

# CASE STUDY

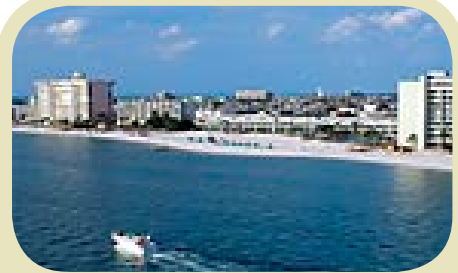
## Clearwater, FL Abates Sanitary Sewer Overflows Using the EPA Region 4 Management, Operations and Maintenance Approach

### Overview

Public sewer utilities in EPA Region 4 have been asked to implement management, operation and maintenance (MOM) programs. Participating municipalities complete self-assessments of their utilities and submit recommendations for improvements to the Region, along with prioritized implementation schedules. MOM project successes in Region 4 have contributed to national development of the capacity, management, operations, and maintenance (CMOM) approach.

The City of Clearwater joined the program in 1998 and submitted its MOM Plan in 1999. An early benefit of the self-assessment was identification of needed maintenance program improvements that were phased in starting before the Mom Plan was complete, moving the City from a reactive to a proactive maintenance approach. As a result, the number of sanitary sewer overflows began to decrease substantially within the first year.

Clearwater is continuing to improve maintenance planning and operations as the Mom Plan implementation progresses. Other Plan elements include a sewer system evaluation survey, a flow model to identify sewer capacity problems, and a capital improvement plan. Because of its investment in self-assessment and planning, Clearwater was able to demonstrate the need for future capital improvements to its system, convincing City leaders to implement a needed rate increase.



### Clearwater Fast Facts

#### Population

- 108,000

#### Size of sewer collection system

- 359 miles of gravity sewer and 35 miles of force main

#### Number of Manholes

- 8,330 manholes and cleanouts

#### Number of Pump Stations

- 78

#### Major Program Achievements to Date

- Backups and pump station failures reduced by 40%
- Proactive maintenance increased by 65%, while reactive maintenance decreased by 35%

## Background

Clearwater is located in central Florida within the Tampa Bay Estuary, adjacent to the Gulf of Mexico. This location is famous for its recreational resources, including sandy beaches and natural island parks. It also presents many problems for sanitary sewer systems, with both significant annual rainfall and extremely flat topography. In an average year, Clearwater gets more than 54.5 inches of rain, most falling during the rainy season from June to November. The topography varies from sea level to 100 feet over the 35-square-mile service area of the sanitary sewer system.



Serving an estimated population of 108,000 with 35,800 service connections, the sanitary sewer system has 78 pumping stations. The system also consists of 8,330 manholes and cleanouts, along with 359 miles of gravity sewers and 35 miles of force main. As estimated by the City, 1% of the system consists of items constructed before 1900, 10% between 1900 and 1924, 20% between 1925 and 1949, 28% between 1950 and 1974 with the last 41% of the system elements being less than 25 years old. Effluent from the sanitary sewer system is treated at three advanced wastewater treatment facilities with a combined capacity of 28.5 MGD.

## History

EPA Region 4 encourages publicly-owned sewer collection system utilities to perform a voluntary self-assessment and use the findings to implement a Management, Operations, and Maintenance (MOM) plan, with an ultimate goal of completely eliminating sanitary sewer overflows (SSOs). Clearwater was one of the first communities contacted by the Region to participate in the program, selected based on its proximity to the federally protected Tampa Bay Estuary. Clearwater agreed to perform a seven-month self-assessment in November of 1998 and completed its MOM Plan in September 1999.

Before starting its MOM assessment, Clearwater acted reactively to problems with the sanitary sewer system. Pump stations and sewer lines were replaced and repaired as problems came to light, but little was done to prevent system failures before they occurred. Before 1998, sewer lines were only cleaned when a clog or capacity restriction was found, and no consistent log of SSOs was kept. During the three-year period from September 1997 to August 2000, Clearwater had a number of SSOs with a total overflow volume of 60,690 gallons. More than 50% of this total volume occurred from September 1997 to April 1998, during an El Nino period characterized by unusually heavy rains. These SSOs, ranging in quantity from a few gallons to 30,000 gallons, occurred sporadically throughout the city. They were caused by a wide variety of problems including blockages due to grease, infrastructure deficiencies, equipment failures and wet weather issues.



Offset sewer joints like this one allowed inflow and infiltration into Clearwater's sewer collection system during wet weather, contributing to SSOs.

*Photo: City of Clearwater*

## The City of Clearwater MOM Plan

Clearwater was one of the first municipalities to develop a MOM Program Plan. The Plan, completed in 1999, describes all three parts of the MOM Program: management, operations, and maintenance of the sanitary sewer system. In completing the MOM evaluation, the City developed numerous recommended action items, some of which have already been implemented.

Pump station performance has been improved through rehabilitation and regular maintenance of pumps and controls.

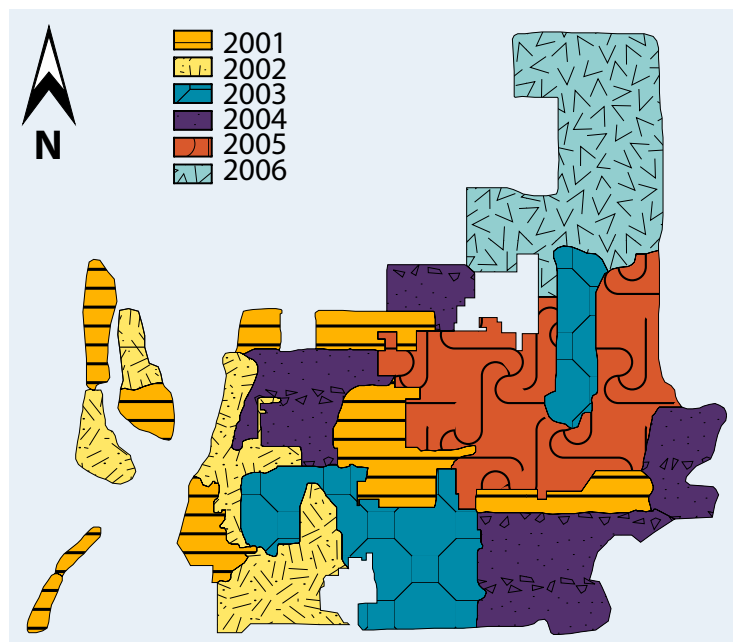
*Photo: City of Clearwater*



Pump station maintenance and operation has always been demanding for Clearwater, and the source of several large-volume SSOs. The MOM Plan recommended development and implementation of a more structured pump station maintenance and monitoring program. Clearwater has provided further funding to the Wastewater Collection Division, allowing additional staffing in the department to meet the goal of visiting and inspecting each pumping station weekly. The Plan also recommended

that more pump stations be added to the supervisory control and data acquisition (SCADA) system and that a standardization plan be developed for all new and rehabilitated pump station projects. The City used these recommendations to help structure long-term planning for pump station upgrades and rehabilitation. All new pump station projects will be standardized following a design developed jointly by Clearwater and pump manufacturers. SCADA controls will be installed on all significant pump stations (duplex and higher) as they are rehabilitated.

The MOM assessment also led to recommendations for regular sewer cleaning. In response, the City developed a new cleaning plan that divided the collection system into six areas. As shown on the map, one area will be cleaned each year, with the expectation that the entire collection system will be cleaned every six years. Similar programs were also developed for sewer line inspection (smoke testing and closed circuit television, or CCTV) and manhole inspection. Clearwater is developing a geographical information system (GIS) to track these cleaning and maintenance programs.



Improved training and customer service programs were also recommended as part of the MOM assessment. Clearwater is now documenting its technical and skills training programs and has created a standard operating procedures manual for wastewater collection. To help with these training programs, a training position was created for public utilities in the City. A customer service log was created and a more proactive approach to grease control is being implemented. A new local ordinance for grease control has been approved by the City Commission and informational packets are being used to notify customers in areas with grease control problems.

## Sewer System Evaluation Project

As a result of its self-assessment, Clearwater is performing a comprehensive sanitary sewer system evaluation (SSES). In the first phase, Clearwater completed a detailed asset identification of the system, using the information to create an operating GIS and an updated system map with identification numbers for all pipes and manholes. As of mid-2002, 1,450 manholes had been inspected, 84 miles of gravity sewer had been smoke-tested, and 109 miles of gravity sewer was cleaned and inspected with CCTV. Rehabilitation projects have been implemented to correct defects identified in these programs.



CCTV inspection and smoke testing are the inspection methods used to identify sewer defects, sediment buildup, grease clogs, and line failures.

*Photo: City of Clearwater*

A capacity analysis model of the interceptor system (all pipes 10 inches and larger) is also being created as part of the sewer system evaluation. The model will help identify capacity constraints leading to SSOs in the system based on a 10-year storm with base flows generated using the estimated 2020 population.

By identifying the locations of capacity constraints and the estimated volume of SSOs, the model will help Clearwater develop line rehabilitation, flow balancing, and system expansion plans. This analysis, supported by more than 300 model simulations, is helping Clearwater assess the financial and physical impacts of expected growth on the sewer collection system.

System data are entered into a GIS for up-to-date system maps, maintenance activity tracking, and capacity analysis modeling. As shown in this hydraulic model input screen, location and system ID information are retrieved from the GIS and supplemented with model data.

*Graphic: TBE Group, Inc.*

## Capital Improvement Planning (CIP)

Collection system improvements are funded through a five-year, 7% annual water and sewer rate increase. Public support for this rate increase was gained by providing the city commissioners, city manager, and citizens with information about the MOM program and major findings of the sewer system evaluation.

Line failures and critical defects are corrected as identified, but major rehabilitation planning is coordinated with development of the SSES and phased over seven years.

*Photo: City of Clearwater*

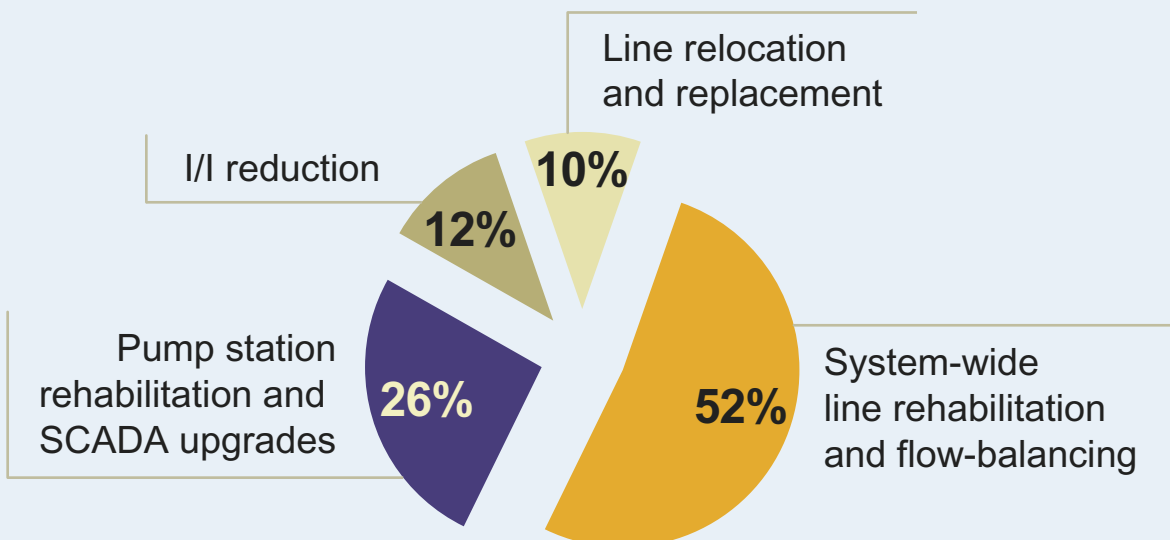


A preliminary seven-year Capital Improvement Plan was developed, which describes how the funds are expected to be used during the period. In the CIP cycle ending in fiscal year 2008, Clearwater expects to devote 52% of its \$11.4 million annual capital budget to sewer line rehabilitation and flow-balancing projects.

Preliminary inspection, SSO tracking, and flow monitoring data have identified several areas of the system where rehabilitation and flow balancing will likely be needed. Specific plans will be developed as the SSES progresses.

Another 26% will be devoted to pump station rehabilitation, which is already well underway. Based on current SSO patterns and modeling of projected future flows, the 78 pump stations have been prioritized for rehabilitation or replacement. The first 24 rehabilitations are underway and should be complete by 2004.

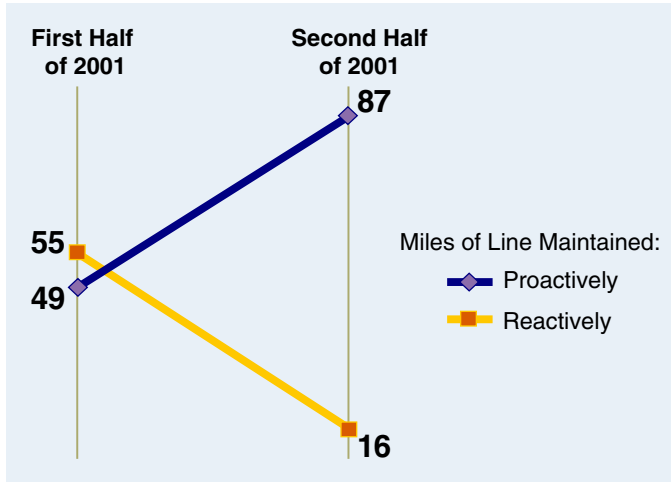
Capital improvement needs averaging \$11.4 million per year are anticipated through 2008. Capital projects are phased to address the most critical problems first, such as pump station failures and line relocation and replacement.



## Results

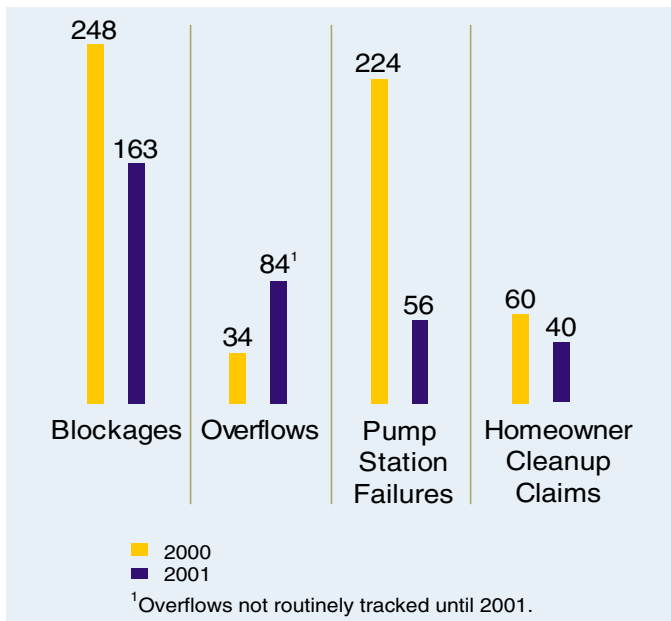
Clearwater is tracking a variety of performance indicators to monitor the effectiveness of its MOM program. In the first phase of the MOM program, one of the primary metrics is the ratio of reactive to preventive sewer maintenance-miles per year. Clearwater realizes that the aggressive sewer line cleaning, maintenance and rehabilitation program it now pursues will only help improve system performance and control SSOs if the right activities are performed at the right time—before failures occur.

The more effective the maintenance program, the fewer unplanned repairs will be required. Though it is impossible to prevent all failures, asset management experts recommend that unplanned maintenance be held to 30% or less of annual maintenance activities. Emergency and unplanned repairs occurring above that level can be considered an indication that planning should be revisited to evaluate the cause of emergencies and adjust maintenance strategies. As the graph at right shows, in the first half of 2001, the ratio of planned to unplanned maintenance was 33% to 47%, such that most maintenance was still performed in a reactive mode. By the end of 2002, the ratio had improved to 86% to 14%, demonstrating that Clearwater’s maintenance planning and performance was well targeted during the period.



In 2001, Clearwater radically reduced emergency maintenance by implementing a program to clean and maintain 60 miles of sewer per year. Planned maintenance saves money, prevents SSOs, and extends the value of sewer system assets.

The improved maintenance helped the City achieve significant improvements in other performance areas, including the number of city-responsible blockages, pump station failures, and homeowner cleanup claims paid. In each of these areas, Clearwater achieved reductions that exceeded initial expectations. The one performance metric increase during the period, SSOs, resulted from better data tracking, since SSOs were not routinely recorded prior to the MOM program.



This series of metrics gives Clearwater a better picture of the effectiveness of the MOM program. The City Commission is kept informed of the program performance indicators, which are also used to identify priorities for additional funding.

## Future Plans

The MOM assessment, sewer system evaluation study, and CIP have provided the future plans for the Clearwater sanitary sewer system. With funding in place, construction of all of the projects developed in this program will now begin. This shift in focus from planning to construction moves the implementation of the work to Clearwater's Engineering Department. The Engineering Department has allocated five staff engineers to Public Utilities Department needs, and the Public Works Construction Services Department will dedicate construction inspectors to effectively administer programs and projects. Plans to update the GIS system as construction occurs are also underway. An innovative program that allows workers to edit the sanitary sewer system GIS while in the field is being tested and will be used in the future.

## For More Information on the City of Clearwater

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## For Program Information on SSO Abatement

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## Publication Information

Office of Wastewater Management  
833-R-02-001  
March 2002

