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**INDEPENDENT STATE AUDITOR'S REPORT ON THE
DESIGN AND CONSTRUCTION OF THE
MASSACHUSETTS WATER RESOURCES AUTHORITY'S
UNION PARK DETENTION/TREATMENT FACILITY**

**OFFICIAL AUDIT
REPORT
FEBRUARY 11, 2009**

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The Massachusetts Water Resources Authority (MWRA) was established by Chapter 372 of the Acts of 1984 to assume the duties and responsibilities of the Metropolitan District Commission's Water and Sewer Division. These responsibilities include providing water and sewer services to 61 communities and approximately 2.5 million people in the Commonwealth.

On September 5, 1985, the Federal District Court in Massachusetts ruled that wastewater discharged into the Boston Harbor was in violation of the 1972 Federal Clean Water Act requirements, and the court ordered MWRA to develop and implement a program to provide treatment of its wastewater as required by that law. In accordance with a court-ordered schedule, MWRA undertook a program of improvements to the wastewater collection and treatment facilities serving the metropolitan Boston area. The court order is primarily composed of three major projects: the Deer Island Primary and Secondary Treatment Facilities, the Fore River Shipyard Residuals Pelletizing Plant, and the Combined Sewer Overflow Program (CSO). The Office of the State Auditor (OSA) has reviewed the first two projects and issued several reports on their activities. The OSA is currently reviewing the component parts of the CSO program.

The Union Park Detention/Treatment Facility - one of the CSO program's components - is the subject of this report. The facility, located between Malden Street and Union Park Street in the South End of Boston, detains and treats the combined stormwater and sewage that previously was discharged into Fort Point Channel approximately 25 times a year during rainstorms. Upon completion, the facility will significantly reduce CSO contaminant loading to Fort Point Channel. The design and construction of the detention/treatment facility was completed at a total cost of \$55,536,979.

The objective of this review was to determine whether MWRA managed the design and construction of the Union Park Detention/Treatment Facility in an efficient and effective manner.

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The contract between MWRA and Barletta Engineering Corp. includes the construction of a new storm and wastewater detention/treatment facility for MWRA that was built on land at an existing pumping station owned and operated by the Boston Water and Sewer Commission (BWSC). The contract also includes major construction improvements to BWSC's existing pumping station. MWRA and BWSC had their own separate design contracts with Metcalf & Eddy, Inc., and the total design and construction costs of this project amounted to \$55,536,979. Our review indicated that, although the CSO project has experienced a number of design errors and omissions that had to be corrected by change order, the added cost of the corrections was satisfactorily recovered from the design contractor. However, we found that MWRA incurred additional finance costs of

at least \$26,000 due to incomplete contract terminology and \$68,384 in delinquent collections due to lax billing and collection procedures.

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INTRODUCTION

Background

The Massachusetts Water Resources Authority (MWRA) was established by Chapter 372 of the Acts of 1984 to assume the duties and responsibilities of the Metropolitan District Commission's Water and Sewer Division. These responsibilities include providing water and sewer services to 61 communities and approximately 2.5 million people in the Commonwealth. MWRA maintains 400 miles of water pipes, aqueducts, and tunnels, and 240 miles of sewers. MWRA's service area covers approximately 410 square miles and includes approximately 890,000 households and 5,500 businesses, which collectively produce approximately 350 million gallons of sewage each day. MWRA supplies drinking water to approximately 2.2 million people in 50 Massachusetts communities.

On September 5, 1985, the Federal District Court in Massachusetts ruled that wastewater discharged into the Boston Harbor was in violation of the 1972 Federal Clean Water Act requirements, and the court ordered MWRA to develop and implement a program to provide treatment of its wastewater as required by that law. In accordance with a court-ordered schedule, MWRA undertook a program of improvements to the wastewater collection and treatment facilities serving the metropolitan Boston area. The court order is primarily composed of three major projects: the Deer Island Primary and Secondary Treatment Facilities, the Fore River Shipyard Residuals Pelletizing Plant, and the Combined Sewer Overflow Program (CSO). The Office of the State Auditor (OSA) has reviewed the first two projects and issued several reports on their activities. The OSA is currently reviewing the component parts of the CSO program.

Many older areas of cities across the country have combined sewer systems, which merge stormwater drainage and sewer discharges in a single pipe. In wet weather, these combined sewers can fill with more stormwater and sewage than can be adequately transported to the treatment plant. As a result, these overflows are often discharged into local waters to avoid backing up into homes and streets. These discharges can pose a potential health threat to swimmers, boaters, and marine life.

Under the Federal Court Order that directed the Boston Harbor Clean-Up Project, MWRA initiated plans to control or treat CSO beginning in 1987. The first step was to improve pumping capability

to the Deer Island Treatment Plant and to implement effective sewerage maintenance practices. Next, MWRA evaluated potential long-term approaches to improve CSO control throughout the system.

MWRA's CSO control plan, composed of 35 projects valued at approximately \$925 million, was designed to bring CSO discharges into compliance with the Federal Clean Water Act and State Water Quality Standards. Design and construction milestones for these projects are included in the Federal Court Order for the Boston Harbor Case. In a typical year, nearly 150 million gallons of combined stormwater and sewage is discharged into the Fort Point Channel, with 132 million gallons coming from Boston's South End via the Boston Water and Sewer Commission (BWSC) Union Park Pump Station (UPPS).

The Union Park Detention/Treatment Facility, the subject of this report, is located between Malden Street and Union Park Street in the South End of Boston. The facility detains and treats the combined stormwater and sewage that previously was discharged into Fort Point Channel approximately 25 times a year during rainstorms. Upon its completion, the facility will significantly reduce CSO contaminant loading to the Fort Point Channel. (See Appendix for pertinent photos).

MWRA and its consultants evaluated several sites within a four-block area around the existing BWSC's UPPS. Utilizing BWSC's existing structure minimized the need for new above-ground structures and street piping.

The Union Park Detention/Treatment Facility consists of two distinct construction projects constructed under a single construction contract based on two distinct design/engineering contracts with Metcalf & Eddy, Inc., the design engineer for both. The construction contract is between MWRA and Barletta Engineering Corp. The project includes the construction of a new detention/treatment facility for MWRA built on land at the existing pumping station owned and operated by BWSC and major improvements to BWSC's existing pumping station. MWRA pays all invoices under the contract but is reimbursed by BWSC for costs relating to the improvements to BWSC's pumping station.

Audit Scope, Objectives, and Methodology

The purpose of our review was to determine whether MWRA managed the design and construction of the Union Park Detention/Treatment Facility in an efficient and effective manner. Our audit

included reviews of the various contracts and memorandums of understanding associated with the design and construction of the Union Park Detention/Treatment Facility. We met with MWRA senior management, including the Chief Operating Officer and the Director of Construction; the Construction Coordinator for the Project; and MWRA's Internal Audit Division on several occasions to discuss design errors and omissions, plant operations, and their monitoring roles. We also toured the Union Park Detention/Treatment Facility.

Our audit was conducted in accordance with applicable generally accepted government auditing standards and included such audit tests and procedures as we considered necessary under the circumstances.

At the conclusion of our review, we provided MWRA with a draft report for comment and considered its responses in the preparation of this final report.

AUDIT RESULTS

IMPROVEMENTS NEEDED IN CONTRACT MANAGEMENT PRACTICES AND PROCEDURES

As noted in the Background section of this report, the Combined Sewer Overflow Program (CSO) contract between the Massachusetts Water Resources Authority (MWRA) and Barletta Engineering Corp. includes the construction of a new storm and wastewater detention/treatment facility for MWRA that was built on land at an existing pumping station owned and operated by the Boston Water and Sewer Commission (BWSC). The contract also includes major construction improvements to BWSC's existing pumping station. MWRA and BWSC had their own separate design contracts with Metcalf & Eddy, Inc., and the total design and construction costs of this project amounted to \$55,536,979. Our review indicated that, although the CSO project has experienced a number of design errors and omissions that had to be corrected by change order, the added cost of the corrections was satisfactorily recovered from the design contractor. However, we found that MWRA incurred additional finance costs due to incomplete contract terminology and lax billing and collection procedures, as discussed below.

Design Contract

On December 15, 1999, MWRA's Board of Directors awarded Contract No. 6264 to Metcalf & Eddy, Inc. (M&E), for the design of a detention/treatment facility on the site of an existing BWSC pump station. The contract award was in the amount of \$5,477,420 covering the period December 30, 1999 through March 31, 2006. Five amendments totaling \$2,677,982, or 49% of the contract's original total, were made to the original contract award, and the completion date was extended to December 26, 2007. Many of the changes resulted in the construction contractor's incurring additional costs due to design errors and omissions, which is discussed in the construction contract section below.

MWRA's Final Combined Sewer Overflow (CSO) Conceptual Plan (1994) and Final Combined Sewer Overflow Facilities Plan and Environmental Impact Report (1997) recommended detention and/or treatment of the pumping station flows as the most cost-effective method to control CSO discharges and improve water quality in the Fort Point Channel. This recommendation was made after evaluations of several alternatives, including complete sewer separation, near-surface storage, screening and disinfection, and primary treatment. To meet

state water quality goals for reduction of pathogens and elimination of aesthetic impacts from floatables, screening and disinfection was included in the treatment recommendation. Due to relatively high CSO pollutant loadings to the Fort Point Channel, detention/storage of flows was added to reduce Biochemical Oxygen Demand¹ (BOD) and solids.

The design contract calls for below-ground, rapid-settling detention basins; fine screening; chlorination with sodium hypochlorite; and dechlorination with sodium bisulfite. Although most of the new facility was below ground, an addition to the existing BWSC pumping station was included. The storage basins, which will have a combined holding capacity of 2.2 million gallons, are intended to reduce the average annual number of pumping station discharges to the Fort Point Channel and to detain and treat flows that exceed the storage capacity in larger storms.

The design contract was competitively bid, and MWRA's selection committee awarded the contract to M&E, the low bidder for the work.

Construction Contract

The contract for the Union Park Facility is a shared project between BWSC and MWRA. BWSC's share represents changes and improvements to its existing pumping station at Union Park, and MWRA's share represents the construction of a new sewerage treatment and detention storage basin facility on the site of BWSC's pumping station.

Construction Contract No. 6265 for the facility was advertised on December 7, 2002 and competitively bid in accordance with Chapter 149 of the Massachusetts General Laws. Bids were received from eight contractors and opened on March 6, 2003. MWRA's Board of Directors awarded the construction contract to Barletta Engineering Corp., for \$37,224,444. MWRA's share of the contract was \$32,925,021 (88.4%), and BWSC's share was \$4,299,423 (11.6%).

In accordance with the federal court order, MWRA was to begin construction of the CSO Facility by March 31, 2003 and complete it by September 29, 2005. However, the Union Park Detention/Treatment Facility did not become fully operational until April 26, 2007.

¹ Biological Oxygen Demand—The amount of oxygen-consuming organic material in wastewater and a measure of potential for depletion of the organic material by bacteria.

The construction contract included developing a new screenings removal area, a disinfection system, a dechlorination system, influent channels, an emergency bypass into the pump station, detention basins, a sizable addition to the pump station building for treatment components, odor control equipment, and an operation control system that would be integrated with BWSC's upgraded pumping-station control system. In addition, several BWSC pump station improvements were included in the contract, including a fourth turbine-driven pump and an emissions stack, replacement of wet well dewatering pumps, and the installation of gates within sewers outside the station to improve sewer system hydraulic performance.

The detention basins at Union Park will provide 2.2 million gallons of storage and will reduce the number of CSO discharges to the Fort Point Channel by holding the entire overflow of most storms. In larger storms, the detention basins will reduce the volume of CSO discharge. All flows that are discharged will receive screening to remove larger solids and floatable materials, disinfection with sodium hypochlorite, and dechlorination with sodium bisulfite to meet National Pollutant Discharge Elimination System permit limits. The CSO Facility, together with BWSC improvements to its collection system, will reduce average annual CSO volume to Fort Point Channel from 132 million gallons to 29 million gallons, with the latter flows receiving treatment.

The cumulative total of all change orders to the construction contract totaled \$7,857,133, or 21% of the original contract amount, and the time to complete the contract has been increased 63% over the original contract duration. Of these changes, \$1,362,364, or 17%, represents BWSC's portion of the changes.

Of the \$7,857,133 in total change order costs, \$5,249,746 was originally determined by MWRA to be attributable to design errors and omissions (E&Os). M&E, the design engineer, took exception to the E&O designation and, after discussions between MWRA and M&E officials, the E&O total change order amount was determined to be \$4,528,237. MWRA's share of the E&Os is \$3,618,486, and BWSC's portion is \$909,751. MWRA determined that the \$3,618,486 of changes resulted in additional contract costs to MWRA of \$998,450 due to the construction work having to be removed and/or rebuilt and a 5% premium for non-bid work. MWRA advised us that M&E paid MWRA \$175,000 and waived collection of unpaid invoices totaling \$825,000 for a total of \$1,000,000 to settle the additional change order costs. MWRA also

negotiated a \$1,750,000 settlement with the construction contractor to resolve disputed claims that were not involved with the E&O issues.

Although the CSO Project experienced a number of design errors and omissions that had to be corrected by change order, the added cost to MWRA for the corrections was satisfactorily recovered from the design engineer. MWRA officials indicated that both the design engineer and construction contractor's awareness of our ongoing audit efforts provided MWRA leverage during negotiations, which was helpful in obtaining favorable results.

MWRA Ratepayers Absorb Unnecessary Finance Charges

Failure to timely invoice BWSC for construction costs and late payment of invoices by BWSC resulted in additional finance charges of at least \$26,000 to MWRA ratepayers and \$68,384 in delinquent collections.

Under the Memorandum of Understanding (MOU) agreement between BWSC and MWRA, BWSC was to pay MWRA \$195,428 per month for BWSC construction costs incurred between December 2003 and September 2005. These payments do not include the additional costs associated with change orders related to BWSC work discussed below. BWSC was delinquent on all of the 22 scheduled payments, ranging from six days to 13 months late.

In addition, the MOU agreement between MWRA and BWSC states that, after obtaining BWSC's approval of necessary change order costs, MWRA should invoice BWSC for its share of the cost and receive payment within 30 days. However, MWRA did not invoice BWSC until October 2006 for items totaling \$1,311,274 paid by MWRA for the period July 2004 through August 2006. Also, BWSC did not reimburse MWRA for these costs until July 2007, some nine months later. On March 21, 2008 MWRA invoiced BWSC for additional change order costs in the amount of \$68,384 for items paid by MWRA in 2006 and 2007. As of the conclusion of our fieldwork in October 2008, BWSC had not paid MWRA the \$68,384 owed for this invoice.

The late payment of invoices by BWSC and the failure by MWRA to timely invoice BWSC resulted in unnecessary costs of at least \$26,000 to MWRA ratepayers. MWRA also failed to collect in a timely manner unpaid balances due of \$68,384.

MWRA officials concurred that the MOU states that BWSC agreed to pay MWRA within 30 days of its receipt of any bill by MWRA. MWRA officials also acknowledged that all 22 base payments were not received within the 30-day period but stated that 20 of the payments were only approximately six to 36 days late, which they did not consider to be substantially late. These officials further stated that, although the remaining two payments were substantially late, BWSC believed that it had paid more than it should have relative to the project's scheduled progress and what had actually been built. MWRA officials indicated that they agreed with BWSC's position stating that although no formal renegotiation of the original payment terms or schedule was deemed necessary by either party, the timing of these two payments was appropriate and in the "spirit of the MOU." The OSA estimates that, had MWRA enforced the 30-day contractual period on base payments, approximately \$17,000 in interest would have been earned.

Regarding change order work, MWRA officials acknowledged that it initially considered billing BWSC monthly for change order work completed by the contractor. However, they indicated that, due to the burdensome administrative logistics of tracking the actual completion of each portion of the change order work and separately billing BWSC, together with the initial relatively low dollar amount of the initial change orders and the significant delays in the project, BWSC requested that billing for change order work not commence until completion of the 22 payments for the base contract work. Finally, MWRA officials stated that they agreed to delay billing of change order work although no formal renegotiation of the terms of the MOU took place. MWRA received the last base payment in late 2006, which is when the first invoice for change order work was billed to BWSC. The OSA estimates that, had MWRA enforced the 30-day contractual period on change order payments, approximately \$73,000 in interest would have been earned.

In summary, MWRA agrees that the late payment of the above base payments and change order invoices were not in accordance with the formal MOU (i.e., within 30 days). MWRA also agrees that several outstanding change order invoices totaling \$68,384 still remain unpaid, of which over \$50,000 has been outstanding for more than a year. However, MWRA believes that no more than \$26,000 of lost interest should be associated with the late payment of its base payments and change order work.

Recommendation

MWRA should:

- Strengthen its contract management practices and procedures to ensure that all pertinent contract and change order payment terms and conditions are formalized in writing and not left up to interpretation of the “spirit of the MOU.”
- Immediately recover the overdue payment of \$68,384 for change order work from BWSC either by cash payment or offset against BWSC for construction contracts BWSC is performing, and being paid for, by MWRA.
- If possible, recover the \$26,000 of interest charges relating to what MWRA believes would be the late payment for change order work.

Auditee's Response

MWRA's response stated, in part:

The design and construction of the Union Park Pump Station was a complex and unique undertaking, unlike any of MWRA's previous projects. In partnership with our largest customer, the Boston Water Sewer Commission (BWSC), this project was successfully completed and is now operating as designed, dramatically reducing the frequency and volume of combined sewer overflow (CSO) discharges to the Fort Point Channel.

In addition, MWRA indicated in its response that it agrees that all pertinent changes to MOUs should be formalized in writing and that it will ensure that such changes are executed. MWRA also stated that it is seeking the \$68,384 overdue payment for change order work. Further, MWRA indicated that, although it does not disagree with the \$26,000 calculation of late payment interest on change orders, it does not believe it to be recoverable because the existing MOU does not contain any provision covering penalties or interest for late payments.

Auditor's Reply

We are satisfied with MWRA's corrective actions regarding our first two recommendations. With respect to our third recommendation, MWRA should include a provision in its future MOUs that addresses penalties or interest for late payments.

APPENDIX

Union Park Detention/Treatment Facility

