximately 650 PM work orders per month.

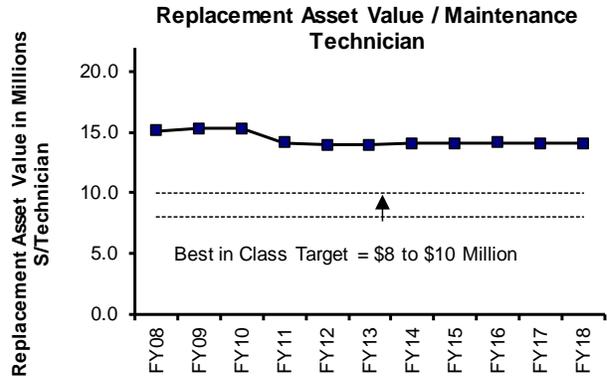
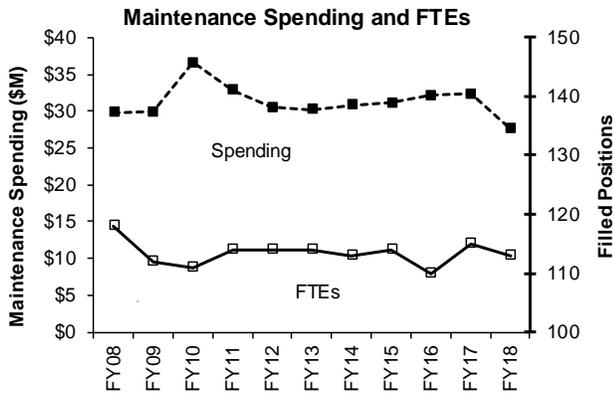


Predictive maintenance has steadily increased from 2% in FY03 to 25% in FY18, DITP's FY18 new goal of 23% was exceeded. The increase in predictive maintenance was achieved through the expanded use of lubrication, vibration, thermography, and acoustic ultrasonic testing techniques. The Condition Monitoring Group continually reviews and investigates new opportunities and initiatives to expand condition monitoring testing and analysis.

Deer Island Yearly Maintenance Metrics

FY18

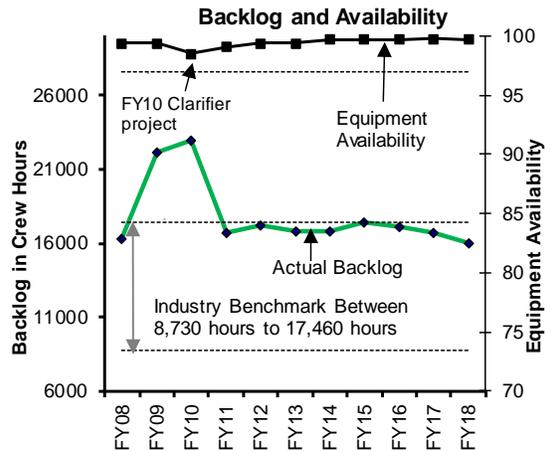
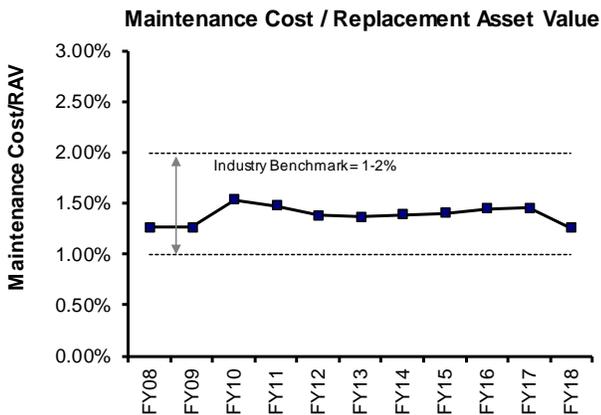
Overall Maintenance Program Measures



DITP's Maintenance staff is currently at 113 FTE's. Maintenance has been successful in meeting its goals through implementation of numerous maintenance efficiencies including: Operations staff performing light maintenance, cross-functional training and flexibility, and Reliability-Centered Maintenance.

DITP adopted a "best in class" target of \$8-\$10 Million/Technician for maintenance staffing. Even after a period of downward trending, DITP remains above this Best in Class target range. However, as the plant ages and additional equipment replacements are expected, DITP management will reassess staffing as needed.

The Maintenance Spending graph shows actual annual maintenance spending and large CIP asset replacements (equipment costs only). Maintenance budgeting continues to evaluate plant assets and requirements for replacement of obsolete equipment to ensure the plant operates at maximum efficiency. In FY18, overall spending decreased from FY17 due to some Maintenance Projects being delayed; Exterior Door Contract, Coatings Contract, PICS Upgrade and Lighting Demand. Scheduled and completed projects during FY18 included: Secondary Battery A & B Valve Replacements, Residuals Rotary Screen Rebuild, Rebuilding of Scum Hoppers, Winthrop Terminal Facility Valve Replacement and Rehabilitation of Gravity Thickeners #5 and #6. The large spike in FY10 and FY11 is attributed to the Clarifier Rehabilitation Project (\$58M), which was an on-going during that period.



The industry benchmark for annual maintenance spending is between 1% to 2% of replacement asset value, currently DITP is at 1.26%. The plant's replacement asset value is calculated at approximately \$2.4 billion dollars. DITP's current maintenance spending is within the industry benchmark. As the plant ages and equipment replacement is required, spending is expected to increase. DITP Maintenance CEB spending is \$12.1 million coupled with CIP spending which funded Secondary Battery A & B Valve Replacements, Rebuilding of Scum Hoppers, Winthrop Terminal Facility Valve Replacement and Gravity Thickeners #5 and #6 Rehabilitation.

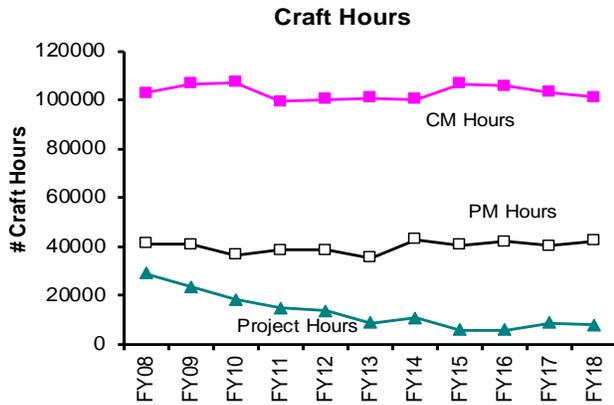
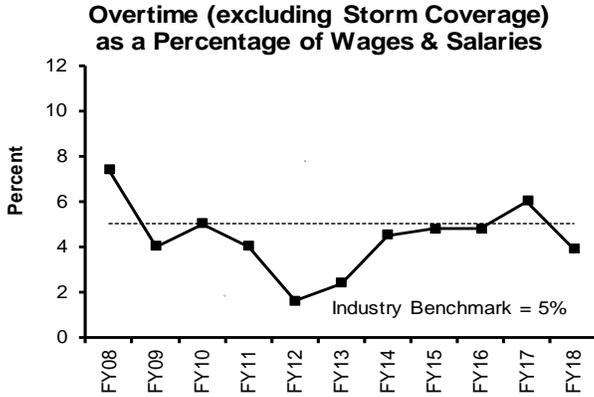
Industry benchmark for Equipment Availability is 97% and over the last ten years, equipment availability has consistently exceeded the benchmark. In FY18 the availability was 99.7%. The very slight decrease in Equipment Availability during FY18 was due to the Internal Rehabilitation of Gravity Thickeners #5 and #6. FY10's decrease was due to the Clarifier Rehabilitation Project.

Industry Benchmark for Backlog is between 8,730 to 17,460 hours for maintenance based on current staffing, the total average backlog for FY18 was 16,052 hours, which is below the industry benchmark. The slight decrease in backlog is from utilizing staff during Cable Outages and Wet Weather to perform light maintenance tasks.

Deer Island Yearly Maintenance Metrics

FY18

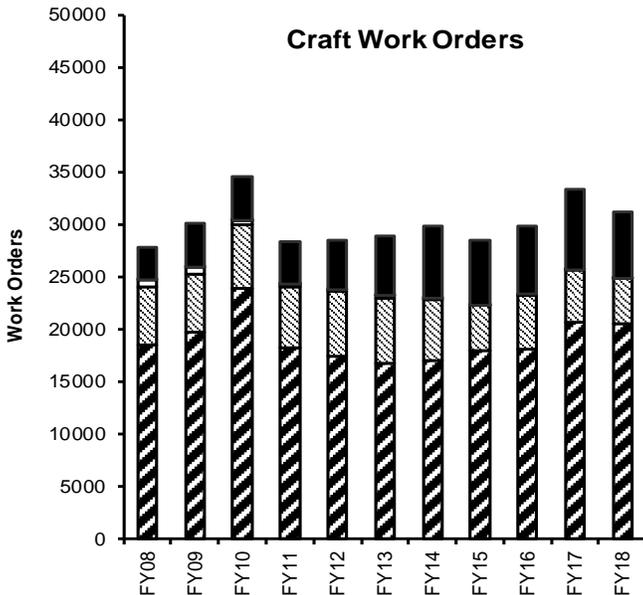
Overall Maintenance Program Measures (cont.)



Management continues its effort to keep overtime below the industry benchmark. DITP maintenance overtime was 3.9% for FY18. Management has taken steps to reduce overtime spending by limiting overtime to repair critical equipment and systems only. DITP has been on or under Industry Benchmark from FY08 through FY16. The increase in overtime in FY17 was due to the Eversource Cable Outage Project.

Continued optimization of the Preventive Maintenance (PM) program through the transfer of some light maintenance tasks from Maintenance to Operations staff (23% of PM hours at the end of FY18), elimination of duplicate work orders, increasing PM frequency due to equipment history and performance. Installation of new equipment and combining some PM's resulted in a slight increase in PM hours in FY18.

Corrective Maintenance (CM) hours slightly decreased from last year. Project Maintenance hours slightly decreased due to a number of CIP projects being completed: Secondary Battery A & B Valve Replacements, Residuals Rotary Screen Rebuild, Winthrop Terminal Facility Valve Replacement and Gravity Thickeners #5 and #6 Rehabilitation.



During FY18, the number of work orders decreased by 2,180 from the previous year. The decrease in work orders was due to Planning combining some PM work orders. The number of Corrective Maintenance work orders decreased slightly in FY18. Project work orders decreased for FY18 due to CIP projects being completed.

The Planning department is continuously modifying PM, PdM, and CM Job Plans to ensure maintenance is being performed efficiently and effectively, while ensuring reliability and availability of DITP's Assets.

- Predictive Maintenance
- Emergency Maintenance
- Project
- ▨ Corrective Maintenance
- Preventive Maintenance

Status Sheets
Wastewater Transport System
July 2017 - June 2018

Wastewater Transport Facilities

1. Facilities Operational Statement

During FY18 Wastewater Transport facilities operated at full capacity throughout the year. All required equipment to maintain flow and processing of wastewater was available with the following exceptions: Chelsea Creek Headworks: Channel #1 was unavailable from January 2, 2018 to June 30, 2018 for channel rehabilitation; Channel #2 was unavailable from July 1, 2017 to July 24, 2017 for PCB remediation; Channel #3 was unavailable from July 24, 2017 to September 11, 2017 for PCB remediation; Channel #4 was unavailable from September 11, 2017 to October 16, 2017 for PCB remediation. There were no operational impacts as a result of this work and all required flows were processed through the Chelsea Creek Headworks during the work associated with these capital improvements. The CSO facilities operated with sufficient chlorination and dechlorination, though some NPDES exceedances were reported. The required number of pumps in each gravity and pumping CSO was available throughout the year.

2. Equipment Availability

The average equipment availability for FY18 was 99.97%. An equipment availability report is generated daily that details the critical equipment required to collect and transport the wastewater flow at the facility design capacity. Higher maintenance priority is given to equipment that drops below the number required. Because of the high daily equipment availability, no operational impact has occurred in the past year.

3. SCADA Program

The MWRA Supervisory Control and Data Acquisition (SCADA) system provides a means of monitoring and controlling facilities and equipment from a remote centralized location, as well as providing a continuous record of facility operations. Although the system is continuously being upgraded through Capital Improvement Program projects and in-house efforts, the SCADA system for all FOD facilities has been in place since FY10.

MWRA SCADA staff perform the required maintenance and upgrades to the majority of the field instrumentation and control panel equipment to ensure accurate measurements and continued operation throughout MWRA's FOD facilities. During FY18, these efforts were supplemented by an Instrumentation Service Contractor who was primarily responsible for performing calibrations and corrective service to the gas monitoring systems within facilities and at H₂S monitoring sites within MWRA interceptors. SCADA staff also maintain, upgrade, program, and patch the computers and hardware used in collecting, controlling, transmitting and displaying facility data. During FY18, continued emphasis was placed on improving MWRA's cyber security posture. This included work on converting the SCADA communications network to "Domain" architecture,

where user accounts and policies are centrally managed via a “Domain Controller” and the expansion of the network monitoring system.

Equipment Replacement and Significant Maintenance Projects

Equipment replacement is part of the overall maintenance strategy that ensures compliance with permit requirements. Projects and initiatives are completed during each fiscal year to maintain redundancy and continued reliability. Many projects are extensive, requiring significant in-house resources and use of specialty/service contractors. Some examples of key improvements, equipment replacement, or significant repair work during the past fiscal year include in-house and outsourced projects.

Maintenance Projects and Equipment Replacement:

In-House Projects

Staff continued to work to replace equipment at the headworks to maintain equipment reliability on an as-needed basis. Each year, staff evaluate systems for upgrade. All channels, all dewatering pumps have been replaced or overhauled. Work continues to maintain reliability and availability of the headworks systems through Preventive and Predictive Maintenance Practices. The following is a detailed list of in-house work performed at all wastewater facilities in Metro East.

- Squantum Pump Station: Electrical Staff upgraded Variable Frequency Drive (VFD) # 1.
- Chelsea Creek, Columbus Park and Ward Street Headworks: Plumbing Staff performed Ultrasonic Thickness Testing on all Grit/Screen Pods, Grit Pipe and Grit Fittings.
- Hough’s Neck Pump Station: Electrical Staff performed Infrared Thermography Inspections on electrical switchgear.
- Nut Island Headworks, South Boston CSO Vent Building, Quincy Pump Station: Mechanical Staff performed Vibration Monitoring.
- Nut Island Headworks: Facility Staff removed and replaced deteriorated concrete curbing on pier.
- Nut Island Headworks: Mechanical Staff removed and replaced conveyor belting on Grit Conveyor # 4.
- Somerville Marginal CSO: Mechanical and Machine Shop removed and replaced Screen #2 head shaft and bearings.
- Somerville Marginal CSO: Plumbing and Electrical Staff installed Vaughn Chopper pumps in channels 1 & 2.
- DeLauri Pump Station: HVAC Staff installed upgraded Air Handling Unit AHU-1.

Outsourced Projects

- Headworks Duct Cleaning Nut Island, Ward Street and Columbus Park: \$400,000
OP-336 Duct Cleaning Contract cleaned all of the ductwork at Nut Island, Ward Street and Columbus Park. As part of the cleaning the duct work was repaired and sealed, to ensure better air quality and efficiency within the facilities.
- Braintree Weymouth IPS: \$400,000
Air Conditioning Unit # 1 for the Electrical Room and Control Room failed and was replaced under Contract OP-347.
- Storage Mezzanines Chelsea Covered Storage/Inside Storage: \$42,000
Installed two mezzanine storage units Chelsea Maintenance Facility covered and inside storage to alleviate storage needs in Chelsea Warehouse.
- Screen Pod Replacement Columbus Park Headworks: \$81,000
Screen Pod # 3 failed and needed to be replaced. The pod was manufactured by Westech Environmental, due to the long lead time associated with the fabrication we had three pods fabricated in the event of future failures at either Columbus Park or Ward Street.
- Braintree Weymouth IPS Pump # 3 VFD Replacement: \$254,000
The VFD on Pump # 3 failed and needed to be replaced in order to maintain pumping redundancy. The VFD was purchased by Standard Electric and installed by MWRA Medium Voltage Electrical Staff.
- Nut Island Fire Pump Controller # 4 Replacement: \$52,978
The fire pump controller was purchased and replaced by SullyMac. The fire pump controller failed and parts were obsolete and unavailable. All work was performed by outside contractor SullyMac and monitored by Engineering Staff.
- Nut Island HVAC Insulation Installation: \$82,058
The HVAC Units Insulation was damaged from water and needed to be removed and replaced. The work was performed under Contract OP-344, to remove and replace all interior insulation on all HVAC Units at the Nut Island Headworks. Work was performed by Marine Insulation Services Inc. and monitored by MWRA Construction Coordinators.

Capital Projects

In addition to the maintenance projects listed above, the following Capital Improvement projects are underway:

- Chelsea Creek Rehabilitation Contract 7161
- Alewife Brook Pump Station Rehabilitation Contract 6797
- DeLauri Pump Station Screen Replacement Contract 7361
- Reading Extension Sewer Rehabilitation Contract 7164

Wastewater Transport Pipelines

1. Manhole Inspection and Rehabilitation Program

The Technical Inspections Unit (TIU) of the FOD conducts manhole inspections. These inspections facilitated the beginning of the manhole rehabilitation program. Specialized equipment and training are the essential elements of the program. Pipeline maintenance crews perform manhole renovations and repairs that result in reduced I/I. The manholes are coated using cementitious material applied with spinning equipment and then covered with special coatings to resist corrosion from hydrogen sulfide.

In FY18 TIU staff inspected a total of **750** manholes. Approximately 175 manholes were rehabilitated utilizing in-house staff. The rehabilitation work included frame and cover replacement, external repairs to raised manholes, internal repairs using the spin-cast application, and other miscellaneous repair work.

2. Pipeline Rehabilitation

Pipeline Rehabilitation projects are first identified by the TIU during routine television inspections of the pipelines and interceptors. MWRA engineers review these projects and perform or coordinate all necessary design and construction contracting. The following are the pipeline construction/rehabilitation projects under design & construction in FY18:

- Contract 7164 – Reading Extension Sewer Construction (Project Completion expected Oct 2018)
- Contract 7512 - Dorchester Interceptor Design (90% design submitted Aug 2018)
- Contract 7643 – Charles River Valley Sewer Rehabilitation (In-house design in progress)
- Contract 7540 – North Metropolitan Sewer Section 19, 20 & 21 Rehabilitation (Draft PDR submitted Sept. 2018)
- Contract 7423 – North Metropolitan Sewer Section 4, 5,6 & 186 Study (Final Report submitted April 2018)
- Contract 7511 – Cambridge Branch Sewer Study (Final Report submitted Dec 2017)

3. Pipeline Inspection and Cleaning

The Technical Inspection and Wastewater Pipeline Maintenance groups were merged to more efficiently and consistently maintain the wastewater collection system. The work performed by the inspection staff is an important element to the planning and execution of pipeline maintenance work. The inspection tasks are shared by the entire staff and the maintenance workload is prioritized based on inspection data and information.

TIU conducts internal inspections of MWRA structures and pipelines to reveal potential problem areas and identify locations requiring maintenance. Pipeline inspections average about 70% of the workload followed by inspections of other structures and manholes. Approximately 32.81 miles of pipelines were TV inspected in FY18.

Community Assistance was provided to member communities on an as-needed basis. This assistance included:

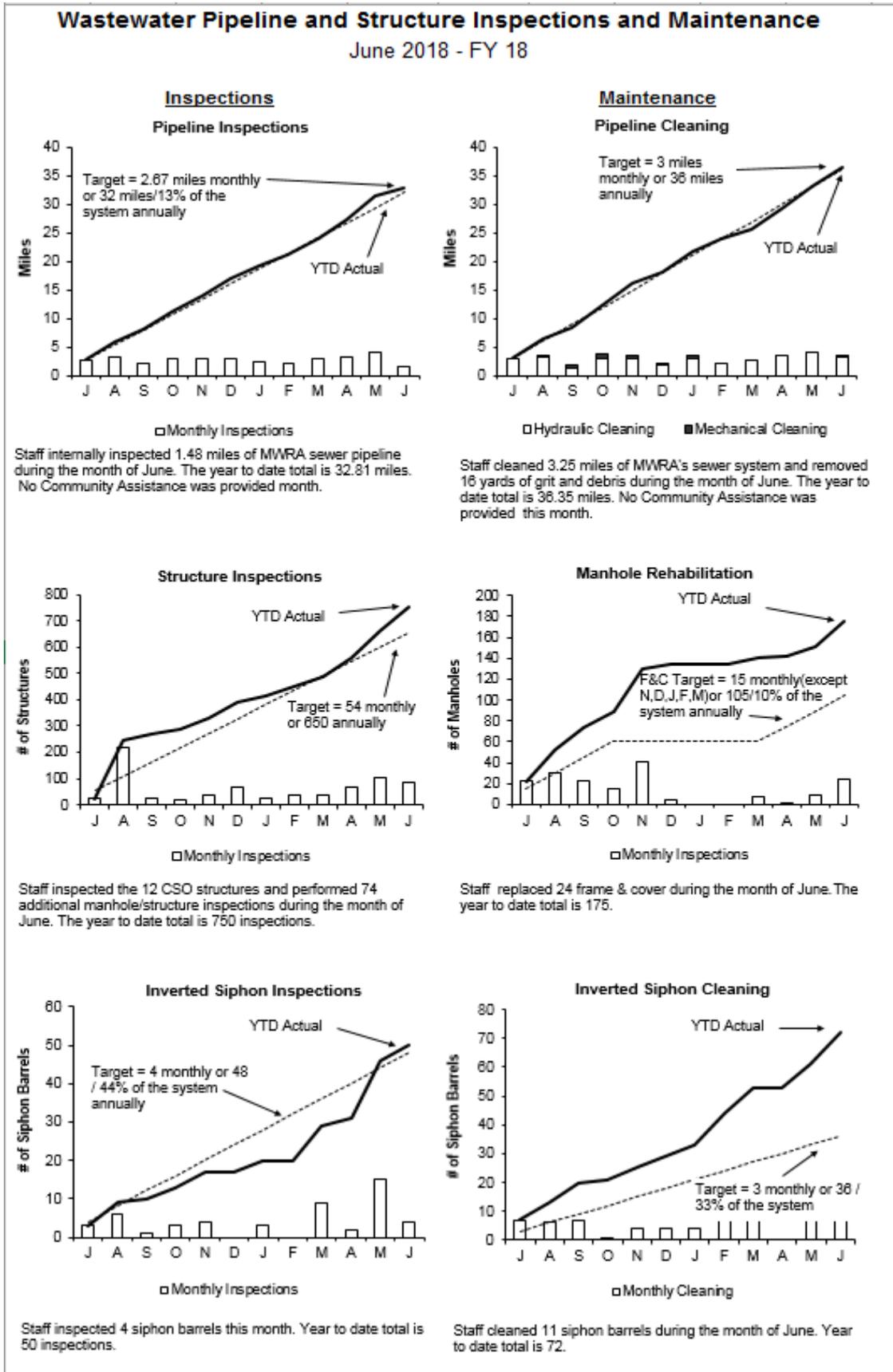
- Community Assistance was provided to the city of Somerville. Staff inspected 2,937 linear feet of 24-inch sewer pipe and discovered a collapse.

Pipeline maintenance crews perform a variety of maintenance activities for the MWRA's Wastewater Transport system. The Transport collection system includes 240 miles of interceptor sewer lines. Approximately 36.25 miles of pipeline and 72 siphons were cleaned in FY18.

In addition to general pipeline and manhole repair work performed under this program, the following are other activities pipeline crews perform during the year:

- Pipeline spot repair work in shallow excavations
- Clear obstructions and clean sections in community lines under the Community Assistance Program
- Snow plowing and removal during winter months
- NPDES inspections and best practice management activities
- Emergency pumping activities for communities during major wet weather events
- By-pass pumping for contracted pipeline rehabilitation or repairs
- Emergency response and overflow monitoring during wet weather events
- Response to odor complaints in the system

The “Maintenance Pipeline and Structure Inspections and Maintenance” page below provides a breakdown of the pipeline inspections and maintenance activities for FY18.



Wastewater Transport Equipment Maintenance

The Field Operations Department Equipment Maintenance page for key indicators of performance for FY18 is on the next page. Monthly maintenance data is shown under six headings.

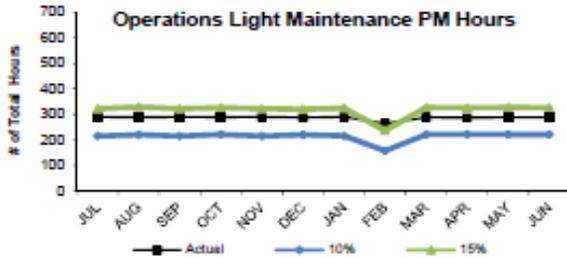
- Operations Light Maintenance Hours – In an effort to free up Maintenance staff to complete more detailed and complex maintenance, Operations staff have been committed to completing a number of the routine monthly preventative maintenance (PM) tasks. These tasks generally consist of observation and light maintenance tasks. The industry benchmark is 10% - 15% of the total preventative maintenance hours. In FY18, Operations staff completed an average of 287 hours per month which accounted for 14.25% of the total preventative maintenance hours.
- Overall Preventive Maintenance – The preventative maintenance work orders are completed by both operation and maintenance staff. The goal for FY18 was to complete 100% of all preventative maintenance work orders. The PM completion for FY18 was 100%.
- Items Kitted Utilizing Maximo – In an effort to more efficiently complete work, maintenance staff and work coordination center staff have utilized the Lawson/Maximo interface to better kit stock and non-stock material. The goal is to kit 30% of all work orders. The average for FY18 was 24% of all work orders.
- Operations Light Maintenance % PM Completion – In an effort to free up Maintenance staff to complete more detailed and complex maintenance, Operations staff have been committed to completing a number of the routine monthly preventative maintenance duties. The goal for Operations staff is to complete 100% of the preventative maintenance work orders. In FY18 Operations staff completed 100% of the work orders.
- Maintenance Backlog in Crew Hours - Backlog is determined by totaling the planned craft hours in open work orders and comparing them to craft resources available. The FY18 backlog average was 12,586.5 hours which remains within the industry standard of 6,450 to 12,940 hours.
- Overtime Spending – Maintenance overtime spending was \$177,000 over budget for FY18. The overtime was used to support call-ins for emergency maintenance and planned overtime. It was also used for maintenance coverage related to weather events.

2. Critical Equipment Availability

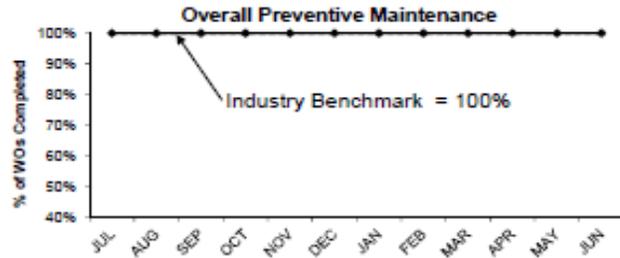
The average equipment availability for FY18 was 99.97 %. An equipment availability report is generated daily that details the critical equipment required to collect and transport the wastewater flow at the facility design capacity. Higher maintenance priority is given to equipment that drops below the number required. Because of the high daily equipment availability, no operational impact has occurred in the past year.

Field Operations' Metropolitan Equipment & Facility Maintenance 4th Quarter - FY18

Several maintenance and productivity initiatives are in progress. The goal for the Overall PM completion and the Operator PM completion was raised to 100% for Fiscal Year 2010. The Operator PM and kitting initiatives frees up maintenance staff to perform corrective maintenance and project work, thus reducing maintenance spending. Backlog and overtime metrics monitor the success of these maintenance initiatives.



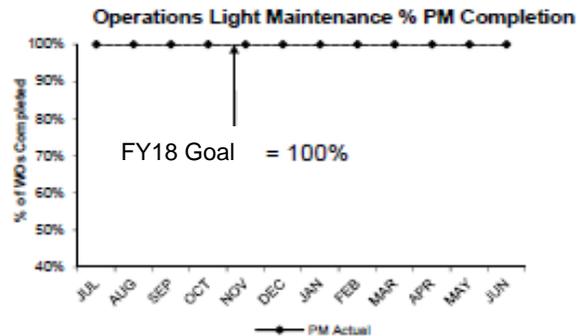
Operations staff averaged 287 hours of preventive maintenance during the 4th Quarter, an average of 15% of the total PM hours for the 4th Quarter, which is within the industry benchmark of 10% to 15%.



The Field Operations Department (FOD) preventive maintenance goal for FY18 is 100% of all PM work orders. Staff completed an average of 100% of all PM work orders in the 4th Quarter.



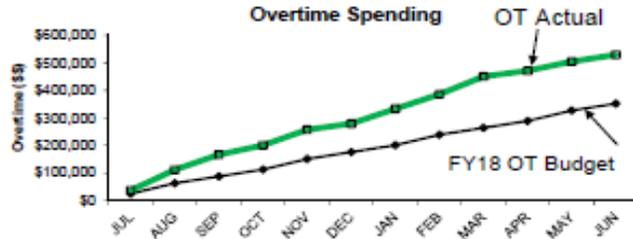
Operation's FY18 maintenance kitting goal has been set at 30% of all work orders to be kitted. Kitting is the staging of parts or material necessary to complete maintenance work. In the 4th Quarter, 28% of all applicable work orders were kitted. This resulted in more wrench time and increased productivity.



Wastewater Operators complete light maintenance PM's which frees up maintenance staff to perform corrective maintenance. Operations' FY18 PM goal is completion of 100% of all PM work orders assigned. Operations completed an average of 100% of PM work orders in the 4th Quarter.



The 4th Quarter backlog average is 13168 hours. Management's goal is to continue to control overtime and still stay within the industry benchmark of 6636 to 13275 hours.



Maintenance overtime was at budget for the 4th Quarter. Overtime was used for critical maintenance repairs. Overtime for FY18 is \$520k which is currently 177k over budget for the fiscal year.

Status Sheets
Fore River Pelletizing Plant
July 2017 – June 2018

Critical Equipment Availability: 91.91%

Operating logs indicate that of the 2,190 machine days in fiscal year 2018, centrifuges were available for 2,013 days for an availability of 91.91%. The centrifuges and ancillary equipment make up the critical components at the Pelletizing Plant because dewatered sludge can be processed through the dryers or it can be sent through a bypass system to trucks and taken to a landfill. The primary driver of downtime was the factory reconditioning of two complete rotating assemblies, which reduces capacity while those machines are off site. At the present time, all 12 centrifuges are available giving the Plant more than enough capacity to process flows from Deer Island. The facility is currently operated on a 5-day workweek ceasing operations on most weekends.

Backlog:

At fiscal year-end, there were nine outstanding work orders. Of the nine, seven are PMs and two are listed as “other.”

Maintenance Work Orders:

In FY2018, there were 1,037 work orders generated in the CMMS. Of those 1,028 were completed during the fiscal year, equating to a 99.9% completion rate. The new eMaint CMMS system has allowed the plant to better track ongoing work orders. The Preventative Maintenance system is continuously being modified to include updates for equipment changes, lubrication schedules, and equipment inspection and cleaning practices. In addition, the operations staff are utilizing the system to track non-routine cleaning tasks to better gauge necessary frequency and to allow these cleanings to be scheduled as preventative rather than corrective actions.

Maintenance:

More than \$1.40 million was spent on replacement parts and maintenance related items in FY2018, including the following:

- A new VFD was purchased and installed in RTO 1 after a power bump caused a failure in the original drive.
- Replaced ceramic media in two of four RTO’s
- Centrifuge repairs – two complete rotating assembly were sent back to the manufacturer and have been overhauled to OEM condition
- Conveyor Repairs – Several small to medium repairs were completed; Major repairs include:
 - Replaced Separator A conveyor on trains 2 and 5
 - Repaired Recycle bin conveyors on trains 1 and 3
- One of the site’s main boilers was replaced with a new boiler.