



MASSACHUSETTS WATER RESOURCES AUTHORITY

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October 29, 2021

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Boston, MA 02109-3912

Kevin Brander
Northeast Regional Office
Massachusetts Department of
Environmental Protection
205B Lowell Street
Wilmington, MA 01887

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

Dear Mr. Borci and Mr. Brander:

Enclosed please find the MWRA's annual status sheets on plant performance and maintenance for the period covering July 2020 – June 2021. 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 email Betsy Reilley at Betsy.Reilley@mwra.com.

Sincerely,

Carolyn Fiore
Deputy Chief Operating Officer

Enclosures:

- Annual Report on Operations and Maintenance, FY2021
- Status Sheets with key indicators of maintenance, FY2021
 - Deer Island Treatment Plant
 - Wastewater Transport System
 - Fore River Pellet Plant

cc: F. Laskey, MWRA
D. Coppes, MWRA

MWRA Annual Report on Operation & Maintenance

July 2020 - June 2021

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 Wastewater Operations Department 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 might 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, capital improvements, and training of staff. Since the Maximo upgrade in 2018, DITP is continuing to build the program with the addition of the Clinton site, 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. Due to the COVID-19 outbreak during the 3rd and 4th quarters of FY20, some benchmarks were below the internal goals and industry standards.

4. COMPUTERIZED MAINTENANCE MANAGEMENT SOFTWARE

Maximo is the Enterprise Asset Management (EAM) software program used by MWRA. The MWRA uses Maximo version 7.6.0.9 (7.6), which is supported by Maximo developer IBM. Maximo EAM includes job and safety plan modules 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 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.

Maximo 7.6 added functionality to track labor, material, service, service contract, spare part costs and usage for over 144,000 assets.

Maximo 7.6 provides the MWRA with updated technology, increasing functionality for maintenance and improved reporting capabilities. The MWRA is now on one instance of Maximo with Deer Island, Field Operations, Information Technology (IT) (formerly Management Information Systems group), Laboratory asset tracking, and Vehicle Maintenance accessible in a single-organization, multi-site application. This increases productivity and limits the number of software systems to perform asset management functions. In addition, Maximo 7.6 add-ons include Maximo Calibration for instrumentation and SCADA assets and Maximo Spatial for buried assets and pipelines.

Clinton Advanced Wastewater Treatment Plant is now using Maximo 7.6. The Clinton Maximo site continues to be built out and PM schedules are in process.

Operations and Maintenance continues to collaborate with IT enhancing Maximo's automation capabilities, data display and reporting efficiencies, and end-user usability, along with preparing to upgrade Maximo to version 7.6.1.

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 show 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 (Legionella testing)
Fire Sprinkler Repair Contract
Hydro turbine generator maintenance
Hydraulic maintenance
Janitorial services
Lab hood certification
Locksmith services
Lube oil analysis
Oil/water separator cleaning
Overhead door maintenance
Pest control
Plant and Public access landscape services
Plant instrumentation and control system (PICS) maintenance
Pratt Whitney (CTG OEM) Preferred service
Reactor Mixer gearbox rebuild
Recycle contract (Scrap/Paper)
Security
Steam turbine generator maintenance
Trash removal
Vibration analysis

TABLE 2 FIELD OPERATIONS 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
Grounds keeping
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), and the Fore River Pelletizing Plant.

Status Sheets
Deer Island Treatment Plant
July 2020 - June 2021

Deer Island Maintenance reporting on Key Performance Indicators for FY21.

- 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%; 21,023 PM work orders were initiated this year. PM completion rate was 94% in FY21. This year's decrease was caused by vacancies and COVID-19 staff absences due to quarantining.
- 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 was slightly under its goal of 57%, with 56% in FY21. This year's decrease was caused by vacancies and COVID-19 staff absences due to quarantining.
- Predictive Maintenance - Extending the useful life of equipment, by monitoring and trending equipment characteristics, allows for better planning for equipment replacement. 6,820 work orders were completed for vibration, acoustic ultrasonic, ultrasonic thickness, and oil analysis. Deer Island met its goal of 25% in FY21 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 available craft resources. The average backlog in FY21 was 19,672 hours, equaling 7 weeks of work for the entire Maintenance workforce. This backlog exceeds the industry standard 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. This year's increase was caused by vacancies and COVID-19 staff absences due to quarantining.
- Maintenance Overtime - The goal is to maintain maintenance overtime at or below 5% of total wages and salaries. DITP was below the benchmark at 4.8%.

Critical Equipment Availability: 12-Month Average — 99.8%

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 critical equipment that drops below the number required to treat the maximum flow. No operational impact has occurred in the past year from a 99.8% versus 100% availability because the plant normally operates at approximately one-quarter of the design flow capacity.

Average Craft Hours and Work Orders per Month:

Preventative Maintenance	2728 hours	24%	1752 work orders	58%
Predictive Maintenance	160 hours	1%	528 work orders	18%
Corrective Maintenance	7410 hours	67%	304 work orders	10%
Emergency Maintenance	14 hours	1%	12 work orders	1%
Project Work	101 hours	1%	21 work orders	1%
Other (SERV, CBM, NPL, NE, EVT, STND.)	632 hours	6%	358 work orders	12%
Total	11,045 hours	100%	2975 work orders	100%

Total Work Orders:

35,700 work orders initiated in FY21
 33,532 work orders completed/closed in FY21

Maintenance Projects and Equipment Replacement:

- **Digester Mixer Rebuild \$100,940**
 There are twelve egg-shaped anaerobic sludge digesters at DITP, which have been in operation for more than 20 years. DITP operates eight mixers concurrently and continuously. A key component common to all of the digesters is the central mixer assembly. The mixer is critical to the proper operation of the digester. Routine maintenance is performed on the mixer assembly along with Predictive Maintenance. Acoustic and vibration tasks monitor asset health and can indicate impending failures before the failure becomes catastrophic and costly. When an impending failure is detected, staff removes and ships the mixer assembly to the manufacturer for refurbishment to original equipment manufacturers (OEM) specifications. Digester Module 2 Mixer Assembly 4 was refurbished in FY21.
- **Reactor Aerator/Mixer Gearbox Rebuilds: \$261,308**
 Secondary Reactor Batteries A, B, and C contain nine aerator trains, each train has (4) aerators and (4) mixers. In total, there are 72 gearboxes that drive 36 aerators and 36 mixers. Each aerator and mixer has a triple reduction gearbox and mixing blade. When condition monitoring techniques (oil analysis, vibration data and physical inspections) indicate a potential for failure, staff removes and ships out gearbox to be refurbished back to original operational parameters. Five gearboxes were refurbished in FY21 with new bearings, gears, seals and shafts.
- **Boiler, STG and Hydro Plant Maintenance: \$1,703,433**
 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 steam turbine 12-year overhaul.

- Cryogenic Facility Repairs: \$1,006,043
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 include replacing GOX Flow control valve and the Inlet Block valve, including Positioner.
- Grinder Rebuilds: \$149,581
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. 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 twelve in-line grinders this year.
- Electric Vehicles: \$232,342
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 seventeen new electric vehicles.
- HVAC Replacement: \$53,000
HVAC staff replaced two intake air handlers at Hydroelectric building. These were direct replacements due to existing units were problematic and exterior metals were showing signs of major corrosion.
- Centrifuges Refurbishment \$275,335
There are twelve waste sludge centrifuges, which, due to high speed rotating assembly and critical nature of the process, require maintenance. Centrifuges require refurbishment at regular intervals based upon running hours for normal wear and tear. Due to the intricacy of the equipment, all overhauls are sent back to Alfa Laval, the original equipment manufacturer. In the past year, two waste sludge centrifuges and gearboxes were refurbished. MWRA Staff is responsible to install and perform functional test units.
- Elevator Controllers Replacements \$133,115
We have replaced one existing elevator controller in the Disinfection Facility. We replaced the existing controller with a new Galaxy controller. The Galaxy controller's variable-frequency closed loop controller with phase 1-2 fire service and code compliant features is state of the art system. The existing controller was obsolete.

Capital Projects

In addition to the maintenance projects listed above, the following Capital Improvement projects included work for Deer Island in FY21:

- Winthrop Terminal Facility Pump and VFD Replacement, Contract 7395 (\$3.4m)
- Gravity Thickener Rehabilitation, Contract 6875 (\$19.6m)
- Chemical Storage Tank Rehab Project, (\$8.5M)

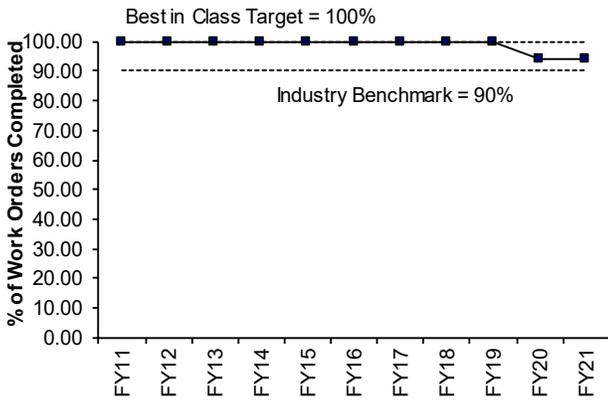
The following pages adapted from MWRA's quarterly performance report to the Board of Directors, the "Orange Notebook", summarize key indicators relating to Deer Island maintenance. The full Orange Notebook can be found at: <http://www.mwra.com/quarterly/orangenotebook/orangenotebook.htm>.

Deer Island Yearly Maintenance Metrics

FY21

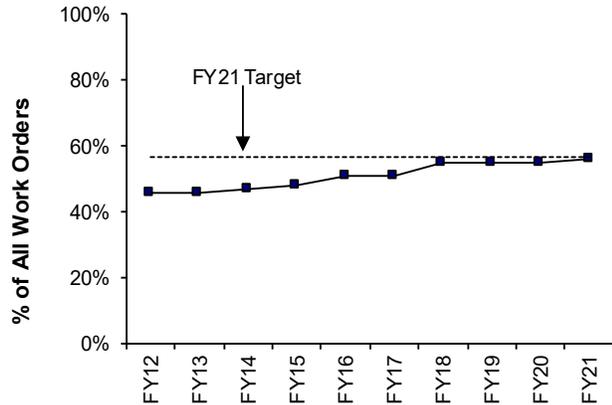
Proactive and Productivity Measures

Preventive Maintenance



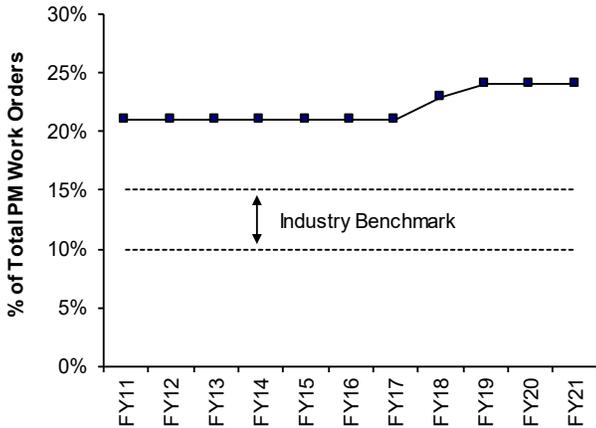
The industry benchmark is 90% for Preventive Maintenance (PM) completion. Upon reaching the 90% goal in FY05, the target goal was increased to the "Best in Class" Target of 100% PM completion. Reliability-Centered Maintenance (RCM) and PM optimization efforts have continued since FY01. PM completion rate was 94% in FY21. We managed to meet the Industry Benchmark, but the slight decrease was caused by vacancies and COVID-19 staff absences due to quarantining.

Maintenance Kitting



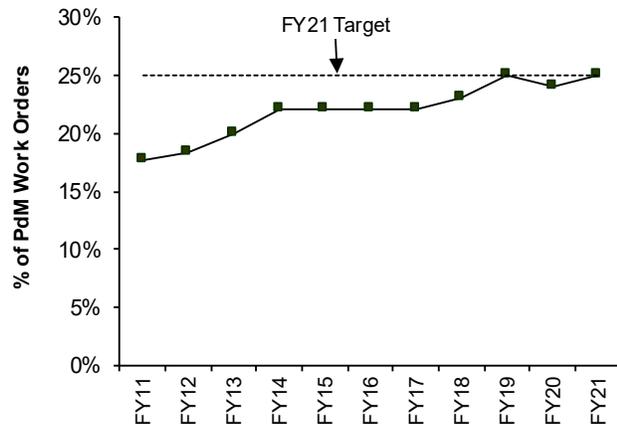
Preventive Maintenance (PM) inventory items were loaded into Maximo to assign spare parts for equipment to PM work orders. DITP reached the PM kitting goal of 100%. In FY12 a new graph (above) was developed to track kitting of all maintenance work orders in an effort to increase wrench time. Staff continues 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 FY21 was 56%, just below DITP's goal of 57%, kits were prepared, but some had to be put on hold because of vacancies and COVID-19 staff absences due to quarantining.

Operations Light Maintenance PMs



The percentage of preventive maintenance work order hours completed by Operations staff (non maintenance staff) increased from less than 1% in January 2002 to the current level of 24% in FY21. DITP reached the industry benchmark range of 15% in April 2003 and has exceeded the goal through FY21. Operations completes approximately 664 PM work orders per month. Operations work percentage stayed on track as operations was fully staffed through COVID-19.

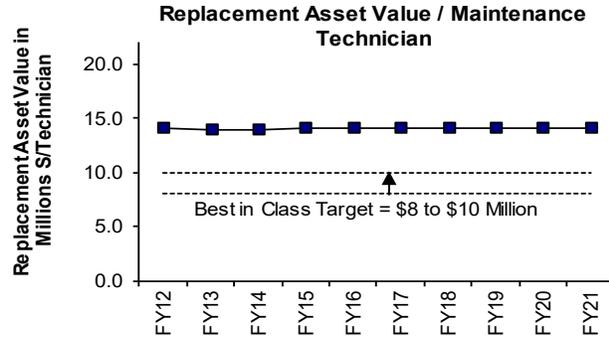
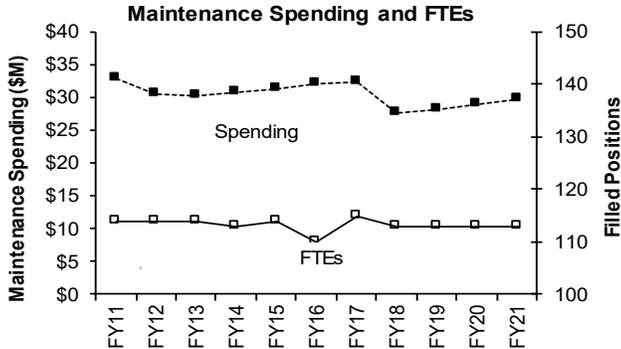
Predictive Maintenance



Predictive maintenance has steadily increased from 2% in FY03 to 25% in FY21. DITP met the FY21 goal of 25%. This percentage 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. The slight increase of Predictive Maintenance work orders, is due to less total work orders being generated because of vacancies and COVID-19 staff absences for quarantining.

Deer Island Yearly Maintenance Metrics FY21

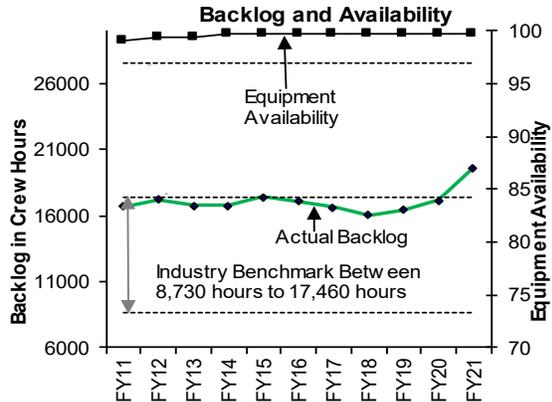
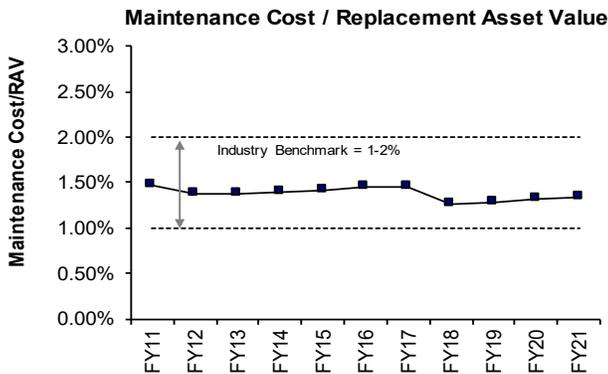
Overall Maintenance Program Measures



DITP's Maintenance staff is currently at 113 FTEs. Maintenance staff levels ended at 113, but for the majority of the year we had limited staff due to COVID-19, retirement and hiring challenges. Maintenance has worked to meet our goals through implementation of numerous maintenance efficiencies including: Operations performing light maintenance, cross-functional training and flexibility, and Reliable-Centered Maintenance. This year's Maintenance spending increased for materials and services, but not all parts were installed.

DITP adopted a "best in class" target of \$8-\$10 Million/Technician for maintenance staffing. DITP remains above this Best in Class. 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 significant 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 FY21, overall spending increased slightly from FY20 due to some large Maintenance Projects; Winthrop Motors and VFD Replacements, Gravity Thickener Rehabilitation, Gravity Thickener Overflow Piping Replacement, Gas Protection System Replacements, Coating Contract (Digesters, Overflow Boxes, Primary Scum Wells and Carbon Absorbers), two Hydro Plant Electrical Building Air Handler Replacements, Installation of two W3 Strainers, and the installation of New Explosion Proof Grit Samplers.



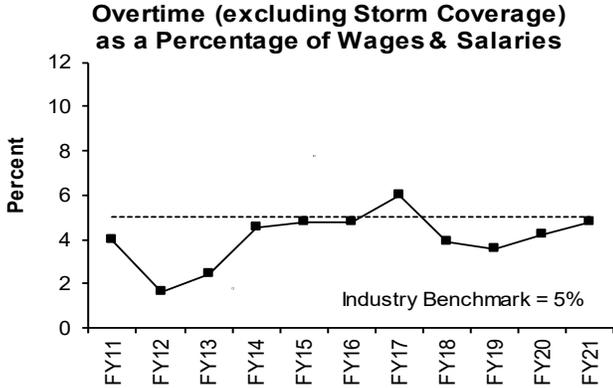
The industry benchmark for annual maintenance spending is between 1% to 2% of replacement asset value, currently DITP is at 1.32%. The plant's replacement asset value is calculated at approximately \$2.6 billion dollars. DITP's current maintenance spending is within the industry benchmark. Maintenance spending has increased since last year. DITP Maintenance CEB spending is \$23.7 million coupled with CIP spending of \$5.9 million (equipment costs only), totaling \$29.6 million.

Industry benchmark for Equipment Availability is 97%. Deer Island has exceeded this benchmark over for the last ten years. In FY21 the availability was 99.8%. The high percentage in Equipment Availability during FY21 is due to redundancy of equipment and effective/efficient maintenance practices.

Industry Benchmark for Backlog is between 8,730 to 17,460 hours for maintenance based on current staffing, the total average backlog for FY21 was 19,672 hours, which exceeds industry benchmark, due to vacancies and COVID-19 staff absences due to quarantining.

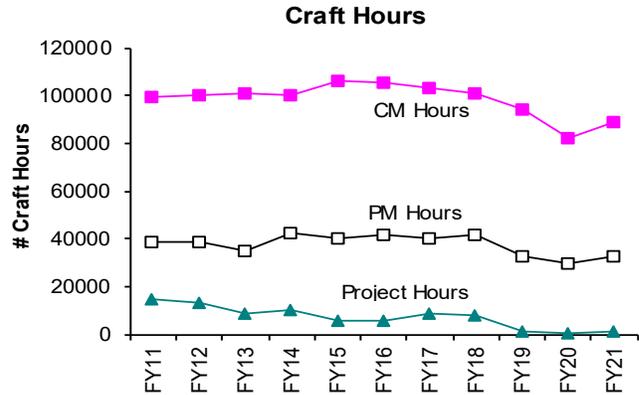
Non-Critical work orders were deferred for critical work orders, to ensure Deer Island Plant would operate at maximum capacity.

Deer Island Yearly Maintenance Metrics FY21 Overall Maintenance Program Measures (cont.)



Management continues its effort to keep overtime below the industry benchmark. DITP maintenance overtime was 4.8% for FY21. Management has taken steps to reduce overtime spending by limiting overtime to repair critical equipment and systems only. DITP has been under the Industry Benchmark every year except FY17, due to the increase in overtime for the Eversource Cable Outage.

The slight increase in overtime from last year was because of vacancies and staff absences due to quarantining.



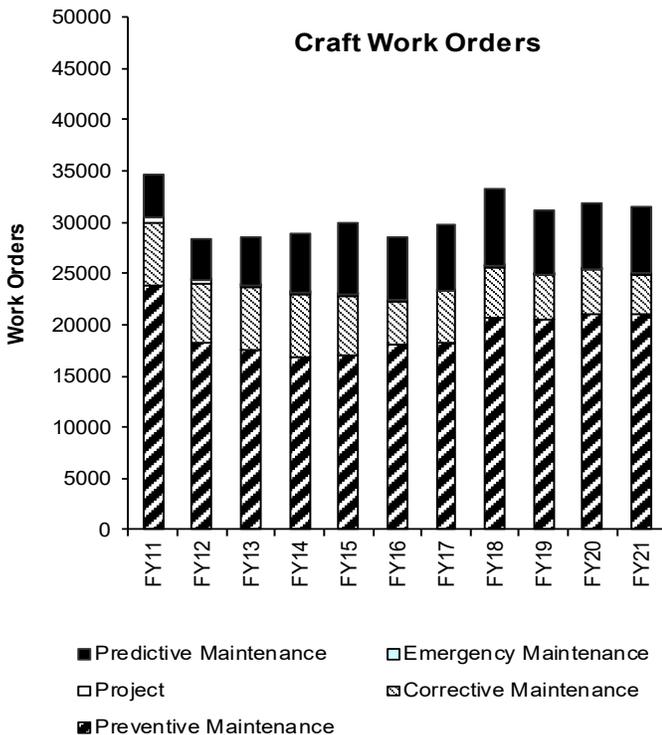
Continued optimization of the Preventive Maintenance (PM) program through the transfer of some light maintenance tasks from Maintenance to Operations staff (24% of PM work orders in FY21), elimination of duplicate work orders, combining some PMs, increasing PM frequency due to equipment history. This process was delayed because of vacancies and staff absences due to quarantining.

This year's significant increase in Corrective Maintenance (CM) hours was due to staff focused on (CM) work orders to ensure all critical equipment was on-line. Project work was put on hold.

Maintenance did complete some significant maintenance work in FY21: Overhauled Centrifuges #11 and #12, Primary AHU Coil Replacement BD:SA.AHU-2, Residuals Air Coil Replacement, Grit Screw Replacement AD:GR.CLSF-16, Fabrication of Grit Screws, Replacement Heating Actuator Valve for FA:SA.AHU-5, and Replacement of Secondary Air Condensing Unit Electrical Building #9.

During FY21, the overall number of work orders decreased by 56 from the previous year. The decrease in work orders was because of vacancies and staff absences due to quarantining.

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.



Status Sheets
Wastewater Transport System
July 2020 - June 2021

1. Facilities Operational Statement

During FY21 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 #4 was unavailable from June 30, 2020, to January 6, 2021 for channel rehabilitation. 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 this capital improvement project. 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 FY21 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 field 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 field facilities. During FY21, 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. SCADA staff also maintain, upgrade, program, and patch the computers and hardware used in collecting, controlling, transmitting and displaying facility data. During FY21, continued emphasis was placed on improving MWRA's cyber security posture. This included the conversion of 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. SCADA will be replacing existing firewalls with newer technology and more secure products which provide multi-factor authentication, encryption, segmentation, and high availability.

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. In all channels, flights, wear shoes and chains have been replaced on an as needed basis to maintain availability. 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: HVAC Staff upgraded Air Conditioning Unit.
- Prison Point Chemical Building: Plumbers upgraded Building Heating Boiler.
- Prison Point CSO: Plumbing Staff replaced wash down water lines in Wet Well and Channels 1, 2, and 3.
- Chelsea Administration Building: Electrical Staff installed additional Electric Vehicle Charging Stations.
- Chelsea Administration Building: Electrical Staff installed new conductors to replace failed in slab conductors for Second Floor Administration Building.
- Chelsea Vehicle Maintenance: Electrical Staff ran new conduit and conductors for two new vehicle lifts in bays 2 & 3 Vehicle Maintenance.
- Chelsea Maintenance Building: Electrical and Machinist Staff installed new lathe and milling machine in the Machine Shop.
- Columbus Park and Ward Street Headworks: Plumbing Staff performed Ultrasonic Thickness Testing on all Grit/Screen Pods, Grit Pipe and Grit Fittings.
- Infrared Thermography Inspections: Electrical Staff performed Infrared Thermography Inspections on electrical switchgear at seven Wastewater Pump Stations, two CSO Facilities and two Headworks Facilities.
- Vibration Monitoring: Mechanical Staff performed Vibration Monitoring at four Wastewater Pump Stations, two CSO Facilities and four Headworks Facilities.
- Nut Island Headworks: Plumbing Staff replaced all Seal Water lines to the Grit Classifiers.

- Nut Island Headworks: Mechanical Staff removed and replaced conveyor belting on Grit Conveyor # 4.

Capital Projects

In addition to the maintenance projects listed above, the following Capital Improvement projects are underway or completed in FY21.

Construction Project Started or On-going during FY21 Include:

- Chelsea Creek Rehabilitation - Contract 7161
- Nut Island Headworks Odor Control & HVAC Improvements - Contract 7548
- Fuel Oil Tank Replacement at the Hayes Pump Station - Contract 7554
- Dorchester Interceptor Rehab. Sections 240, 241 & 242 – Contract 7279

Design Projects Started or On-going during FY21 Include:

- Braintree-Weymouth Pump Station Improvements – Contract 7435 (100% design)
- Prison Point CSO Facility Improvements - Contract 7462 (100% design)
- Ward St. & Columbus Park Headwork Design/CA – Contract 7429
- Hayes PS Rehab. Design/CA – Contract 7162
- Remote HW Access Shaft Improvement (in-house) – Construction Contract 7550
- Siphon Structure Rehab Design/CA – Contract 6224
- CHE008 Pipe Replacement Design – TO Contract 7691
- Interceptor Renewal No. 7 Malden-Melrose Design/CS – Contract 7216

Wastewater Transport Pipelines

1. Manhole Inspection and Rehabilitation Program

The Technical Inspections Unit (TIU) of the Wastewater Operations Department 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 FY21 TIU staff inspected a total of **1,025** manholes. Approximately 64 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 FY21:

- Interceptor Renewal No. 3, Dorchester Interceptor Sewer Design CA/RI - Contract 7512
- Charles River Valley Sewer Rehabilitation Construction (Section 191 & 192) - Contract 7643
- Siphon Structure Rehab Design/CS/RI - Contract 6224
- Interceptor Renewal No. 7, Malden/Melrose Interceptor Sewer Design CA/RI - Contract 7216

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 23.02 miles of pipelines were TV inspected in FY21.

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 30.72 miles of pipeline and 64 siphons were cleaned in FY21. Due to the Covid 19, staff were out of work for most of the last quarter. This resulted in reduced pipeline maintenance numbers.

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

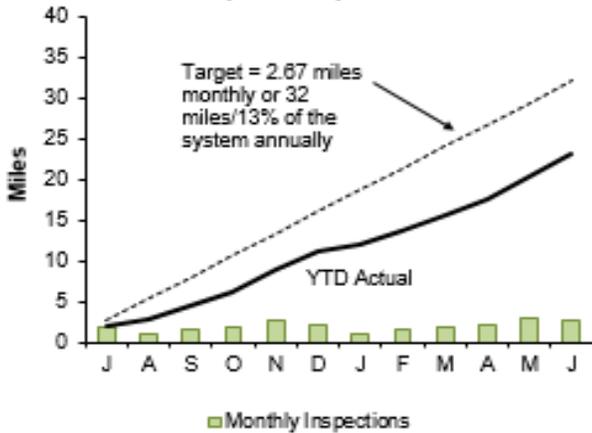
- Pipeline spot repair work in shallow excavations
- Clear obstructions and clean sections in community lines under the Community Assistance Program
- Snow plowing and removal during winter months
- NPDES inspections and best practice management activities
- Emergency pumping activities for communities 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 FY21.

Inspections

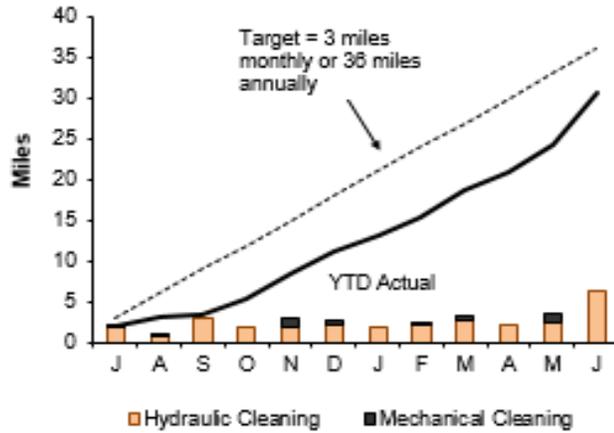
Pipeline Inspections



Staff internally inspected 2.68 miles of MWRA sewer pipe during this month. The year to date total is 23.02 miles. No Community Assistance was provided. Shortcomings for the month were a direct result of staffing availability.

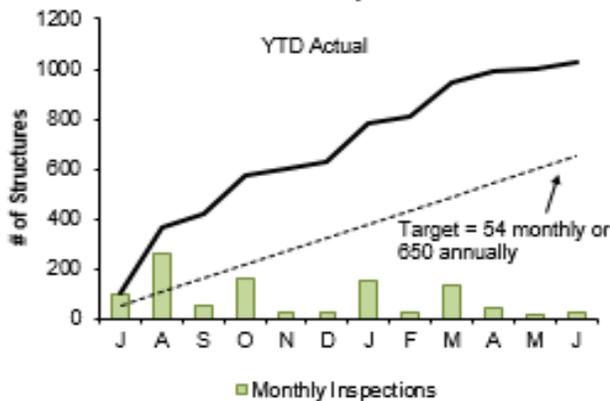
Maintenance

Pipeline Cleaning



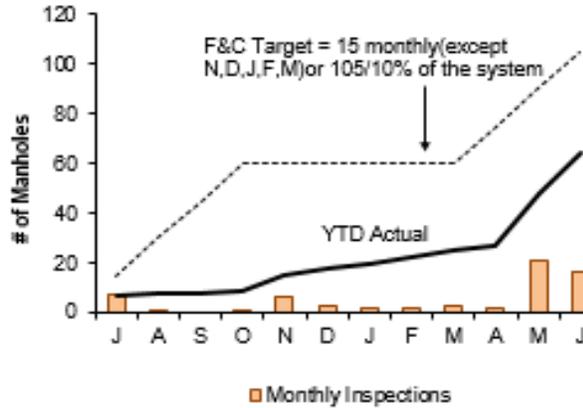
Staff cleaned 6.44 miles of MWRA sewer pipe, and removed 24 yards of grit. The year to date total is 30.72 miles. No Community Assistance was provided.

Structure Inspections



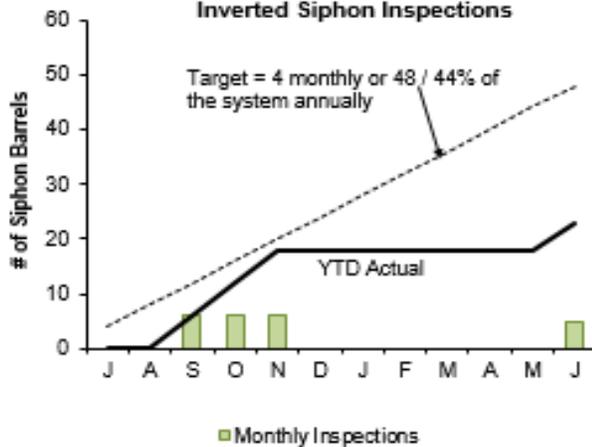
Staff inspected the 12 CSO structures and performed 10 other additional manhole/structure inspections during this month. The year to date total is 1,025 inspections.

Manhole Rehabilitation



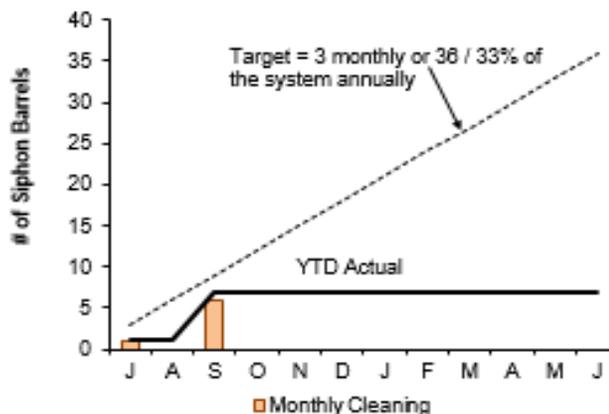
Staff replaced 16 frame and cover replacement this month. The year to date total is 64.

Inverted Siphon Inspections



Staff inspected 5 siphon barrel this month. The year total is 23 inspections. Shortcomings for the month were a direct result of staffing availability.

Inverted Siphon Cleaning



Staff did not clean any siphon barrel this month.

2. Critical Equipment Availability

The average equipment availability for FY21 was 99.97%. An equipment availability report generated daily, details the critical equipment required to collect and transport the wastewater flow at the facility design capacity. Higher maintenance priority is given to critical equipment that drops below the number required to transport the maximum flow. Because of the high daily equipment availability, no operational impact has occurred in the past year.

Maintenance Projects and Equipment Replacement:

In-House Projects

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.

- Hayes Pump Station: Mechanical Staff Replaced Pump #3 rotating assembly.
- Squantum Pump Station: Facilities Specialists installed higher elevation flood barriers.
- Braintree Weymouth Pump Station: Facilities Specialists installed higher elevation flood barriers.
- Quincy Pump Station: Facilities Specialists installed higher elevation flood barriers.
- South Boston CSO: Electrical Staff upgraded exterior lighting to LED.
- Squantum Pump Station: Facilities Specialists repaired Cupola and painted exterior of building.
- Framingham Pump Station: Electrical Staff installed upgraded pump 1, 2, & 3 Pump VFD's.
- Columbus Park and Ward Street Headworks: Plumbing Staff upgraded Sodium Hypochlorite transfer lines.
- Columbus Park and Ward Street Headworks: Plumbing Staff upgraded Odor Control water mist delivery system.
- Chelsea Creek Headworks: Installed Safety grating effluent channels 1-4.
- Nut Island Headworks: Electrical Staff replaced imbedded conduit with overhead conduit for Grit Classifiers.
- CNY & Chelsea Maintenance and Administration Building: Fabricated Plexiglas guards on desks and cubicles.
- Chelsea Maintenance Facility: Install one mezzanine covered storage.

Wastewater Transport Equipment Maintenance

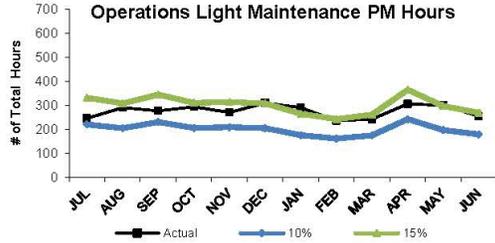
The Field Operations Department Equipment Maintenance page for key indicators of performance for FY21 is on the next page. Monthly maintenance data is shown under six headings.

- 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 FY21, Operations staff completed an average of 277.6 hours per month which accounted for 13.60% of the total preventative maintenance hours.
- Overall Preventive Maintenance – The preventive maintenance work orders are completed by both operations and maintenance staff. The goal for FY21 was to complete 100% of all preventative maintenance work orders. The PM completion for FY21 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 60% of all work orders. The average for FY21 was 63% of all work orders. The kitting goal was changed midyear from 30% to 60%.
- 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 FY21, 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 FY21 backlog average was 20,147 hours, which is above within the industry standard of 6,636 to 13,275 hours. The increase in Backlog for FY21 was due to Covid-19.
- Overtime Spending – Maintenance overtime spending was \$287,756 under budget for FY21. 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.

Field Operations' Metropolitan Equipment & Facility Maintenance

4th Quarter - FY21

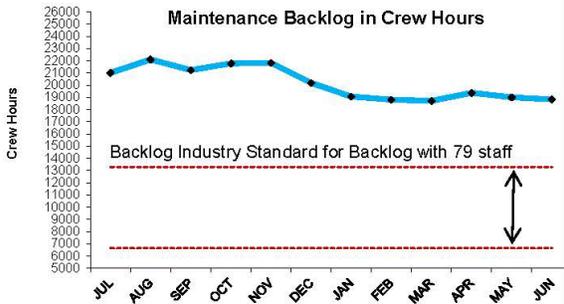
Several maintenance and productivity initiatives are in progress. The goal for the Overall PM completion and the Operator PM completion was raised to 100% for Fiscal Year 2010. The Operator PM and kitting initiatives frees up maintenance staff to perform corrective maintenance and project work, thus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



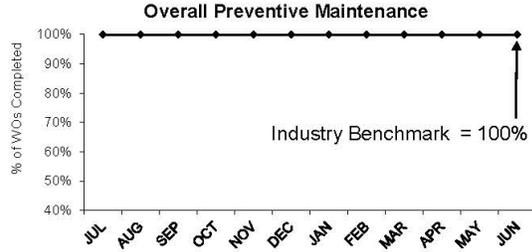
Operations staff averaged 288 hours per month of preventive maintenance during the 4th Quarter of FY21, an average of 14% of the total PM hours for the 4th Quarter, which is within the industry benchmark of 10% to 15%.



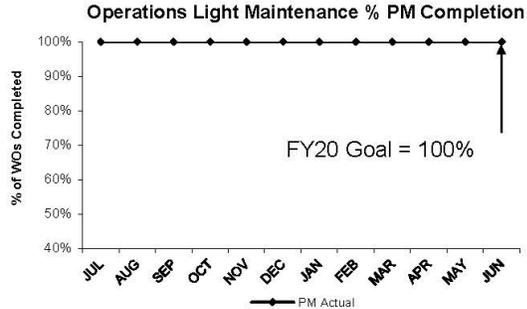
Operations' FY21 maintenance kitting goal has been set at 60% of all work orders to be kitted. Kitting is the staging of parts or material necessary to complete maintenance work. In the 4th Quarter of FY21, 63% of all applicable work orders were kitted. This resulted in more wrench time and increased productivity.



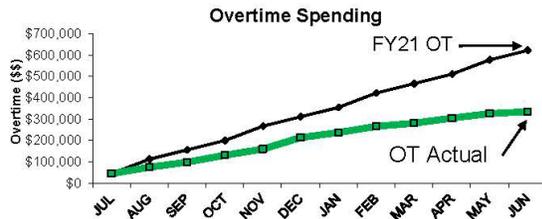
The 4th Quarter of FY21 backlog average is 19,050 hours. Management's goal is to continue to control overtime and try to get back within the industry benchmark of 6,636 to 13,275 hours. The increase is due to the previous reduction in staffing levels due to COVID19.



The Field Operations Department (FOD) preventive maintenance goal for FY21 is 100% of all PM work orders. Staff completed 100% of all PM work orders in the 4th Quarter of FY21.



Wastewater Operations complete light maintenance PM's which frees up maintenance staff to perform corrective maintenance. Operations' FY21 PM goal is completion of 100% of all PM work orders assigned. Operations completed 100% of PM work orders in the 4th Quarter of FY21.



Maintenance overtime was \$33,630 under budget on average, per month, for the 4th Quarter of FY21. Overtime was used for critical maintenance repairs and wet weather events. The overtime budget for FY21 was \$621,114 and we were \$287,756 under budget for the fiscal year.

Status Sheets
Fore River Pelletizing Plant
July 2020 – June 2021

Critical Equipment Availability: 91.92%

Operating logs indicate that of the 2,190 machine days in FY21, centrifuges were available for 2,013 days for an availability of 91.92%. Two rotating assemblies were at the OEM repair shop for a total of 167 days and one centrifuge required reprogramming of the HMI which accounted for 10 days. The total lost time for FY21 was 177 days. 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 disassembly and cleaning of the rotating assemblies. At the present time, 11 of 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.

Maintenance Work Orders and Backlog:

In FY21, there were 1,378 work orders created in the eMaint Computerized Maintenance Management System, 883 of those were PM's. As of 7/1/21, there were 103 open work orders, 55 of them PM's representing 92.5% completion rate. Currently, all FY21 work orders are complete. The Preventative Maintenance system is continuously being modified to include updates for equipment changes, new lubrication schedules and new 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 FY2021, including:

- The train 2 burner housing/wind box was replaced with a new stainless unit
- New signal lines were installed on every transporter booster for silos 6-9
- Replaced the main drive motor on Centrifuges 1 and 6 with new units
- Replaced discharge cone and outlet sprocket on drum 2
- Replaced both drive shafts on pugmill #2, installed all new holders and paddles
- 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
- Replaced the entire mixer B conveyor on train 4
- Replaced train 6 outlet drum tire with a new unit
- Conveyor Repairs – Several small to medium repairs were completed