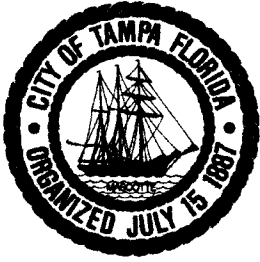


**WATER DEPARTMENT  
WATER DISTRIBUTION  
AUDIT 06-19  
JUNE 8, 2007**



# CITY OF TAMPA

Pam Iorio, Mayor

Internal Audit Department

Roger Strout, Internal Audit Director

June 8, 2007

Honorable Pam Iorio  
Mayor, City of Tampa  
1 City Hall Plaza  
Tampa, Florida


RE: Water Distribution, Audit 06-19

Dear Mayor Iorio:

Attached is the Internal Audit Department's report on Water Distribution.

The Tampa Water Department has already taken positive actions in response to our recommendations. We thank the management and staff of the Water Distribution Division for their cooperation and assistance during this audit.

Sincerely,

  
Roger Strout  
Internal Audit Director

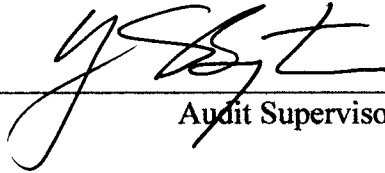
cc: Darrel Smith, Chief of Staff  
Steve Daignault, Public Works and Utility Services Administrator  
Brad Baird, Water Department Director  
Bonnie Wise, Revenue and Finance Director  
James Buckner, Technology and Innovation Director

**WATER DEPARTMENT  
WATER DISTRIBUTION  
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*James Smith – Not Available to sign*

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Auditor



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Audit Supervisor



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Audit Director

**WATER DEPARTMENT  
WATER DISTRIBUTION  
AUDIT 06-19**

**INTRODUCTION**

The Tampa Water Department is a city operated water supplier, with a treatment capacity of 100 million gallons of surface water per day. It distributes the treated water through 2,230 miles of water mains to the city's more than 500,000 consumers. The Department's service area encompasses 211 square miles.

The Water Department has several divisions, including Water Distribution (the Division). In April 2006, the Division reorganized into four zones, each providing the following services:

- Service and Installation
- Construction and Maintenance
- Metering
- Valve and Hydrant

The Division utilizes two separate computer systems for operational purposes. One is the Multi-Service System (MSS), which is a mainframe system. Any transaction or service that results in customer billing, is MSS based. Triage is the other system. The Water Department's IT staff developed it to document and track customer complaints, which MSS cannot effectively do. The use of the two systems can result in duplicate entries when the Division renders certain types of services. The Division also maintains several Access databases to assist in the scheduling and tracking of certain preventive maintenance processes.

**STATISTICS**

	<b><u>FY04</u></b>	<b><u>FY05</u></b>	<b><u>FY06</u></b>
<b>Operating Expenditures</b>	\$3,542,844	\$3,580,840	\$4,949,070
<b>Personnel Services</b>	4,912,239	5,155,482	5,451,796
<b>Personnel Services-Overtime</b>	<u>195,230</u>	<u>222,287</u>	<u>515,184</u>
<b>Total Personnel Services</b>	<u>5,107,469</u>	<u>5,377,769</u>	<u>5,966,980</u>
<b>Total</b>	<u>\$8,650,313</u>	<u>\$8,958,609</u>	<u>\$10,916,050</u>

Source: The City's financial system (FAMIS)

## **STATEMENT OF OBJECTIVES**

This audit was conducted in accordance with the Internal Audit Department's FY06 Audit Agenda. The objectives of this audit were to determine if:

1. The Division is performing preventative maintenance in accordance with established standards.
2. Fireline information in MSS is accurate and complete for billing purposes.

## **STATEMENT OF SCOPE**

The audit period covered Water Distribution activity that occurred from October 1, 2005 to December 31, 2006. However, for purposes of Valve testing, we used activity information that occurred from October 1, 2004. We also used Hydrant data from 1999 for comparative purposes. Source documentation was obtained from the Water Distribution Division, MSS, and the City's financial system. Original records as well as copies were used as evidence and verified through physical examination.

## **STATEMENT OF METHODOLOGY**

To achieve the audit's objectives, we placed reliance on computer-processed data contained in the City's financial system, MSS, and a Fireline Access Database program maintained by the Division. The City's financial system and MSS were previously determined to be reliable and no additional work was necessary. We assessed the reliability of the data contained in the Database program and conducted certain tests of the data contained therein. Based on our assessment and tests, we determined that the Database did not appear to contain all relevant Fireline information. However, through alternative means, we were able to utilize a portion of the data for testing of fireline billing. In addition, we were able to perform preventive maintenance testing for those firelines recorded in the database.

The Technology and Innovation Department (TI) provided us with the relevant MSS information for all meters including back-flow-prevention devices. We converted the information to a Database and ran queries for all meters up to 2 inches, which allowed testing 100% of the population.

We ran Database queries for hydrants and valves testing 100% of the population. We also traced hydrant samples from the databases to MSS.

The sample size and selection were statistically generated using a desired confidence level of 90 percent, expected error rate of 5 percent and a desired precision of +/- 5 percent. Statistical sampling was used in order to infer the conclusions of test work performed on a sample to the population from which it was drawn and to obtain estimates of sampling error involved. When appropriate, judgmental sampling was used to improve the overall

efficiency of the audit.

### **STATEMENT OF AUDITING STANDARDS**

We conducted our audit in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to afford a reasonable basis for our judgments and conclusions regarding the organization, program, activity, or function under audit. An audit also includes assessments of applicable internal controls and compliance with requirements of laws and regulations when necessary to satisfy the audit objectives. We believe that our audit provides a reasonable basis for our conclusions.

### **AUDIT CONCLUSIONS**

Based upon the test work performed and the audit findings noted below, we conclude that:

1. The Division was not performing preventative maintenance in accordance with its established standards.
2. Fireline information in MSS appeared to be accurate and complete. However, controls over Fireline data could be improved.

While the findings discussed below may not, individually or in the aggregate, significantly impair the operations of the Water Distribution Division, they do present risks that can be more effectively controlled.

## **NON-REVENUE PRODUCING WATER**

We obtained a copy of the Non-Revenue Producing Water (NRPW) analysis prepared by the Water Department. The NRPW percentage is a twelve-month moving average of the percent of pumped water with no associated revenue. In our previous Audit 01-23, the April 2001 NRPW was 7.1 %. In September 2006, it was 12.4 % with a further increase to 13.0% in November 2006. According to management, the target NRPW is 10%. However, the Division has not met the targeted goal since September 2003.

The Water Department represented that the City's cost of production for one unit of water (748 gallons) is \$0.69. Had the targeted NRPW of 10% been attained in 2006, the City could have realized a potential reduction in annual water production costs of approximately \$650,000.

### **RECOMMENDATION 1**

Management should identify the reason for the NRPW increase. Once identified, they should develop and implement an action plan to reduce NRPW to an acceptable level.

### **AUDITEE RESPONSE**

We agree with the Audit's Recommendation and have already started addressing the Non-Revenue Producing Water (NRPW) comments. This discussion of NRPW and Preventive Maintenance are intertwined with each other because deferred preventive maintenance is a causative factor in NRPW.

The Tampa Water Department's aging infrastructure is contributing to both Non Revenue Producing Water and to the Distribution Division's problems with meeting preventive maintenance standards. Approximately 15% of the water infrastructure is at or beyond its useful life. As a result, approximately 65% of the Distribution Division's workload during the period May 2006 through April 2007 was to react to system repair, shutdowns, and restorations. This has led to the Division's inability to keep up with their required preventive maintenance.

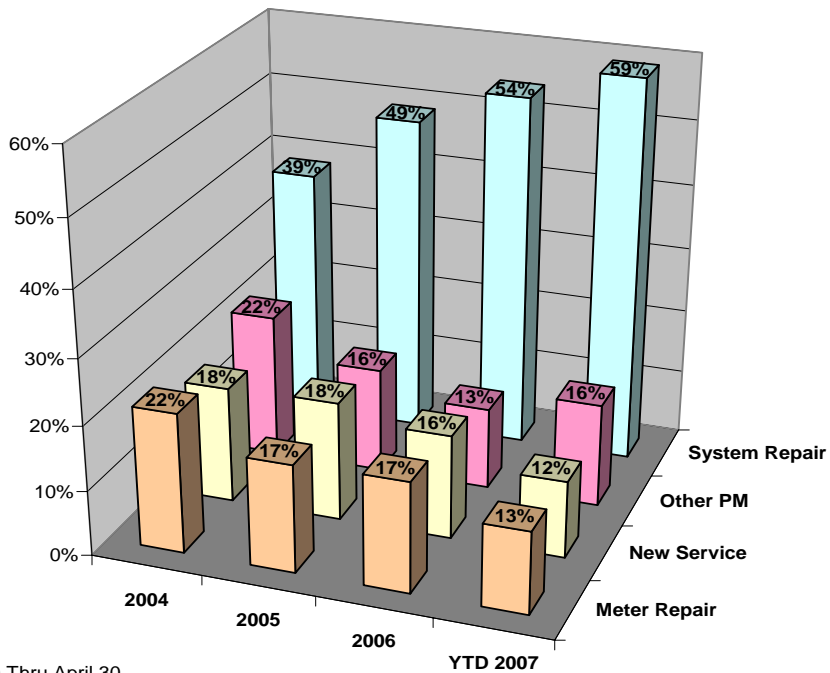
Since system repairs and shutdowns must be addressed immediately and there is a finite amount of time available to perform all of the required work, preventive maintenance is deferred. As the chart on the next page shows, the Distribution Division is short approximately 34,000 hours to perform all of the preventive maintenance work required and to respond to system failures. As the amount of time spent on system failures decrease, the amount of time available for preventive maintenance will increase.

**Distribution Division  
Workload Summary  
May 2006 through April 2007**

<b>Item</b>	<b>Total Hours Required/ Performed</b>	<b>Percent of Available Hours</b>
Preventive Maintenance Program Requirements	37,293	28.3%
Corrective Maintenance Activities	17,954	13.6%
Star Related Activities	4,897	3.7%
Potable Customer Installations/Removal	20,238	15.3%
System Repair, Shutdowns and Restoration	85,326	64.7%
Miscellaneous	418	0.3%
	166,125	126%
Total Available Hours	131,976	
Total Hours Over/(Short)	(34,149)	

The Water Department contracted with PB Consult Inc., to perform a water audit of the system. In their report issued to the Department this past March, they identified that the two largest contributors to water loss were: 1) water infrastructure leakage and 2) metering inaccuracies.

**Distribution Division  
Workload Summary  
FY04 - FY07 YTD\***



\*YTD Thru April 30, 2007

This is confirmed and reinforced by the amount of time and effort the Distribution Division is spending to repair the aging infrastructure. As the infrastructure continues to age, the Distribution Division is required to allocate a larger percentage of its workforce toward system repair.

The Water Department is taking several steps to address both the non-water revenue producing problem and the preventive maintenance problems:

- Initiated a 100 valve test and leak detection program within the downtown area. The purpose of this program is to identify problem valves and to also check the water distribution system for leaks. The Water Department plans on expanding this program, if successful, beyond the downtown area in FY08 and beyond if funding is available.
- Included funding in the FY08 – FY13 Capital Improvement Plan funding to replace large valves. This is the first time the Department has specifically identified funding for large valve replacement.
- Identified and developed a plan to repair and replace more than \$150 million in deferred maintenance. This plan has been included in our FY08 – FY13 Capital Improvement Plan as an unfunded program.
- Requesting \$1,000,000 in FY08 to contract for the replacement of small meters. This program will allow the Distribution Division to reduce the back-log of small meters that are scheduled for replacement. This one-year program will allow the Department to address what PB Consulting has identified as the second largest contributor toward NRPW.
- While maintenance for the STAR program does not account for a significant amount of time, the amount of time spent does exceed the two FTEs that were added when the program was started. To address STAR maintenance issues, the Department is planning to flush the STAR system. This should help reduce the amount of maintenance effort spent on the system.

## **PREVENTIVE MAINTENANCE**

We tested water distribution devices including meters and valves, firelines, backflow devices and hydrants for preventive maintenance (PM) compliance. Although management has set preventive maintenance standards, we noted a significant number of exceptions to these standards. This indicates an apparent weakness in the PM internal control process. Management believes that the transitioning from the reorganization that began in April 2006 has adversely affected the accomplishment of PM programs. Some objectives of a PM program are to reasonably ensure equipment efficiency, reduce equipment failure, and promote the life of the equipment within manufacturer standards. Adequate internal controls over planned maintenance are necessary to achieve these objectives.

Management should provide day-to-day oversight, to help address and correct PM deficiencies. An effective PM internal control process will help provide reasonable assurance that PM objectives are achieved.

### **Back Flow Prevention Devices**

The purpose of a back flow prevention device (BFP) is to ensure that reclaimed water does not mix with potable water within a household. The Division standard requires annual PM's of these devices. We obtained a TI report listing all BFP devices and related PM data, which we used to test PM compliance. The information was transferred into an Access database and a query was developed to determine PM compliance in 2006. Our database indicated that preventive maintenance was due on 4,906 BFP devices. We identified 2,509 exceptions (51.1% exception rate). The exceptions include 405 BFP devices that should have been PM'd in the previous year, but were not serviced.

The preventive maintenance of BFP devices is essential to help minimize the public's exposure to reclaimed water contamination.

### **Large Meters**

#### **Size 1"– 2"**

Meters of this size require chamber replacement every four years according to Division PM Standards. The TI Department provided us a report that listed all large meter information and related PM statistics. We transferred the information into an Access database and ran a query to test for PM compliance. For 2006, 1,540 meters required chamber replacement. We found 1,111 exceptions to the replacement schedule (72.1% exception rate).

Without consistent and regular preventive maintenance, there is a greater likelihood of meter malfunctions including leaks and/or inaccurate metering of water usage. This could result in revenue loss to the City.

### Size 3”– 8”

Meters 3 inches and larger are tested annually. Each zone maintains a large meter spreadsheet to schedule and complete PM's. Once a PM is completed, the Division enters it into MSS. We obtained copies of the spreadsheets and a copy of the Water Department's Application Systems Analyst database listing all these meters. Using the database, we selected a statistical sample of 46 from a universe of 381 large meters. Based on our test results, we found fourteen exceptions to the established PM standard (30% exception rate).

There is a risk that if a large meter was defective, a significant loss of revenue to the City is possible. The lack of timely inspections could increase this risk unnecessarily.

### Small Meters

There are approximately 131,000 small meters (5/8 inch and 1 inch) in the water distribution system. Meters of this size are on a ten-year replacement cycle. The TI Department provided us with a report that listed all small meter information and related PM statistics. We transferred the information into an Access database and ran a query to test compliance with the 2006 replacement schedule. The query listed 7,941 small meters due for change out. We found that 6,479 were not replaced (an exception rate of 81.6%).

There is a risk that if a meter was defective, it might indicate a lower flow than actual consumption, resulting in loss of revenue to the City.

### Firelines

There are two types of firelines, doubles and singles. According to Division Standards, doubles are to be tested annually, and singles every other year. The Division maintains a database of all firelines. We ran a query on doubles and found that 309 out of 1,037 had not been tested in 2006 (29.8% exception rate). However, a similar query for single firelines indicated that there was not a material exception to the PM standard.

### Fire Hydrants

There are approximately 12,700 hydrants in service and included in the Division's PM database. Department policy requires that biennial maintenance be performed on all hydrants. The database listed 3,830 that should be scheduled for testing as of October 31, 2006. Our database query identified 3,080 hydrants not maintained as scheduled (80.4% exception rate).

Using the Division Hydrant database, we completed an additional test to determine the number of hydrants that had required a PM in years other than 2006. We found 2,062 had no documented PM with dates ranging from 1999 to 2003.

## **Valves**

We obtained a copy of the Division's Valve database. Depending on the type of valve, PMs (turns) are required either annually or biennially on a fiscal year basis. The database listed 909 total active valves.

### **BFV Valves (Butter-fly) 16" and Larger**

Under Department policy, these valves are supposed to be turned every two years to assure they work properly. There are 534 valves of this type in the database. Our query listed 336 of this type of valve that were not tested in 2006 (63% exception rate).

### **Non-BFV Valves and Valves Larger than 24"**

The database listed 375 valves in this category. According to the Division, these valves require annual turning. We ran a database query and found 346 of this size of valve were not turned in FY06 (92% exception rate).

## **RECOMMENDATION 2**

Management should determine the reasons for not meeting water distribution device preventative maintenance guidelines. A plan to bring the PM backlog current should be developed. If appropriate, using contracted maintenance should be considered to reduce the maintenance backlog. In addition, management should develop and implement an effective PM monitoring plan to track adherence to PM standards.

## **AUDITEE RESPONSE**

We agree with the Audit's Recommendation and have already started addressing the Preventive Maintenance comments. We have already discussed the inter-relationship between the aging infrastructure and deferred preventive maintenance. Ideally, we would like to see the Distribution Division's work effort focus primarily on preventive maintenance. However, it will take several years to achieve this goal because no matter how much we plan, we must respond to system failures which will vary in impact and frequency. When these unplanned failures occur, we must adjust and/or deviate from our PM program.

In addition to the steps we are taking (see NRPW), we need to take additional steps to improve our preventive maintenance program:

- Implement an asset management system. We have started this effort by continuing to develop our GIS based asset identification which is a preliminary step for the City implementing an Enterprise-wide solution for asset management.
- Assessment of the Distribution's Optimization Program. It has been one year since the Distribution Division was re-organized into a Four Zone concept. Working with a consultant, we held two recalibration workshops in May 2007 to assess where we are to date; to determine what's working and what's not; redefined the goals of the

optimization, and to develop a framework to ensure the Division continues to move forward in realizing the Department's mission. An outcome of the workshops was the development of six focus areas designed to enhance the overall effectiveness of the new organization. In addition, the focus areas will specifically address our preventative maintenance needs by:

- ✓ Enhancing resource utilization of staff and equipment across all zones;
- ✓ Facilitating the development of preventative maintenance planning schedules; and
- ✓ Maximizing training opportunities to ensure cross-training skills are achieved and maintained.

### **FIRELINE DOCUMENTATION**

Firelines are a pipework system (usually in larger buildings) dedicated to providing water for extinguishing fires. The Division maintains a Fireline database that is used to schedule preventative maintenance. It is also used to make comparisons to the information in MSS. The Division is responsible for entering fireline information into MSS for billing by the Utility Accounting Division.

We tested the database for agreement with MSS by selecting random samples of fireline data. We noted the following:

- Data entry is performed by two separate employees and not entered in the same manner
- Data is not reconciled between the two systems
- Information in the two systems is not always consistent

Inaccuracies in the database could result in Firelines not being billed and preventative maintenance not accomplished in accordance with Division standards.

In addition, we tested the samples selected for billing in accordance with policy. We noted three exceptions where the billing screen was not populated and the firelines were not billed.

We also noted that the Fireline database is not backed up on a daily basis. The safeguarding of information through backup is an internal control mechanism that helps ensure effective and efficient operations and timely reporting.

### **RECOMMENDATION 3**

Management should develop a data entry control process that promotes accuracy and agreement of fireline information between the two systems. The in-house database should be reconciled to MSS on a periodic basis. Any exceptions should be researched and corrections made as required.

#### **AUDITEE RESPONSE**

We agree with the Audit's Recommendation and have developed a data entry control process. We are currently reconciling the fireline database with the MSS billing system.

#### **RECOMMENDATION 4**

Management should require the Fireline database be backed up on a daily basis.

#### **AUDITEE RESPONSE**

We agree with the Audit's Recommendation. The database is currently located on a network drive and is backed-up nightly by T&I.

#### **PRODUCTIVITY**

Management prepares monthly activity reports to monitor production. However, productivity is not measured. Productivity standards can be used as a means of defining management's expectations for the division. In addition, the standards can be used to evaluate the division's performance and determine capacity to stay current with planned maintenance. Evaluation of performance can also be used as a means to identify the need for training, equipment, improved technology, or staffing requirements. The productivity standards can be developed in-house using historical performance data, or if applicable, utilize industry standards.

We noted that the cost of overtime increased by 132% from FY05 to FY06. Although we recognize there are costs involved in the reorganization transition process, effective internal controls should help management evaluate the economy of overtime incurred.

#### **RECOMMENDATION 5**

Management should develop a program to measure productivity.

#### **AUDITEE RESPONSE**

We agree with the Audit's Recommendation. The Distribution Division will review the American Water Works Association's recommended performance measures. Starting in FY08, we will start to implement those measures that are applicable, meaningful, and has a data set that is easy to gather.

## **FLAGGERS**

We observed an emergency response to a water main break in a high traffic volume intersection. A flagger should have been present to help mitigate the traffic hazards. However, the Division has no trained flaggers available. According to management, the State requires flaggers be trained and certified in accordance with the FDOT Maintenance of Traffic Committee (MOTC) standards. These standards state “City and County governments are required to comply with the Manual on Uniform Traffic Control Devices (MUTCD) as a minimum.” MUTCD is a Federal Highway Administration program that defines flagger qualification requirements but not an avenue to attain them. The flagger-training program established by the State (as per the MOTC) would satisfy the MUTCD requirements.

## **RECOMMENDATION 6**

Management should implement a flagger program in accordance with state regulations.

## **AUDITEE RESPONSE**

We agree with the Audit’s Recommendation and have already taken steps to improve the Maintenance of Traffic (MOT) while working in the right-of-way. The Distribution Division has taken the following steps:

- Contracted with a private firm to provide flagger service where and when appropriate
- Contracted with a private firm to provide MOT services on major arterials and connectors
- Sponsored FDOT certified MOT training for utility technicians.

We want to thank the Audit Team for their professional approach to this audit. Their analysis and recommendations will contribute toward an improved water distribution system.