

CHAPTER 6

UTILIZING TECHNOLOGY EFFECTIVELY

Collection system owners and operators have a variety of technology-based resources available to them. Effectively utilizing these resources will allow for operation and maintenance program enhancement.

Information for this chapter was primarily obtained from the following sources: *U.S. EPA's Guide for Evaluating Capacity, Management, Operation, and Maintenance Programs for Sanitary Sewer Collection Systems (DRAFT)* and *Draft Notice of Proposed Rulemaking—NPDES Permit Requirements for Municipal Sanitary Sewer Collection Systems, Municipal Satellite Collection Systems, and Sanitary Sewer Overflows* and California State University, Sacramento's *Collection Systems: Method for Evaluating and Improving Performance*.

6.1 Benchmarking

Benchmarking is a process of gathering information on the productivity and performance of other collection system agencies and then comparing actual information for an agency that wishes to improve its level of production and performance. The concept became popular in the private sector in the 1970s and more recently it has been adopted by the public sector and professional associations as a method to develop new ideas, make fact-based decisions, and initiate organizational change.

The benchmarking process enables a collection system agency to conduct an internal assessment of its operation and maintenance program, compare its performance with the performance of other similar agencies that are considered high-performing agencies, and attempt to improve its performance. Agencies can compare their system characteristics with other systems and also their level of production, performance, and budget with other similar agencies. Subjects for comparison include operation and maintenance data, finance, training and certification, safety, level of service, regulatory compliance, policies and procedures, and information management.

It should be noted, however, that there are very few areas where performance data from one agency can be used directly by other agencies to produce the same performance results. This is due to the wide variations in the collection system infrastructure such as age of the system, pipe materials, number of pump stations, and soil and groundwater conditions.

In spite of these difficulties, it is possible to establish performance indicators, which will provide insight into the performance of the collection system and the effectiveness of the system's operation and maintenance program. Data from multiple agencies can be plotted to develop a "range" of performance for various activities such as cleaning, stoppages, overflows, financial data, number of staff, and safety. This information can be used to determine if performance falls within the desired range. If it does not, additional investigation should be carried out to determine why agencies have different levels of performance.

6.1.1 Performance Indicators

Performance indicators should describe the performance of the collection system on the basis of measurable objectives. Thus, the number of stoppages and the number of complaints or service requests are important level of service performance indicators. Performance indicators should not be confused with production indicators. Typical production indicators could be miles of sewers televised per year or miles of sewers cleaned per year.

Performance indicators can be used to:

1. Compare performance with similar agencies and then attempt to determine potential areas for improvement.
2. Compare performance on an annual basis to identify performance trends within an agency.
3. Compare performance of subsystems within an agency.

If the results from comparison of performance indicators reveal that other similar agencies are performing at a higher level, it could mean a need for more equipment, more crews, increased training, a better capital improvement program, or an increase in certain areas of the budget.

If the results from comparison of performance on an annual basis reveal either an increasing or a decreasing level of performance, then the cause of the trend should be identified. The comparison could reveal a decreasing trend caused by equipment that is wearing out and needs replacing, operators may be retiring and are not being replaced, or new operators are not being trained due to budget restrictions. An increasing trend could be caused by a successful capital improvement program, or additional equipment and crews, which could justify additional funds to continue improving performance. Comparisons should also consider other factors that could contribute to trends, such as extremes in weather patterns.

6.2 Management Information System

The foundation of a collection system agency's management system is its management information system. The ability of the authority to effectively manage its collection system is directly related to its ability to maintain and have access to the most up-to-date information concerning its facilities. Maintenance of this up-to-date information is an effort involving all members of the authority from the staff person answering the telephone to the operator in the street.

A satisfactory management information system should provide the authority with the ability to:

- Access information queries faster.
- Maintain preventive maintenance and inspection schedules.
- Provide budgetary justification.
- Track repairs and work orders.
- Organize capital replacement plans.

- Manage tools and equipment inventories.
- Print out purchase orders.
- Record customer service inquiries/complaints.

Collection systems agencies have been increasingly moving towards computer-based systems to manage data. Only the very smallest systems still rely on paper data management systems. Computer-based Maintenance Management Systems (CMMSs) are designed to manage data needed to track the collection system's O&M performance.

Global Positioning Systems (GPS) and Geographic Information Systems (GIS) are used in the field to map and locate system components and, because of their computer-based compatibility, can easily be integrated with a CMMS. However, it is important to note that these computer-based systems can only be as accurate as the data that is being generated in the field.

Management information systems are critical to the collection system authority in that they help ensure appropriate staffing and budgeting, proper operation and maintenance, and compliance with environmental and safety requirements. Regardless of the management information style chosen, the collection system should have written instructions regarding the use of the management information systems. These procedures may include operating the system, upgrading the system, accessing data and information, and developing and printing reports.

6.3 Maps and GIS

The importance of maintaining accurate, up-to-date maps of the collection system cannot be overestimated. Efficient collection system maintenance and repairs are not possible if mapping is not adequate.

Collection system maps should have a numbering system, which uniquely identifies all manholes and sewer cleanouts. The system should be simple and easy to understand. Manholes and sewer cleanouts should have permanently assigned numbers and never be renumbered. Maps should also indicate the property served and reference its cleanout.

Sewer line maps should indicate the pipe diameter, type of pipe, the length between the centers of the up and downstream manholes, the direction of flow, location of manholes and service wye's including three (3) swing ties to known fixed objects (hydrants, telephone poles, etc.) pipe invert elevations, slopes, pipe materials. The dimensions of easements and property lines should be included on the maps. Other information to be included on maps is access and overflow points, storm drainage systems, a scale and a north arrow. All maps should have the date the map was drafted and the date of the last revision. The use of GPS to accurately measure the location of collection system components is increasing.

GIS has made the mapping and map updating process considerably more efficient. GIS is a computerized mapping program capable of combining mapping with detailed information about the physical structures within the collection system as well as historical information including video imaging of the pipe and manhole interiors.

It is important that there are specific procedures established for correction of errors and updating maps and drawings. Field personnel must be properly trained to recognize discrepancies between

field conditions and map data and to record changes necessary to correct the existing mapping system. The accuracy of the drawings used by field personnel and contractors is critical to proper identification of wastewater collection system components.

6.4 Flow Monitoring

Fundamental information about the collection system is obtained by flow monitoring, namely how much wastewater is conveyed through the system by pipes, pump stations and force mains. Flow monitoring will provide information on both dry and wet weather flows as well as areas of the collection system potentially affected by infiltration and inflow. Flow measurement may also be performed for billing purposes, to assess the need for new sewers in a certain area or to calibrate a model. There are basically three techniques for monitoring flow rates: permanent, long-term monitoring; temporary monitoring; and instantaneous monitoring. Permanent installations are done at key points in the collection system such as the entry point of a satellite collection system, pump stations, and key junctions. Temporary monitoring consists of flow meters typically installed for 30-90 days. When the operator performs instantaneous flow metering, one reading is taken and then it is removed.

A flow-monitoring plan should provide for routine inspection, service and calibration checks (as opposed to actual calibration). In some cases, the data is calibrated rather than the flow meter. Each meter should be checked on a predetermined schedule. Checks should include taking independent water level (and ideally velocity readings), cleaning accumulated debris and silt from the flow meter area, downloading data (sometimes only once per month), and checking the desiccant and battery state. Records of each inspection should be maintained.

6.5 Modeling

A model is a computer program that is capable of simulating the different flows within the collection system. Modeling is a tool that may be used to assess the collection system's capacity under various flow scenarios. If a collection system is not experiencing any capacity related issues, i.e., overflows, bypasses, basement backups, street flooding, hydraulic overload at the treatment plant, etc., then maintenance of a model may be optional for that system, although most medium and large systems should maintain a model of the larger diameter portion of their system. The use of a model is also effective for determining how system expansion and extension might effect overall operation. If any of the mentioned conditions are occurring, then maintenance of a model is essential to performing a capacity assessment in the problem areas.

Modeling is also useful in examining effects before and after rehabilitation. For example, models can be calibrated with "before" and "after" flow monitoring to estimate the effects of the repairs.

The model also needs to be properly calibrated. Improperly calibrated models may yield under- or over-estimations of flow. Calibration involves comparing actual flow measurements to those generated by the model. For wet weather modeling, comparison of two to three storms is generally adequate.

6.6 More Information

Additional information on benchmarking is available from the following document:
Optimization of Collection System Maintenance Frequencies and System Performance. American Society of Civil Engineers. February 1999. Available at: www.epa.gov/npdes/pubs/optimization-finalreport.pdf.

CHAPTER 6 REFERENCES

- Collection Systems: Method for Evaluating and Improving Performance*. California State University, Sacramento. 1998.
- Guide for Evaluating Capacity, Management, Operation, and Maintenance Programs for Sanitary Sewer Collection Systems* (DRAFT). U. S. Environmental Protection Agency. 2000. EPA No. 300-B-00-014.
- Draft Notice of Proposed Rulemaking—NPDES Permit Requirements for Municipal Sanitary Sewer Collection Systems, Municipal Satellite Collection Systems, and Sanitary Sewer Overflows*. U. S. Environmental Protection Agency. January 4, 2001.

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