

October 19, 2004

Ms. Linda Murphy, Director  
Office of Ecosystem Protection  
U.S. Environmental Protection Agency  
Water Technical Unit "SEW"  
P.O. BOX 8127  
Boston, MA 02114

Mr. Glenn Haas, Director  
Division of Watershed Management  
Department of Environmental Protection  
1 Winter Street  
Boston, MA 02128

RE: Massachusetts Water Resources Authority  
Permit Number MA 0103284  
Part I.18.f - Operation and Maintenance Annual Report

Dear Ms. Murphy and Mr. Haas:

Attached please find the MWRA's annual status sheets on plant performance and maintenance for the period covering July 2003 – June 2004. This submittal fulfills the requirements of MWRA's NPDES Permit MA0103284 - Section I.18.f and I.18.g that states in part:

"The MWRA shall submit annual status sheets on plant performance, using key indicators for maintenance "

The Status Sheets will be posted at [www.mwra.com](http://www.mwra.com).

If you have questions or need additional information, please feel free to call Grace Bigornia-Vitale at 617-788-4716.

Sincerely,

Michael J. Hornbrook  
Chief Operating Officer

cc: MA DEP, Worcester  
B. Pitt, US EPA  
T. Borci, US EPA  
D. Ferris, MA DEP  
C. Coniaris, MA DEP

# **MWRA Annual Report on Operation & Maintenance**

July 2003 – June 2004

This report has been generated to fulfill the requirements of MWRA's NPDES Permit MA0103284 - Section I.18.f that 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**

### **Deer Island Sewage Treatment Plant**

The Deer Island Sewage Treatment Plant (DITP) is the centerpiece of MWRA's \$3.5 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 and community-owned sewer lines and approximately 230 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 cared for 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 collection system, which transports wastewater from MWRA member communities to the Deer Island Treatment Plant. This system includes a network of 228 miles of interceptor sewer lines and related appurtenances: a screen house, twelve pump stations, four headworks facilities, and five combined sewer overflow (CSO) 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 (FRPP) is regulated in part by the terms of federal regulations (40 CFR 503), Massachusetts sludge regulations 310 CMR 32.00, and the states to which the pelletized product are shipped. Other important external factors that influence operation of the FRPP include an extensive residuals management facility plan developed as part of the permitting process for the FRPP 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 MWRA's Pelletizing Facility. NEFCO's proposal contains a plan for the maintenance, repair and replacement of the facility. This plan is intended to establish the standard, by which, to measure NEFCO's performance.

The operating agreement calls for 6-month, 12-month, and subsequent annual reviews to ensure that NEFCO is operating and maintaining the facility correctly. The operating agreement also requires NEFCO to provide a letter of credit in the amount of \$1,000,000 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. COMPUTERIZED MAINTENANCE MANAGEMENT SOFTWARE**

The maintenance management software used by the Authority is MAXIMO version 4i. The software includes safety features that allow users to document hazardous materials in real time, automate lockout/tag-out/lineup activities, and "push" proper procedures out to the field. MAXIMO provides document management capabilities to streamline maintenance and regulatory functions, and workflow capabilities for synchronizing operations. Applications can be fine-tuned to suit specific work processes. The software also includes mobile applications for gathering and downloading data and an intuitive interface.

Maintenance staff can prioritize tasks, assign work based on the availability of necessary parts and labor, and analyze equipment failures in order to implement appropriate preventive maintenance measures.

The MAXIMO maintenance management tool is used to manage all aspects of the DITP maintenance program and is being implemented for all wastewater facilities. The software is used for work order management, planning and scheduling, asset management, resource management, recording of maintenance costs, and generation of reports and analysis. The software can store large amounts of data and is equipped with built-in failure analysis programs. In addition, MAXIMO contains the historical record for all maintenance activities, thus allowing staff to better address a problem with a facility, or an equipment part, for example. The MAXIMO system has been very

successful at Deer Island, and thus is being implemented throughout the wastewater system.

FRPP utilizes different maintenance management software – Quickmaint, to track work orders that includes preventive and corrective maintenance work.

### **3. FACILITIES ASSET MANAGEMENT PROGRAM**

The goals of the MWRA multi-year maintenance plan include: coordinated and consistent asset inventory, condition assessment, maintenance scheduling, and long-term replacement planning. The MWRA has developed and is implementing this multi-year plan, in part, under an initiative entitled the (FAMP) program. This asset management program addresses the goal of becoming more efficient by developing consistent, compatible and cost-effective operations and maintenance procedures.

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

During Phase II of FAMP, the MWRA is expanding its efforts in the areas of condition monitoring, RCM rollout, asset replacement prioritization and capital improvements, and in training of staff.

### **4. SERVICE CONTRACTS**

The 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. Table 1 shows the service contracts currently used by MWRA.

**Table 1. Current Service Contracts**

Trash removal
Janitorial services
Digester cleaning *
Centrifuge maintenance
PICS maintenance
Security
Copier/fax maintenance
Electrical testing
CTG maintenance
STG maintenance
Boiler maintenance
Elevator maintenance
Crane maintenance
Oil separator cleaning
Vibration analysis
Overhead door maintenance
Lab hood certification
Locksmith services
HVAC chemical treatment
Power sweeping
Pest control
Public Access groundskeeping
Facilities painting
Cryo facility maintenance
CCTV maintenance
Legionella testing
Bridge crane services
Air balancing
Lube oil analysis
Instrumentation maintenance

\*Not an annual contract

## Deer Island Treatment Plant

July 2003 - June 2004

**Annual Report:** The Deer Island Maintenance page of the MWRA Report on Key Indicators of Performance for FY04. These key indicators are summarized under six headings.

- Operations Light Maintenance PMs – The PIP program is for Operations personnel to perform light maintenance tasks. This will free up Maintenance personnel to work on the most critical maintenance work. This program has been initiated and the operations personnel now complete approximately 13% (from 11% in FY03) of all PM work orders hours.
- Preventive Maintenance (PM) Orders Completed is shown with respect to the target of 100% in a bar chart. Maintenance is working to increase the PM goal to 100%. The PM % complete has improved from 92 % to 96% in the past year.
- Preventive Maintenance Kitting - The first step to increase wrench time is to have all parts available for preventive maintenance work orders. Kitting is a task where the maintenance planner identifies the specific parts required for a task and the warehouse personnel assemble the parts in one location (kit) for the technician to pick up and use. Deer Island kitted PMs for 11% of all work orders in the past year.
- Predictive Maintenance - To extend the useful life of equipment and plan for equipment replacements predictive maintenance technologies are being implemented. 1051 work orders were completed for vibration, acoustic ultrasonic and oil analysis in the past year. As the year progressed more predictive maintenance was planned. For the month of June 2004, 7% of all work orders where predictive maintenance
- Maintenance Backlog in Crew Weeks - Backlog is determined by totaling the planned craft hours in open work orders and comparing them to craft resources available. The June 2004 backlog was 5.4 weeks and the yearly backlog average was 6 weeks, which is within industry benchmark standards.
- Maintenance Overtime - The goal to maintain maintenance overtime to 5% of total wages and salaries was exceeded to control maintenance backlog increases caused by technician vacancies. Overtime for the year was 7.9% of wages and salaries and will decrease as technician vacancies are filled.

**Critical Equipment Availability:** 12-Month Average - 97.4 %

An equipment availability report is generated daily that details the critical equipment required to treat the design flow of approximately 1.2 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 97.4 % versus 100 % availability because the plant normally operates at approximately one-third the design flow capacity.

**Backlog:** 6.0 weeks average

Backlog is determined by totaling the planned craft hours in open work orders and comparing them to craft resources available. A 6.0-week backlog constitutes 6.0 weeks of work for the entire maintenance workforce. This backlog is within industry standards of 4 to 6 weeks.

**Preventive Maintenance (PM):**

96% of all PMs were completed (an increase of 4% from the last report), and 24,314 work orders were initiated this year. Incomplete PM's that are not completed in one month are safely rolled over into the next month's workload.

**Predictive Maintenance (PM)**

1051 predictive maintenance work orders were completed in the past year. Predictive maintenance work includes vibration, acoustic ultrasonic and oil analysis and is proactive maintenance work to extend equipment useful life.

**Average Craft Hours per Month:**

Preventative Maintenance	4464 hours	30.0 %
Predictive Maintenance	117 hours	0.8 %
Corrective Maintenance	8697 hours	58.2 %
Emergency Maintenance	84 hours	0.6 %
Project Work	913 hours	6.1 %
Other Work	661 hours	4.4 %

**Total Work Orders:**

40,442 work orders initiated this year.

**Equipment Replacement:**

Major replacements, in the past year, include the following:

- **Centrifuges Refurbishment - \$ 191,000**  
Nine centrifuges (two digested sludge centrifuges and five waste sludge centrifuges) were refurbished by the original equipment supplier, Alfa Laval, in the past three years. In the past year, two waste sludge centrifuges were refurbished. The centrifuges were disassembled, new parts installed or existing parts refurbished, reassembled, and balanced. The centrifuges require refurbishment at regular intervals based upon running hours for normal wear and tear and will continue in future years.
- **Digester Mixers Refurbishments - \$ 54,000**  
Two digester mixers were refurbished based upon impeller and bearing wear identified through vibration testing. One mixer was removed, shipped to the factory,

bearing and impellers replaced and returned and one mixer was refurbished on site. The mixer motors also were replaced or refurbished for each mixer.

- Residuals Module 3 Pinch Valve Replacement - \$ 67,000  
The major 10" and 12" digester isolation plug valves were replaced with pinch valves to provide more reliable isolation capability.
- Reactor Aerator/Mixer Gearbox Rebuilds \$86,000  
The secondary reactor aerators and mixers have large gearboxes that have started to fail. Two gearboxes were refurbished with new gears, seals, and bearings as necessary.
- Primary Scum Actuator Replacements - \$204,000  
The primary scum actuators are reaching the end of their useful life and are being replaced with a more robust design to extend the service life.
- Grit Classifier Refurbishment - \$ 14,000  
The grit classifiers were all refurbished to provide better operational performance. Modifications to the original design and actuator change outs were made.
- Secondary Return Sludge Pumps - \$ 52,000  
The secondary return sludge pumps were refurbished with a new robust design to improve pump and tank availability. New shafts, bearings and seals were installed.
- Disinfection Hypochlorite Hose Pumps - \$30,000  
Two disinfection hypochlorite hose pumps were replaced due to normal wear and tear.
- Gravity Thickener Rebuilds - \$ 20,000  
Two gravity thickeners were rebuilt due to normal wear and tear. Gravity thickener #2 rake arm was refurbished and gravity thickener #4 scum rake arm was refurbished.
- Cryogenic Facility Repairs - \$ 281,000  
The cryogenic facilities were inspected and necessary corrective work was completed including rebuild of the vaporizers, extensive valve replacements, and replacement of the expander turbine.
- HVAC Equipment Rebuilds and Replacements - \$ 406,000  
HVAC equipment throughout the facility was replaced due to normal corrosion, wear and tear. The plant and ocean environment and resulted in premature failure of the HVAC cooling coils and components, which required replacement.
- Pump Station Mechanical Seal Installation - \$ 137,000  
Mechanical seals are being installed to replace the packing and sleeve in the north main pump station, south system, and Winthrop facility pumps. The mechanical seals will save energy and ease maintenance of the pumps and are being replaced over several years.
- Steam Turbine Generator Bearings - \$ 70,000  
The steam turbine generator bearings were replaced after a loss of power to the bearing lube oil pumps.
- Electrical Repairs - \$ 430,000  
The major electrical repairs were completed with in-house staff in the last year included:
  - Various variable frequency drive service and replacements
  - Battery and charger replacements
  - Uninterruptible power supply replacements
  - Bus duct and load break switch replacements



- Power conditioners
- Ancillary Modifications Design & Construction 3-1 – \$4,550,000 (\$ 2,403,990 of the contract was expended in FY04)

This project is concentrated on fixing problems identified with operation of the Secondary Clarifiers and includes the following:

  - Furnish and install 66 cross collector hatches and 144 intermediate hatch covers; remove and dispose of the 144 existing intermediate hatch covers.
  - Furnish and install 80 sections of safety railing, and railing support brackets in 90 locations.
  - Furnish and install influent and effluent channel drains and sluice gates in six locations (each).
  - Furnish and install modifications to the Return Sludge (RSL) piping system.
  - Furnish and install modifications to the scum collection system.
- Equipment Condition Monitoring - \$ 1,530,000 (\$ 148, 540 was expended in FY04 for this project)

This project involves the installation of an additional condition monitoring equipment (vibration and temperature monitoring devices) on major pieces of rotating equipment (e.g. pumps, compressors, etc.) on Deer Island. Benefits are that the machine health can be monitored and repairs made before catastrophic failures.
- Expansion Joint Repair - \$316,570 was expended in FY04 for this project

The DITP is close to some of the Town of Winthrop's residents. In order to reduce noxious odors, the primary clarifiers were covered with concrete decks. The construction of these decks required an extensive grid of expansion joints, totaling several miles in length. Some areas have failed caulking that allows water into the expansion joint, which freezes in the winter and causes additional cracks in the concrete. If left unchecked, the expansion joint system could be compromised and concrete sections could experience catastrophic failure. In order to maintain the system of expansion joints and prevent this, a concrete repair contractor was being utilized to replace/repair the primary clarifier and secondary reactor expansion joints.
- Ancillary Modifications I Construction - \$9,504,000 - no expenditures in FY04

This contract was awarded in June 2004, so construction fieldwork is only beginning in FY05. The major project elements include:

  - Rehabilitation of Residuals Complex scum screen room
  - Rehabilitation of Winthrop Terminal Facility including Influent Screens
  - Rehabilitation of North Met Trunk Sewer
  - Replacement of North Main Pump Station Sump Pumps
  - Replacement of various valves and meters in Digester Complex
  - Insulation of HVAC ductwork in NMPS and WTF
  - HVAC Modification in Disinfection Gallery

# **Wastewater Transport System**

July 2003 - June 2004

## **Wastewater Transport System Overview**

The Field Operations Department (FOD) operates and maintains MWRA's Wastewater collection system, which transports wastewater from MWRA member communities to the Deer Island Treatment Plant. This system includes a network of 228 miles of interceptor sewer lines and related appurtenances: a screen house, twelve pump stations, four headwork's facilities, and five combined sewer overflow (CSO) facilities. The primary goal of FOD is to operate the system in a manner that will provide uninterrupted wastewater transport service in a safe, cost-effective, and environmentally sound manner.

During FY04, the Quincy and the Squantum replacement pumps came online, providing the MWRA more reliable service to the City of Quincy. Also, the wastewater Operations Control Center (OCC) was activated, providing 24/7 central monitoring of the MWRA facilities.

## **Wastewater Transport Facilities**

### **1. Facilities Operation**

During FY04, wastewater transport facilities operated at full capacity throughout the year. All required equipment to maintain flow and process of wastewater were available.

CSO facilities operated with sufficient chlorinating and dechlorinating capabilities. The required number of pumps in each gravity and pumping Coos were available throughout the year.

### **2. Equipment Availability**

The critical equipment evaluated includes pumps and screens in the twelve pump stations, five Coos, the screen house, and four headworks. Reports that track the availability of critical equipment are generated by Operational Staff on a daily basis. Other weekly operations and maintenance reports include flow information as well as pump and screen status at each facility. Transport Facilities operated at full capacity throughout the year with sufficient available equipment to meet wastewater flow demands. This information is presented in Table 2.

**Table 2. Critical Equipment Availability**

<b>Facility Types</b>	<b>Pumps Available (monthly average)</b>	<b>Pumps Required</b>	<b>Screens/in-line grinders Available (monthly average)</b>	<b>Screens/in- line grinders required</b>
Pump Stations (12)	39	24	17	10
Pumping CSOs (2)	8	6	9	7
Screenhouse (1)	0	0	4	3
Gravity CSOs (3)	0	0	4	3
Headworks (4)	0	0	17	13
<b>Total available (reported)</b>	47	<b>30</b>	51	<b>36</b>
<b>Total number (in facilities)</b>	49		52	
<b>Total number required</b>	30		39	
<b>Percentage available</b>	96%		98%	
<b>Percentage required</b>	61%		75%	

### 3. Equipment Replacement and Significant Maintenance Projects

Equipment replacement is part of the maintenance strategy to ensure that requirements of the permit are consistently met. Projects and initiatives are completed during each fiscal year that maintain redundancy and continued reliability. Many projects are extensive, requiring in-house resources or specialty/service contractors.

Selected projects, which represent improvements, equipment replacement, or significant repair work over the past fiscal year, include the following:

- Headworks Roof Replacement-approximate project cost, \$340,000  
The roofs were replaced with a spray-on, high-density foam system with a silicone coating. The new roofing system will reduce maintenance costs, and includes a 15-year warrantee. Unlike other roofing systems, any breach in the surface is localized and moisture would not travel and be trapped under the roof material. In-house staff replaced all the stairways onto the roofs using a composite wood materials longer life and reduced maintenance.
- Major Spare Parts Purchases- approximate cost, \$215,000  
FOD began a ‘mission critical’ spare parts purchasing initiative for various facilities to ensure availability for items with long lead times. Facilities, such as the Headworks have components that are special order, such as grit ejection pipefittings. This is another key item that ensures reliability with quick turn-around maintenance by having critical spare parts on hand.
- Cottage Farm VFD/motor replacement – approximate project cost, \$95,000  
In-house electricians, mechanics, and machinists completed the installation of the new motor and VFD. This was the second phase that completed the project starting with the installation of a new service to the facility. The variable frequency drive will allow more pump control in conjunction with the constant speed diesel driven pumps.
- Cottage Farm Heating System replacement – approximate project cost, \$55,000  
In-house trades staff completed the installation of new boilers in the main building of the Cottage Farm Facility. The new system replaces an old boiler that reached the end of its useful life. MWRA engineers and as-needed consultant developed the requirements for a dual-fuel, energy efficient system
- Ward Street Headworks, chemical system- approximate project cost, \$11,000

In-house electricians and plumbers substantially completed the chemical feed system upgrade. The installation included a sodium hydroxide chemical tank & mixer with associated piping and pumps. New peristaltic-type chemical feed pumps replace the old diaphragm pumps, for both hypochlorite and hydroxide chemical delivery to the scrubbers for odor control. The floor and containment areas were coated with a chemical-resistive epoxy around the drains and piping.

- Nut Island Headworks conveyors- approximate cost, \$25,000  
The Nut Island conveyors continue to be a focus for Maintenance, and adding a spray wash-down system and remote lubrication lines for the vertical grit conveyors made more improvements. Additional belting work was done along with purchasing additional rotating parts for the screenings conveyor.
- Conveyor System upgrades- approximate project cost, \$20,000  
Conveyor belts and components were replaced on two conveyors - one at the Chelsea greenhouse and one at the Somerville CSO. This work was out-sourced to a contractor specializing in conveyor belting.
- Chelsea Headworks, screen repair  
Repairs to the No. 1 Screen were completed after it suffered major damage during the wet weather event on April 1, 2004. The project was completed within days by in-house mechanics, machinists, and welders resulting in no interruption of service. The screens at the Headworks are scheduled for replacement under the Capital Improvement Program.
- Alewife Brook Pump Station, pumping system  
The number 3 pump at this station required extensive packing and adjustment to reduce leaking around the packing gland. An alternative to standard pump packing is an injected system designed to seal around the irregularities of a worn shaft. A future pump replacement project will include pumps with mechanical seals. As a short-term measure, this packing was used successfully for the first time at the Wastewater facilities in a sewerage environment.

## **Wastewater Pipelines**

### **1. Manhole Inspections and Rehabilitation Program**

The Technical Inspections Unit (TIU) 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 FY04, TIU staff inspected a total of about 955 manholes. Approximately 160 manholes were repaired or rehabilitated. This 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

The following projects are included in the MWRA Capital Budget. The TIU staff first identifies these projects during routine television inspections of the pipelines. MWRA Engineering staff review these projects and perform or coordinate all necessary engineering with a conceptual design. Actual pipeline rehabilitation projects are contracted out. The following represents a list of current and ongoing pipeline projects.

- Section 80.82 Sewer Rehabilitation, Arlington  
The Mill Brook Valley Sewer is a 75-year-old vitrified clay sewer 20-24-inches in diameter. Sections of the pipe are damaged and up to 8000 feet will be rehabilitated. Preliminary design is scheduled for completion in September 2004, final design completion in June 2005 with construction scheduled in 2006.
- Section, 153, Winchester  
The Mystic Valley Sewer is a 125-year-old vitrified clay sewer 12- inch diameter. Routine TV Inspection revealed portion of partially collapsed pipe. The sewer was by-passed and repaired with in house staff, the sewer was back in service within two days, September 2003.
- Section 47, Winchester  
The Cummingsville Branch sewer is a 100-year-old vitrified clay sewer 18- inch diameter. Routine TV Inspection revealed portion of partially collapsed pipe. The flow was diverted to a larger sewer, the pipe was repaired with a form and fold trenchless technology liner, March 2004.
- Section, 160, Winchester, and Medford  
Design began for rehabilitation of 27" brick and concrete pipe. Portions of the Mystic Valley Sewer were identified as being damaged. Approximately 11,600 feet of the sewer being evaluated, recommendations for rehabilitation will be made, were needed. Construction is currently scheduled to begin in February 2006.
- Chelsea Sandcatcher Stabilization, Chelsea  
The abandoned sandcatcher located on the bank of Chelsea Creek is severely deteriorated due to age. Design is underway to stabilize the structure by filling it, and adding riprap. Construction is currently scheduled to begin in September 2004.
- Somerville Sewer Repair, Somerville  
A contractor working on an MWRA water main damaged an adjacent 30-inch brick city sewer line, and performed temporary repairs. The MWRA designed a permanent repair using a cured-in-place (CIP), resin-impregnated, flexible felt tube liner. The CIP liner installation was completed in December 2003, substantial completion per post video inspection completed in February 2004, and the project was closed out in June 2004.
- Section 93A, Lexington Contract 6798  
Substantial Completion of Construction was reached on April 16,2004. The work included the rehabilitation of 1425 linear feet of 30-inch diameter reinforced concrete sewer main and 22 manholes along the Mill Brook Valley Relief Sewer, parallel to the Minuteman Bicycle Path in Lexington. The adjusted contract price is \$ 1.6 million.
- East Boston Branch Sewer Rehabilitation, East Boston  
Construction began on the repair of approximately 5400 feet of 45-inch x 41-inch brick sewer in April 2003. The pipe is being rehabilitated using a cured-in-place,

resin-impregnated, flexible felt tube liner. The scheduled completion date was May 2004. The project cost is about \$5.4 million.

### **3. Pipeline Inspections and Cleaning**

During FY03, the TIU and the Wastewater Pipeline Maintenance groups were merged to increase the efficiency and consistency of maintaining 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 entire staff shares the inspection tasks and the maintenance workload is prioritized based on inspection data and information.

The 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 structures, which include manholes. Approximately 32.7 miles of pipelines were TV inspected in FY04. Included in this total is approximately 6.7 miles of community assistance work. TIU uses sonar technology to inspect full pipes and structures enhancing our ability to identify maintenance areas.

Pipeline maintenance crews perform a variety of maintenance activities for the MWRA's Wastewater Transport system. The system includes a network of 228 miles of interceptor sewer lines. Approximately 20.7 miles of pipelines and 78 siphons were cleaned in FY04.

In addition to general pipeline and manhole repair work performed by the pipeline crews, the following are other activities they perform throughout the year:

- Pipeline and structure repair work consisting of short sections in shallow excavations
- Construction activities, such as fencing, trenching, pavement and masonry repairs
- Community Assistance, to clear obstructions and clean sections in community lines
- Assistance to TIU to clear lines or bypass pump for TV inspection work
- Snow plowing and removal during winter months
- NPDES inspections and best management practice activities
- Emergency pumping activities for communities during major wet weather events
- Bypass pumping for contracted pipeline rehabilitation or repairs
- Easement clearing for access to pipelines and structures
- Emergency response and overflow monitoring during wet weather events
- Response to odor complaints in the system

## **FY04 Maintenance Program Costs**

### **1. Budget**

The Field Operations Department has made a significant overall commitment to the maintenance of its wastewater system. Additional maintenance and improvement projects are included in the MWRA Capital Program.

Table 3 presents a summary of the budget approved in FY03 for programs within FOD that relate to wastewater pipeline and facility maintenance efforts. The program budgets include maintenance staff that provides interior and exterior care of the facilities, maintenance of the equipment, wastewater pipeline maintenance, planning and scheduling, management and supervision, and administrative support.

**Table 3. FY04 Approved Maintenance Annual Budget**

<b>Budget Line Item</b>	<b>Wastewater Transport</b>
Wages and Salaries	\$7,682,268
Overtime	\$267,303
Fringe Benefits	\$5,500
Chemicals	\$20,000
Utilities	\$116,099
Maintenance (Parts & Supplies)	\$2,395,009
Other Materials	\$355,115
Other Services	\$108,925
<b>TOTAL</b>	<b>\$10,950,219</b>

### **2. Maintenance Expenses**

The actual spending in FY04 for ongoing maintenance in the Facility Maintenance program, which includes Building & Grounds and Facility Specialists work, is approximately \$ 378,888. The total related ongoing maintenance spending for wastewater pipeline and technical inspections for collection system maintenance is approximately \$ 265,441.

Spending by the Metro Trades staff and specific facility costs are captured under the Equipment Maintenance program as Ongoing Maintenance. This includes special and major facility projects and initiatives, out-sourced projects, service contracts, spare parts purchasing, corrective maintenance materials and parts, and preventive maintenance materials at cost of approximately \$ 1,928,269. A small proportion of these dollars includes spending for water pumping facilities; the major portion of dollars included in Ongoing Maintenance represents expenses for wastewater facilities.

### **3. Staffing**

There are a total of 157 personnel that are responsible for the maintenance of wastewater transport facilities and pipelines. Unit Supervisors for each trade provide supervision and support in their respective areas: electrical, mechanical, machinists and welding, plumbing, HVAC, Painting, and Carpentry.

Facility Maintenance and Equipment Maintenance are two consolidated programs made up of the mechanic specialists, machinists, metalworkers, welders, plumbers, HVAC specialists, electricians, building & grounds workers, and facility specialists (carpenters and painters). These groups perform maintenance activities at both wastewater and water facilities.

Work Coordination in the Field Operations Department provides scheduling and job planning at all water and wastewater facilities, water and wastewater pipeline maintenance, and Western Operations. The Wastewater Pipeline Maintenance and Technical Inspection programs maintain the collections system for the transport system only.

The staffing represents FY04 levels for employees reporting to the Chelsea Facility. Employees who were reporting at FRSA, Quincy facility or at operating facilities were relocated to the centralized maintenance facility in Chelsea, Massachusetts. The numbers of staff may vary slightly during the fiscal year due to vacancies and re-allocation or assignment from Wastewater Operations to the Equipment Maintenance shops, resulting from organizational changes. Table 4 summarizes the level of staffing dedicated to maintenance efforts.

**Table 4. Maintenance Staffing Levels**

<b>Staffing Categories</b>	<b>No. of staff</b>
Maintenance Manager	3
Engineers	4
Work Coordination; super. and staff	18
Area Managers	3
Administration	1
Mechanic Specialists	16
Electrical Specialists	12
Plumbers	8
HVAC Specialists	3
Machinists and Welders	6
I&C Specialists	1
Technical Inspections; inspectors, foremen, and supervisors	<b>15</b>
Pipeline Maint; supervisors., foremen., HEO's, & laborers	<b>27</b>
Laborer	6
Building & Grounds Workers & Foremen	19
Carpenters/Painters/Masons (Facility Specialists)	14
Garage Repair Specialists	1
<b>Total</b>	<b>157</b>

#### 4. Service Contracts

The Maintenance Program is supplemented by a series of service contracts. These services are intended to provide resources beyond the in-house capabilities of the Maintenance staff. The Field Operations Department currently utilizes service contracts



and services, listed in Table 5 to supplement the existing workforce and assist with maintenance projects at Wastewater Facilities.

**Table 5. Service Contracts & Utilized Services**

<b>Type and description</b>	<b>Term</b>	<b>Type of service</b>
Boiler and Water Heater Service (Contract)	2 years	Scheduled, corrective & emergency repairs
Elevator maintenance (Contract)	2 years	Scheduled, corrective & emergency repairs
Crane maintenance (Contract)	2 years	Scheduled, corrective & emergency repairs
VFD maintenance (Purchase order)	1 year	Scheduled maintenance
Instrumentation maintenance (Contract)	2 years	Scheduled maintenance
HVAC pneumatic controls (Purchase order)	As needed	As needed adjustments
High Voltage Maintenance (Purchase order)	As needed	Preventive Maintenance
Hydraulics Maintenance (Purchase order)	As needed	Preventive and Corrective Maintenance
Compressed air maintenance (Purchase order)	1 year	Preventive and Corrective Maintenance
Diesel generator maintenance (Purchase order)	As needed	Preventive and Corrective Maintenance
Nut Island Landscape (Contract)	1 year	Specified scope
Overhead door maintenance (Purchase order)	As needed	Corrective Maintenance
Engineering & Consultants (Task order)	As needed	Mechanical, Electrical, HVAC, and Architectural Design

## **Annual Maintenance Program Performance**

### **1. Backlog**

The Maximo computerized maintenance management system captures all work order requests from operations and maintenance personnel. This gives management the ability to track, prioritize work orders, and generate reports of open and closed work activities. Backlog varies from as low as two weeks, for essential work orders, and up to six months for low priority work. Backlog levels depend on resources available, but daily coordination ensures that primary and critical equipment is functioning at adequate levels at all times. Critical equipment status is monitored by Operations and this information is provided to the Maintenance group. Work is prioritized accordingly, with critical equipment receiving the most attention.

Work Coordination is working closely with Deer Island's Metrics Task Team to develop standardized measurement and reporting for the Maintenance Program throughout the Operations Division. Maximo is the system that captures the work activities and is capable of generating all of the necessary information and reporting.

### **2. Preventive Maintenance**

A primary focus in FOD is preventive maintenance. Both Operations and Maintenance staff perform preventive maintenance tasks. The tasks performed by operational staff are defined as light maintenance duties.

In FY04 Maintenance and Operations managers began working on a plan to define the light maintenance activities for operations staff to be performed during off-shift schedules. Further development and implementation is expected in FY05.

The purpose of the light maintenance duty assignment is to increase the number of man-hours contributed to PM activities and to allocate the PM work more efficiently. Wastewater Operations crews travel from facility to facility using a handheld monitoring system. Roving crews perform daily checks of equipment that include taking readings and conducting visual inspections. The information is captured in a separate database outside of the Maximo work order system. Reports are generated and information retrieved about the condition of any equipment. Abnormal conditions are noted and forwarded to planner/schedulers for work order processing and further action by the Equipment Maintenance section.

Reliability Centered Maintenance (RCM) was adopted by FOD to begin identifying the most productive and beneficial preventive maintenance for critical systems and their components. Each system's operating context and preventive maintenance needs are analyzed based on the performance requirements of the equipment. The RCM analysis focuses on preventing failures by trying to more closely monitor the condition of the equipment based on the possibility of failure and the causes of failure.

FOD is working on rolling out many more RCM analyses over the next five years. A criticality study was completed for all Wastewater facilities and will be the basis to prioritize all remaining system analyses. Recommendations from these analyses are approved by management and then implemented and tracked by FOD staff.

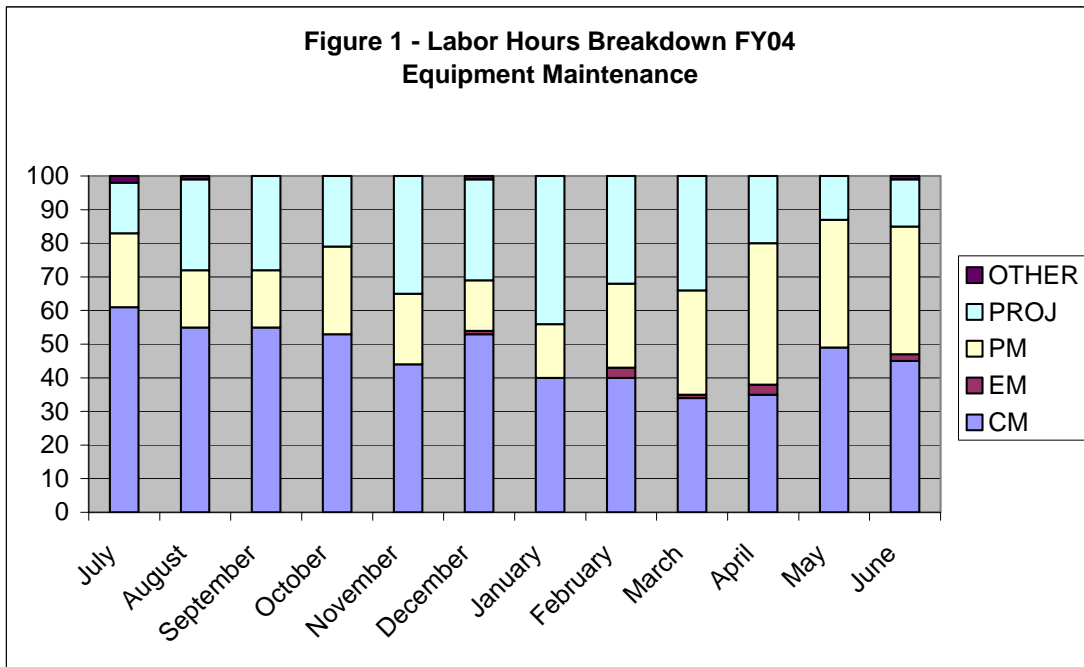
Lube oil analysis was utilized more extensively in FOD during FY04. Samples were taken from various equipment oil reservoirs and analyzed by an outside lab service. Based on results, the oil is either scheduled for change or for repeat sampling in the future. Other condition monitoring techniques are under review for future implementation.

### **3. Annual Statistical Maintenance Performance Indicators**

#### *Equipment Maintenance*

Key indicators of performance are used to monitor maintenance activities. Monthly maintenance staff hours are used to track productivity as well as monitor the type of maintenance performed. Typical levels of effort represent maintenance staff time by percentage, for various programs. These are derived by reported hours in the Maximo work order system. Equipment maintenance personnel are dedicated trades that maintain the wastewater facilities as well as water facilities. Figure 1 indicates the level of effort for equipment maintenance activities at the wastewater facilities. Staff in the associated trades shops are utilized for both types of facilities, and are assigned based on critical work priorities and demand.

Preventive/Predictive Maintenance (PM), Corrective Maintenance (CM), Emergency (EM), Project Work, and Other Work are the work types for Facilities Maintenance activities. The percentages will vary each month depending on the extent of corrective maintenance needed. The preventive maintenance target goal is 25% by the trades groups. Preventive maintenance performed by roving operational crews is not included.

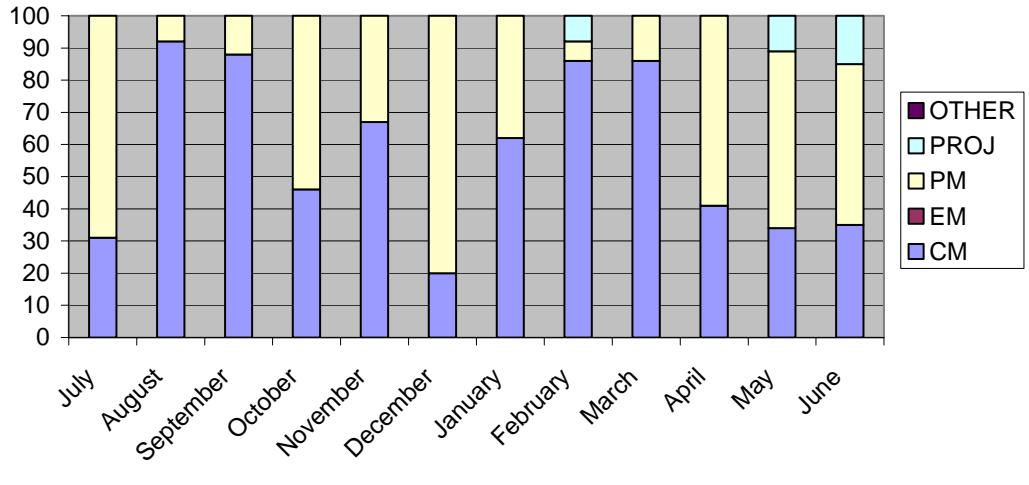


*Wastewater Pipeline & Technical Inspections*

The Technical Inspections program is responsible for inspecting the various elements of the Wastewater Collections System. Pipeline inspections average about 70% of the workload followed by structure inspections, including manholes, averaging about 30%. Approximately 32.7 miles of pipelines were inspected in FY04. Tidegate inspections are part of the monthly routine inspections required by the NPDES permit. Other structures inspected include: 48 headhouses, 23 diversion structures, and 955 manholes. The information generated by this area of the program provides the general need and priority for pipeline cleaning and maintenance.

Figure 2 shows the level of maintenance activities for the wastewater Pipeline Maintenance and the Technical Inspections team from the Maximo work order system. These are key indicators of performance for FY04, based on monthly maintenance man-hours and the percentage of work performed for each work type. It shows the distribution of workload based on the work types shown. The general categories can be further broken down to subcategories. An example of this is CM (corrective maintenance), which can be comprised of bucketing, jetting, manhole repairs, and activities that were corrective in nature. Work orders are coded so that these accumulative man-hours can be further broken down for management use. It shows the distribution of workload based on the work types shown. The general categories can be further broken down to subcategories. An example of this is CM (corrective maintenance), which can be comprised of bucketing, jetting, manhole repairs, and activities that were corrective in nature. Work orders are coded so that these accumulative man-hours can be further broken down for management use.

**Figure 2. Labor Hours Breakdown FY04  
Wastewater Pipeline Maintenance/Technical Inspection**



## **Annual Status Sheets – Fore River Pelletizing Plant**

July 2003 - June 2004

Critical Equipment Availability: Twelve Month-Average – 67 %

Operating logs indicate that an average of 8 of the 12 centrifuges were available during FY04. The centrifuges and ancillary equipment make up the critical components at the Pelletizing Plant because sludge can be processed through the Dryers or it can be sent to a landfill via the by-pass system. At this time, 10 centrifuges are available, giving the plant more than enough capacity to process current flows from Deer Island. The facility is currently operated on a 5-day workweek, ceasing operations most weekends.

Backlog:

The current maintenance monitoring software does not track craft hours, but it is estimated that the outstanding work orders could be completed in approximately one week.

Work Orders:

In FY04, staff completed 2,028 or about 95 % of the 2140 work orders that were opened.

Equipment Replacement:

More than \$ 1,024,447 was spent on replacement parts and maintenance related items in FY04 including:

- Overhaul of Process Trains 1 and 2
- Replacement of Mixer Feed B Screw on Trains 1 and 4
- Pugmill Paddle replacement on Train 4
- Complete Overhaul of the Rotating Assembly on Centrifuge No. 10
- Regenerative Thermal Oxidizer No. 2 Media Replacement
- Replacement of the Wear Saddles on all 12 Centrifuges