

October 31, 2002

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, Acting Assistant Commissioner
Department of Environmental Protection
1 Winter Street
Boston, MA 02108

RE: Massachusetts Water Resources Authority
Permit Number MA 0103284
O&M Annual Report

Dear Ms. Murphy and Mr. Haas:

Attached please find the MWRA Annual Report on Operation and Maintenance for the period covering July 2001 – June 2002. This submittal fulfills the requirements of MWRA's NPDES Permit MA0103284 - Section I.18.f that states in part:

"The MWRA shall report on the plan's implementation and results to EPA and 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. The Status Sheets will be posted at <http://www.mwra.com/harbor/pdf/omstatus02.pdf>.

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, Wilmington
MA DEP, Worcester
Eric Hall, US EPA
Steven Lipman, MA DEP
Catherine Coniaris, MA DEP

**Massachusetts Water Resources Authority
Annual Maintenance Status Sheets**

**Deer Island Treatment Plant
July 2001 - June 2002**

Critical Equipment Availability: 12-Month Average - 96.1 %

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 96% versus a 100% availability because the plant normally operates at approximately one-third the design flow capacity.

Backlog: 4.5 weeks

Backlog is determined by totaling the planned craft hours in open work orders and comparing them to craft resources available. A 4.5-week backlog constitutes 4.5 weeks of work for the entire maintenance workforce. This backlog is within industry standards of 4 to 6 weeks.

Preventive Maintenance (PM):

86% of all PMs were completed (an increase of 6% from the last report), and 28,053 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.

Average Craft Hours per Month:

Preventative Maintenance	5182 hours	36%
Corrective Maintenance	6383 hours	44%
Emergency Maintenance	75 hours	1%
Project Work	2178 hours	15%
Other Work	661 hours	4%

Total Work Orders:

40,661 work orders initiated this year.

Equipment Replacement:

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

- Combustion Turbine Generator Upgrade – \$ 2.1 million
The two Pratt & Whitney FT-8 Phase 0 engines were upgraded to Phase 1 engines as part of a warranty at a cost of \$ 1.6 million. These changes were made to correct bearing cooling issues identified during fleet development. In addition another \$500,000 in supplemental modifications were completed to provide higher reliability of the engines. No interruption of power to the thermal power plant occurred from this activity.
- Electrical Modifications (Ancillary Modifications 2-1) - \$ 3 million total, \$552,000 expended to date

The scope of work includes replacements of segments of bus duct with cable bus in the Main Switch gear Building and Thermal Power Plant. Also included are modifications to the switchgear and substation associated with the North Main and Winthrop Pumping Stations. Lastly, it includes installation of a fire alarm system in the Old Administration building. In the past year, the fire alarm system has been installed, and the construction associated with the North Main and Winthrop Pump Stations started.

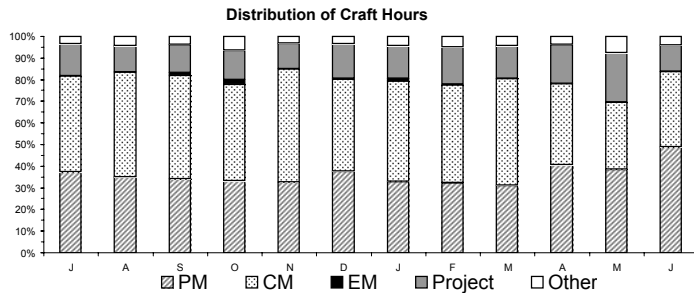
- Residuals Thickened Primary Sludge Pumps - \$100,000
The residuals thickened primary sludge pumps continued to have issues with the pump bases that resulted in premature failure of the pump components. These pumps were rebuilt, under warranty, by Komline-Sanderson with strengthened bases and new components. The rebuilt pumps have resolved availability issues with these pumps.
- Centrifuge Refurbishments - \$207,000
Three digested sludge, and two waste sludge centrifuges were transported to the Alfa Laval shop for refurbishment. The centrifuges require refurbishment at regular intervals based upon running hours. The centrifuges were disassembled, new parts installed or existing parts refurbished, reassembled, and balanced.
- Thermal Power Plant Digester Gas Room Exit - \$108,000
The thermal power plant digester gas room did not have an alternative exit from the digester gas room platform. Two new exit doors and an outdoor platform were added to address this safety concern.
- Secondary Clarifiers Railing Modifications - \$275,000
Entry into the secondary clarifiers required intricate safety equipment to make a safe entry for tank repairs. Swing gates and davits were added to each clarifier to ease entry and maintenance activities.
- North Main Pump Station Motor Bearings - \$141,000
The bearings in three North Main Pump Station motors were replaced to correct a motor design issue after one motor bearing failed.
- Pier Ladders - \$50,000
Replaced or installed new ladders and safety ring holders on the pier facility for safety purposes. The original ladders were painted carbon steel and were replaced with stainless steel to provide a longer life.

Annual Report: Attached, please find the Deer Island Maintenance page of the MWRA Report on Key Indicators of Performance for the 4th quarter FY01. Monthly maintenance data is shown under five headings.

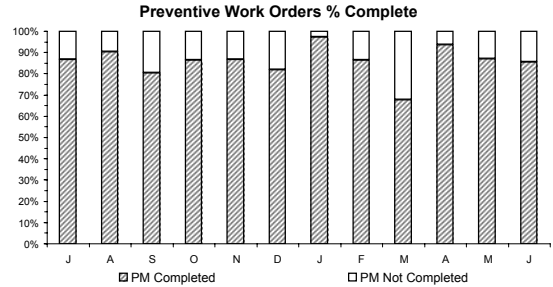
- Preventive Maintenance (PM), Corrective Maintenance (CM), Emergency Maintenance (EM), Project and Other are the categories shown in the Distribution of Craft Hours bar chart. DI maintenance is implementing Reliability Centered Maintenance (RCM) to define the plant maintenance program. Maintenance metrics will be changed to reflect performance based on RCM objectives in the next year.
- There is a table showing the actual craft hours. The table includes a monthly total of craft hours and a year-to-date average of the PM percentage.
- The percentage of Preventive Work (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 80 % to 86% in the past year.
- Total work orders, and the numbers completed, are shown in a table. The table also shows a year-to-date average of the percentage of work orders completed.
- Productivity Improvement Plan (PIP) – 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 10% of all PM work orders.

Deer Island Maintenance

June 2002



DI maintenance is piloting Reliability Centered Maintenance (RCM). Maintenance metrics will be changed to reflect performance based on RCM objectives.



Maintenance did not meet its PM goal of 100%. The PM completion rate for June is 85%. This is the fourth month of cross-functional teams. The PIP training had significant impact on maintenance reaching its PM goal.

Craft Hours

	J	A	S	O	N	D	J	F	M	A	M	J
PM	5101	5868	4866	5942	5223	5487	5035	4046	4116	5993	5374	5140
CM	6034	8152	6873	7979	8417	6232	7106	5667	6532	5571	4313	3715
EM	28	20	181	347	15	56	182	30	32	11	0	0
Project	2008	2015	1866	2420	1895	2322	2325	2169	1979	2699	3166	1274
Other	479	763	554	1176	506	509	676	624	597	558	1067	429
FY02 Total	13650	16818	14340	17864	16056	14606	15324	12536	13256	14832	13920	10558
FY01 Total	15569	17240	15487	17561	16458	15967	18081	15606	16563	15813	17093	15643
% PM	37%	35%	34%	33%	33%	38%	33%	32%	31%	40%	39%	49%
YTD Avg	37%	36%	35%	35%	34%	35%	35%	34%	34%	35%	35%	36%

Preventive Work Orders

	J	A	S	O	N	D	J	F	M	A	M	J
Total	2374	2760	2843	2613	2289	2710	1994	1686	2284	2616	1963	2469
Completed	2056	2491	2284	2261	1989	2220	1941	1459	1548	2448	1710	2110
% Completed	87%	90%	80%	87%	87%	82%	97%	87%	68%	94%	87%	85%
YTD Avg	87%	88%	86%	86%	86%	84%	88%	88%	83%	86%	84%	83%

FY02 NWT - Ave 28 % June NWT - 36 %

Craft Hour Definitions:

Total hours charged to work orders by the following categories:

PM - Preventive Maintenance - maintain uninterrupted operation of equipment

CM - Corrective Maintenance - restore operational condition

EM - Emergency Maintenance - restore operations with minimal downtime to avoid or minimize hazard/system failure

Project - Repairs necessary due to contractor or designer deficiencies

Other - Shut downs, safety, standing work orders, warranty work

Non Wrench Time (NWT) - Vacations, training, etc.; time not charged to the maintenance of equipment or facilities.

RCM Pilot Update

The RCM pilot program has been successfully completed and the RCM pilot metrics will no longer be updated on this page. Deer Island has shown an overall decrease in Preventive Maintenance hours of 26%. A white paper is being prepared to discuss the pilot results.

Productivity Improvement Plan (PIP) Results

One component of the PIP program is for Operations personnel, as well as others, to perform light maintenance. Since January 2002 Operations personnel have been assigned inspection-type Preventive Maintenance (PM) tasks. The percentage of Preventive Maintenance work orders has increased from 3% in January 2002 to 12% in June 2002. In June 2002, Operational PMs were assigned that included the use of tools for machinery lubrication.

Deer Island began the implementation of cross-functional teams on March 4, 2002 and was fully implemented this month. DITP has brought together a labor/management team to address on-going issues dealing with cross-functional teams.

**Massachusetts Water Resources Authority
Annual Maintenance Status Sheet**

Wastewater Transport Facilities

July 2001 - June 2002

Critical Equipment Availability:

The Critical Equipment, evaluated in FY01, includes pumps and screens in the 11 pump stations, 5 CSO's, 1 Screenhouse, and 4 Headworks. Transport facilities operated at full capacity throughout the year.

Pump and Screen Availability Chart

<u>Facility Types</u>	<u>Pumps Available (monthly average)</u>	<u>Pumps Required</u>	<u>Screens/ in-line grinders Available (monthly average)</u>	<u>Screens/ in-line grinders Required</u>
Pump Stations (11)	39	24	17	13
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
Total available (reported)	47	30	51	39
Total number (in facilities)	48		52	
Total number required	30		39	
Percentage available	98%		98%	
Percentage required	63%		75%	

All CSO facilities operated with full chlorination capability. The required number of pumps, in each gravity and pumping CSO, were available throughout the year. The CSOs have dechlorination capabilities, however, startup was not complete as of June 30, 2002.

Backlog:

The new MAXIMO computerized maintenance management system was implemented during FY02 by the Work Order Coordination group. This system provides capability to track, prioritize work orders, and generate reports of open and closed work activities. Backlog varies from as low as 2 weeks, for essential work orders, to as long as long as 6 months, for low priority work. Backlog levels depend on resources available, but daily coordination insures that primary and critical equipment is functioning at adequate levels at all times.

Preventive Maintenance (PM):

Preventive Maintenance is performed by both Operations and Maintenance staff. A new training program in FY02, the Productivity Improvement Program (PIP), was rolled out in negotiation with the bargaining units to train operations (as well as maintenance staff) to perform ordinary and generic preventive maintenance tasks.

Reliability Centered Maintenance (RCM) was also piloted in FOD to begin identifying the most productive and beneficial preventive maintenance for critical systems and their components. This technique was initiated as part of the Facility Asset Management Program (FAMP). Each system's operating context is studied and the preventive maintenance plan is designed based on the performance requirements of that equipment. This may not align with the OEM's recommended, frequency-based preventive maintenance tasks. RCM 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 completed tagging all existing equipment, within the Transport System, for purposes of tracking and maintaining work performed on critical systems at each facility. This is now consistent with Deer Island. Similar work practices and procedures are being used throughout the Operations Division.

During Phase II of the FAMP implementation, more emphasis is being placed on condition monitoring techniques. Through a series of task teams and committee charters, established in FY03, we will further explore, and implement new programs, such as vibration monitoring and lube oil analysis.

Equipment Replacement: Major equipment replacement and improvements during the past fiscal year include the following:

- Alewife Brook Pump Station, VFD installation - approximately \$10,000
A variable frequency drive (VFD) was installed to provide a greater operational range for the No. 4 pump at this facility. The No.4 pump is the smallest of four pumps at this facility and enables the facility to operate efficiently at low flows. Work was accomplished by a combination of vendor contract and in-house staff.
- Delauri Pump Station, Mechanical Seals – approximately \$30,000
Mechanical seals were installed on each of the three 42 inch, 65 MGD pumps. This conversion from packing glands to mechanical split seals is part of an initiative to eventually upgrade all pumps presently using standard packing for seals. In addition to saving maintenance costs, there are anticipated savings for both electrical usage and water consumption.
- Headworks, Grit Ejection Systems - approximately \$58,000
Worn grit pods, at the three remote Headworks, are being replaced over three years, starting in FY01. The newer units were ordered with thicker steel walls to replace existing units. The benefit is longer life with a minimal increase in cost. Other improvements include periodically rotating inlet pressure piping to more evenly distribute the wear.
- Chelsea Headworks, Exterior Piping Insulation - approximately \$10,000
Rooftop piping, part of the glycol system, was re-insulated. The existing insulation was compromised and the system experienced heat loss and freezing. This was an interim improvement since the heating systems at each of the three Headworks are scheduled for future replacement and upgrades.
- Hayes Pump Station, Softstarts - approximately \$17,500
All pumps at this facility were outfitted with softstart units. This alternative was selected over standard VFDs for more economical pump start-up and

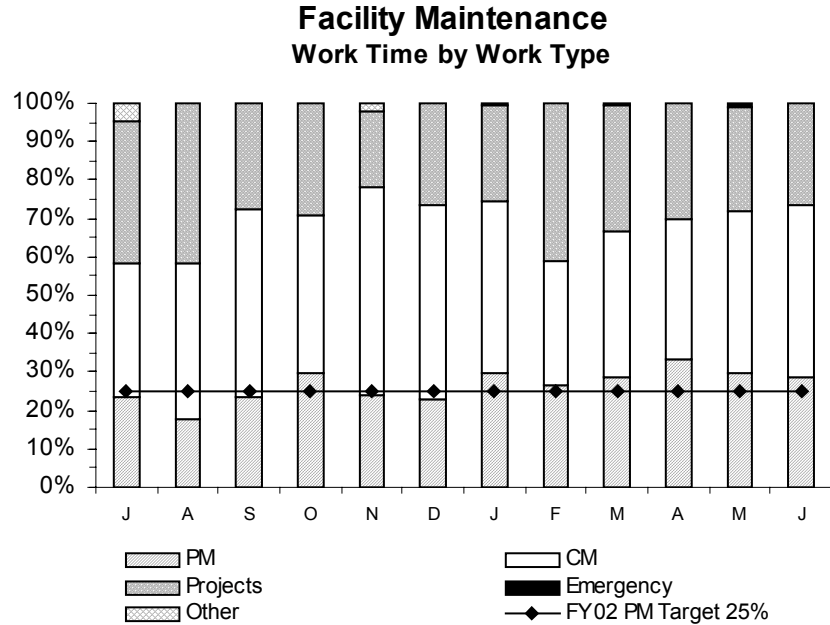
overall energy cost savings. The system was designed by in-house process and control staff and installed by an outside vendor.

- Nut Island Conveyor Systems - approximately \$36,000
The conveyors require new roller bearings that withstand the harsh environment at this facility while transporting grit and screenings across horizontal and up vertical belt conveyors. The required maintenance includes periodic roller bearing and belt replacement. An outside vendor was hired to replace sections of belt conveyors at a cost of \$28,000.
- Prison Point, Conveyor Rehabilitation - approximately \$23,000
This conveyor provides transport of screenings from the storm water screens to the table tray and grinder. The supporting frame for the conveyor was replaced and all new components were installed. This project was done by a contractor.
- Prison Point, Stripping Pump - approximately \$11,500
The existing stripping pump used to dewater sewage from the detention tanks was replaced with another self-priming trash pump. The pump was replaced as a result of impeller wear from grit and other debris in the waste stream. The old pump was in a failed state since it could not achieve the required output. The pump was replaced with an entirely new skid-mounted unit.
- Prison Point, Dry Weather Flow Pump Motor/VFDs - approximately \$20,000
The two dry weather flow pumps were upgraded to include new motors and variable speed drives (VFDs). The VFDs were designed to interface with a remote monitoring & operational control system.
- Nut Island, UPS- approximately \$13,700
The un-interruptible power supply (UPS) was replaced in the electrical room. This unit provides safe operation of critical control room functions during loss of power.

Annual Statistical Maintenance Performance Information:

Attached, please find graphical data for the Metro Trades group. These are key indicators of performance for Fy02. Monthly maintenance man-hours are included in the representative chart.

Preventive/Predictive Maintenance (PM), Corrective Maintenance (CM), Emergency (EM), Project Work, and Other Work are the work types for Facilities Maintenance activities.



By Work Type	Facility Maintenance											
	J	A	S	O	N	D	J	F	M	A	M	J
CM	943	1201	1043	1043	1304	1919	1883	1476	1976	2693	2754	1758
PM	642	520	505	746	584	879	1263	1244	1475	2425	1905	1117
Projects	1013	1234	586	740	472	1015	1073	1911	1685	2192	1755	1043
Emergency	0	6	0	0	0	3	9	10	5	0	53	1
Other	128	0	0	0	56	0	8	0	20	16	0	7
Total	2726	2960	2134	2529	2416	3816	4236	4641	5161	7326	6466	3927
FY02 PM Target 25%	25	25	25	25	25	25	25	25	25	25	25	25

**Massachusetts Water Resources Authority
Annual Maintenance Status Sheet**

Wastewater Transport Pipelines

July 2001 - June 2002

Manhole Inspection and Rehabilitation Program:

The Technical Inspections Unit, within the Field 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 carry out the manhole renovations that result in reduced I/I. The manholes are renovated using cementitious material applied with spinning equipment and then covered with special coatings to resist corrosion from hydrogen sulfide.

The Technical Inspections Unit also conducts Global Positioning System (GPS) inspections at all Authority-owned pipeline structures and appurtenances. The program goals are to improve the ability of field staff to accurately locate MWRA manholes & structures and to expand the use of the computerized GIS system for detailed analyses and custom mapping. Inspections began in January 2002, and by the end of the fiscal year a total of 2,200 were completed.

In FY02, Technical Inspection Unit (TIU) staff inspected a total of about 1,037 manholes. Approximately 66 manholes were repaired or rehabbed, in FY02. This work included frame and cover replacements, external repairs to raised manholes, internal repairs using the spin-cast application, and other miscellaneous repair work.

Pipeline Rehabilitation:

Section 11A, Milton, Massachusetts: This was a 'spot' repair of 4 feet of 8 inch vitrified clay pipe that the pipeline inspection program revealed had failed at the invert. In-house staff performed the repair with a materials cost of about \$5,000.

Section 51, Melrose, Massachusetts: Approximately 500 feet of 12 inch vitrified clay was replaced along with 2 manhole structures. This project was a result of the crown of the pipe failing and a need to relocate for hydraulic improvements and construction of a new school. In-house staff completed this project at an approximate cost of \$27,000.

Contract 5342- Rehabilitation of the Framingham Extension Sewer: Construction is substantially complete on this contract. The work included the rehabilitation of 15,056 feet of the Framingham Extension Sewer in Natick and Dover. The sewer line consisted of 27-inch, 42-inch and 48-inch reinforced concrete pipe. It was rehabilitated by cured-in-place, resin-impregnated, flexible felt tube liner. The contract also included 448 feet of open-cut pipe replacement using 48-inch epoxy lined ductile iron pipe to replace the 42-inch reinforced concrete pipe just upstream of the Framingham Extension Sewer tunnel section. The contract also included the rehabilitation of the upstream and downstream Eliot Street siphon chambers. The adjusted contract price is \$12.9 million.

Contract 6569- Repairs to Sections 138 & 137:

Construction is substantially complete on this contract. The work consisted of the rehabilitation of 980 feet, of Section 138, by insertion of a 72-inch structural pipe liner, and the repair of Section 137 (New Haven Street drop chamber) by open-cut excavation and reconstruction. The access risers, east and west, and the roof of the chamber were replaced. Adjusted contract price is \$6.7 million.

Contract 6370 – Chelsea Branch Sewer & Revere Extension Sewer Rehabilitation Project:

Construction is substantially complete. The project consisted of rehabilitating existing sewers by a cured in-place, resin-impregnated flexible felt tube liner. The work included: 70 feet of 30” sewer; 1,890 feet of 33” sewer; 3,190 feet of 42” sewer; 1,120 feet of 48” sewer and 3,000 feet of 54” sewer. The adjusted contract price is \$3.4 million.

Pipeline Inspection and Cleaning:

The Technical Inspection Unit (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 59 miles of pipelines were TV inspected in FY02. Included in this total is approximately 5 miles of community assistance work. In January, the TIU began utilizing sonar technology to inspect full pipes and structures enhancing our ability to identify maintenance areas.

Pipeline crews perform a variety of maintenance activities on MWRA's wastewater transport system. The system includes a network of 228 miles of interceptor sewer lines. Approximately 17 miles of pipelines and 44 siphons were cleaned in FY02.

In addition to general pipeline and manhole repair work performed by the pipeline crews, the following are other activities performed 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
- plant beautification and grounds keeping at Transport Facilities
- assistance to TIU to clear lines or bypass pump for TV inspection work
- 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
- easement clearing for access to pipelines and structures
- operational coverage at facilities during wet weather events
- emergency response and overflow monitoring during wet weather events
- response to odor complaints in the system

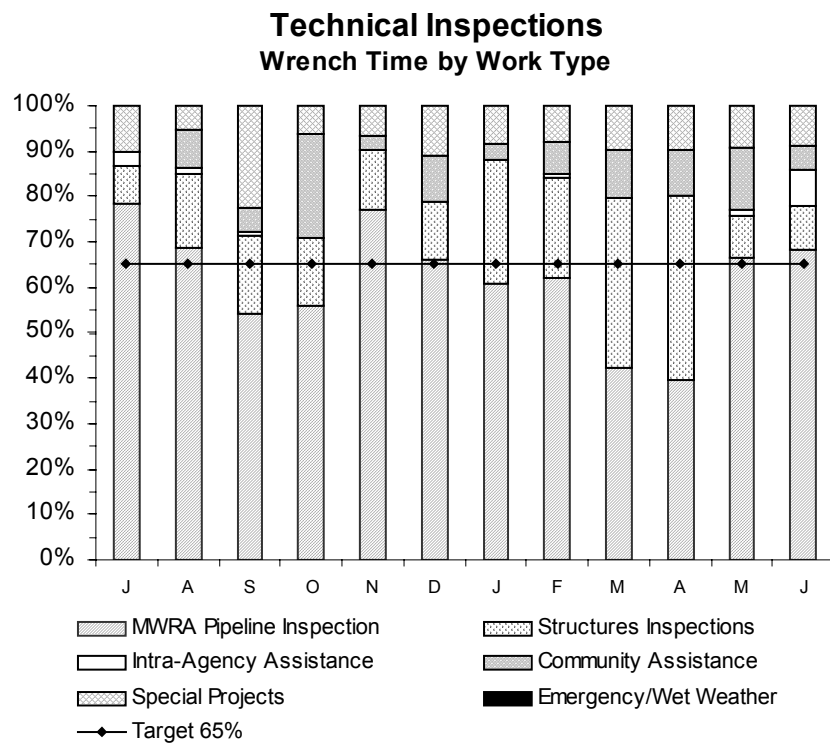
Annual Statistical Maintenance Performance Information:

Attached, please find graphical data for the Technical Inspection and Pipeline Maintenance groups. These are key indicators of performance for Fy02. Monthly

maintenance man-hours are included in the representative charts based on work types, as noted.

Technical Inspections:

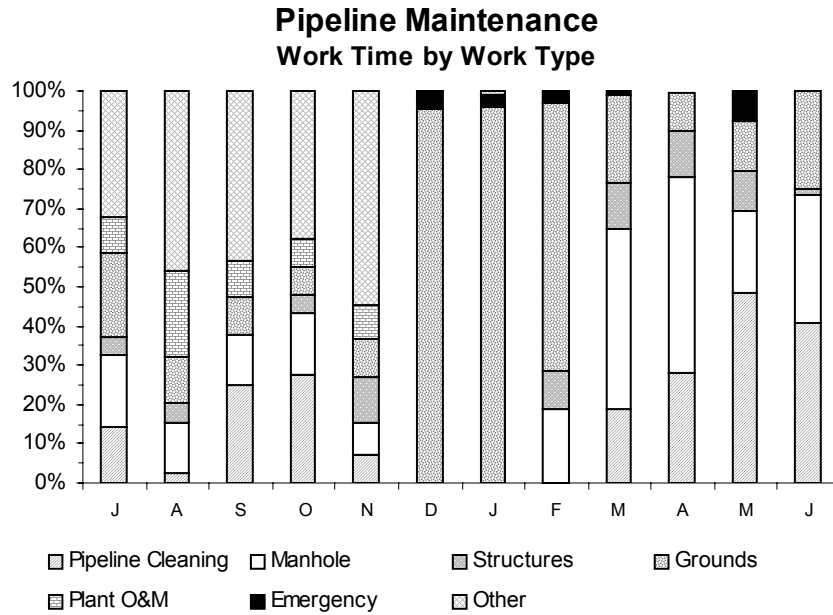
Pipeline Inspections, Structures Inspections, Intra-Agency Assistance, Community Assistance, Special Projects and Emergency /Wet Weather are the categories shown on the “Technical Inspections Wrench Time by Work Type” bar chart. Pipeline inspections average about 70% of the workload followed by structures inspections, including manholes, averaging about 30%. Approximately 59 miles of pipelines were inspected. Structures inspected include about 1,037 manholes. Other structures inspections include tide-gates (65 for FY02) as part of the monthly routine inspections required by the NPDES permit. Other structures included (154) Head Houses and (53) Diversion Structures.



	Pipeline Internal Inspection											
FY02	J	A	S	O	N	D	J	F	M	A	M	J
MWRA Pipeline Inspection	1082	1371	1027	1245	1391	1075	1122	939	645	622	1060	1009
Structures Inspections	114	321	330	330	234	214	510	331	576	638	144	149
Community Assistance	0	168	100	512	56	160	64	104	160	160	212	80
Intra-Agency Assistance	40	32	16	0	0	0	0	16	0	0	24	112
Emergency/Wet Weather	0	0	0	0	0	0	0	0	0	0	0	0
Special Projects	140	103	426	140	120	182	152	123	150	150	150	131
Total	1376	1994	1899	2227	1801	1631	1848	1513	1531	1570	1590	1481
Target 65%	65	65	65	65	65	65	65	65	65	65	65	65

Pipeline Maintenance:

Core business includes general pipeline cleaning and structures maintenance. This chart demonstrates the distribution of workload based on the work types shown. During December and January the work base for pipeline maintenance was relocated to a new consolidated facility in Chelsea. This had an impact on core business.



	Pipeline Maintenance											
FY02	J	A	S	O	N	D	J	F	M	A	M	J
Pipeline Cleaning	353	70	586	692	168	0	0	0	92	162	340	226
Emergency	0	0	0	0	0	3	9	10	5	-2	53	1
Plant O&M	235	562	204	184	201	0	0	0	0	0	0	0
Structures	124	128	0	120	283	0	0	33	59	69	72	10
Grounds	526	303	232	176	230	59	274	238	110	56	91	137
Manhole	455	320	293	390	188	0	0	66	227	287	148	179
Other	797	1167	1017	946	1292	0	3	176	180	545	353	139
Total	2489	2549	2332	2508	2362	62	286	523	672	1117	1056	691
FY01 Pipeline Cleaning	26	49	38	27	20	20	26	24	9	28	25	31

**Massachusetts Water Resources Authority
Annual Maintenance Status Sheet**

Fore River Pelletizing Plant

July 2001 - June 2002

Critical Equipment Availability: Twelve Month-Average – 75.0 %

Operating logs indicate that an average of 9 of the 12 centrifuges were available during FY02. 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, 9 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 two weeks.

Work Orders:

In FY02, staff completed 1,653 or about 91 % of the 1825 work orders that were opened.

Equipment Replacement: More than \$ 715,000.00 was spent on replacement parts and maintenance related items in FY02 including:

- Complete overhaul of Processing Trains Nos. 3, 4, 5 and 6.
- Replaced feed tube in Centrifuge No. 11.
- Overhaul Sludge Pump No. 3.
- Replaced/rebuilt Train No. 6 sludge conveying screws.