

Operation and Maintenance of Wastewater Collection Systems, Volume II
Office of Water Programs
California State University, Sacramento
(9.0 Continuing Education Units)

COURSE DESCRIPTION

This course focuses on three areas: (1) lift stations, (2) sewer rehabilitation, and (3) administration of a collection system agency. Detailed information is provided on the components and practical operation of lift stations. Operators learn to operate and maintain a variety of types of motors, supervisory controls, pumps, valves, and other equipment. They will also learn to examine the condition of a sewer system, set up a sewer rehabilitation program, and safely use various methods to replace or repair damaged sewers. This course also teaches operators critical aspects of effectively administering a wastewater collection agency or department. Administrative topics include overall organization of the agency as well as employment, training and compensation of personnel, selection and acquisition of equipment and facilities, system mapping, management information systems, report writing, and public relations. Operators learn to organize and administer all facets of a collection system agency.

CHAPTER 8. LIFT STATIONS
OBJECTIVES

Following completion of Chapter 8, students should be able to:

1. Determine the locations of lift stations.
2. Describe the requirements of a lift station.
3. Discuss the components of a lift station.
4. Indicate the advantages and disadvantages of the different types of controllers.
5. Review lift station prints and specifications.
6. Inspect a new lift station.
7. Keep a lift station operating as intended.
8. Determine the frequency of visits to a lift station.
9. Perform necessary lift station maintenance tasks.
10. Prepare record forms for a lift station, complete them, and file them.

Lift stations or pumping stations lift wastewater to a higher elevation when the continuance of the sewer at reasonable slopes would involve excessive depths of trench, or when the wastewater must be raised from areas too low to drain into available sewers. The most desirable operation of a lift station is the situation in which all the flow and solids that discharge into the wet well from the gravity sewer are lifted to the higher elevation and continue to the wastewater treatment plant without delay.

This chapter discusses the components of a lift station, including the wet well, control systems, pumps, ventilation, and auxiliary equipment. How to inspect and place a new lift station into service is very important. After the station is placed on line, the station must be properly operated and a preventive maintenance program must be implemented. Frequency of visits to lift stations depends on operating conditions of the station; potential damage that could result from lift station failure; condition of the equipment; effectiveness of the preventive maintenance program; and type, adequacy, and reliability of the telemetry system.

Proper lift station maintenance is critical to minimizing lift station failures and odor complaints from the public. Accurate and useful records must be kept of all pertinent lift station data including costs, operating procedures, maintenance, unscheduled repairs, and modifications.

The supplement to this chapter presents a typical lift station book describing the maintenance and overhaul procedures for an actual lift station.

CHAPTER 9. EQUIPMENT MAINTENANCE

OBJECTIVES

Following completion of Chapter 9, students should be able to:

1. Explain the serious consequences that could occur when inexperienced, unqualified, or unauthorized persons attempt to troubleshoot or repair electrical panels, controls, circuits, wiring, or equipment.
2. Communicate with electricians by indicating possible causes of problems in electrical panels, controls, circuits, wiring, and motors.
3. Properly select and use the following pieces of equipment (if qualified and authorized):
 - a. Multimeters
 - b. Ammeters
 - c. Meggers
 - d. Ohmmeters
4. Describe how a pump is put together.
5. Discuss the application or use of different types of pumps.
6. Maintain the various types of pumps.
7. Operate and maintain a compressor.
8. Develop and conduct an equipment lubrication program.

Effective equipment maintenance is very important to the successful operation of a wastewater collection system. Pumps in lift stations, as well as pumps used in the field and pumps on high-velocity cleaners, must be included in a preventive maintenance program. Other equipment in lift stations and used by field crews must be maintained to keep the equipment in operating condition and to ensure that the equipment does not wear out too fast.

Maintenance of electrical equipment requires extra caution and special training and skills. Do not attempt to install, troubleshoot, maintain, repair, or replace electrical equipment, panels, controls, wiring, or circuits unless you:

1. Know what you are doing
2. Are qualified
3. Are authorized

All students, instructors, and experienced operators must realize the hazards involved when working with or near electricity and never take a chance.

Special procedures are outlined for troubleshooting. This chapter contains tables and lists on how to identify problems, how to look for possible causes of problems, and how to remedy or solve the problem once it has been identified. Topics covered include electrical equipment maintenance, pumps, compressors, and equipment lubrication.

CHAPTER 10. SEWER RENEWAL (REHABILITATION)

OBJECTIVES

Following completion of Chapter 10, students should be able to:

1. Evaluate the condition of a sewer.
2. Determine the need for sewer renewal (rehabilitation).

3. Establish priorities for a sewer renewal (rehabilitation) program.
 4. Identify the various sewer renewal (rehabilitation) methods.
 5. Select the appropriate sewer renewal (rehabilitation) method.
 6. Implement and complete a renewal (rehabilitation) project.
 7. Notify and cooperate with the public during a renewal (rehabilitation) project.
- This chapter stresses the need for and importance of a sewer renewal (rehabilitation) program. Collection system agencies must have a program that determines and evaluates the existing conditions in sewers and establishes priorities for rehabilitation. The alternative methods of rehabilitation are presented and discussed.

CHAPTER 11. SAFETY/SURVIVAL PROGRAMS FOR COLLECTION SYSTEM OPERATORS

OBJECTIVES

Following completion of Chapter 11, students should be able to:

1. Demonstrate their awareness of the hazards of working in the collection system environment by performing their assigned duties safely.
2. Identify potential and existing hazards.
3. Develop and establish a safety/survival program.
4. Outline the objectives and benefits of a safety/survival program.
5. List the responsibilities of the different staff levels in a collection system agency that are responsible for a safety/survival program.
6. Prepare and conduct tailgate safety sessions and monthly safety meetings.
7. Develop and implement appropriate safety/survival program policies.
8. Accurately complete accident forms and properly maintain records.

A review of the safe procedures presented in this manual is summarized in this chapter. Emphasis is placed on the philosophy of safety and the fact that all procedures must be developed and learned as safe procedures. Therefore, if at all possible, all safety procedures should be learned by actual hands-on application of the procedures. The topics are presented in such a manner to encourage the use of the material to develop short, informal, tailgate safety sessions.

Topics covered include the testing of the atmospheres in sewers for toxic gases, explosive conditions, and lack of oxygen. Safe driving is important on the job as well as off the job. Traffic must be safely routed around a job site before work starts. Cave-ins are a serious hazard to collection system operators. Their causes must be identified and proper shoring must be selected, installed, maintained, and removed.

A basic first-aid class should be completed by all crew members. Once safe procedures are learned, the collection system operator should be able to prepare and present effective safety programs.

CHAPTER 12. ADMINISTRATION

OBJECTIVES

Following completion of Chapter 12, students should be able to:

1. Explain the need for effective administration.
2. Develop the goals, tasks, and procedures for an operating plan.
3. Prepare and justify staffing and equipment requirements for their program.
4. Determine whether a piece of equipment should be leased or purchased.
5. Hire new operators.

6. Administer their agency's safety program.
7. Determine the facility requirements for their program.
8. Read the various types of maps used by collection system operators.
9. Explain the importance of and need for maps.
10. Keep maps up to date.
11. Determine the management information system requirements for their program.
12. Prepare and maintain records essential for budgeting, scheduling, and meeting legal requirements.
13. Write an informative report.
14. Organize an effective public relations program for their agency.

How to properly administer a wastewater collection system agency is the main topic of this chapter. Emphasis is placed on the day-to-day operation of the collection system agency.

Accurate maps must be available to collection system crews so they can operate and maintain the collection system. Crews must be able to determine the location of manholes and sewers in order to maintain the facilities and correct problems. Maps must be kept up to date.

Important information must be recorded and filed for future reference and use. Records are especially important for the preparation of budgets and personnel and equipment requests. Whenever legal action is threatened, accurate records can be very helpful. Collect only the information needed and file it in a manner that makes it easy to find in a readily accessible location.

CHAPTER 13. ORGANIZATION FOR SYSTEM OPERATION AND MAINTENANCE

OBJECTIVES

Following completion of Chapter 13, students should be able to:

1. Organize an agency to operate and maintain a wastewater collection system.
2. Identify functions and work activities of essential units within an agency.
3. Staff and equip essential units within an agency.
4. Develop priority lists for job assignments for units within an agency.
5. Describe the various types of equipment maintenance programs.
6. List the factors that influence an equipment maintenance program.
7. Develop and implement an equipment maintenance program.
8. Schedule the collection system activities of an agency.
9. Evaluate the performance of the collection system and agency.

Confronted with scarce resources of personnel and funds, wastewater collection system agencies must be organized as efficiently as possible. The agency must be organized to produce a comprehensive program that minimizes problems and service requests or complaints. To work effectively, this program must identify the potential problems and, if possible, correct the problems. Such an organization and maintenance program will minimize the development of a nuisance or a public health hazard, but some will develop through no fault of the system due to accidents or disasters that may occur. With the minimization of problems, the taxpayers of the community will be assured that they are receiving excellent service from the wastewater collection system agency.

A collection system agency should be organized to respond to various types of problems or complaints that develop and also to attempt to prevent these problems or complaints from occurring. Sections or units within an agency could include emergency service,

preventive maintenance, collection system repair and new construction, lift station operation and mechanical maintenance, and an industrial waste section.

Key factors that influence the size and organization of a wastewater collection system agency include the size of the community and area served, topography, population, industrial activity, construction practices, soil conditions, type of materials, age of facilities, adequacy of construction inspection, enforcement of sewer-use ordinances, and effectiveness of past maintenance programs.

Organization charts are helpful to show the overall organization of a municipality and the detailed organization of the collection system. Charts also show the chain of command or flow of authority in an agency to meet the responsibilities of the agency. An effective organization collects good records and reviews and evaluates the effectiveness of equipment and programs in order to develop improved standards and procedures.

CHAPTER 14. CAPACITY ASSURANCE, MANAGEMENT, OPERATION, AND MAINTENANCE (CMOM)

OBJECTIVES

Following completion of Chapter 14, students should be able to prepare and implement a CMOM program for their collection system utility. The CMOM program should contain elements on how to:

1. Manage a collection system.
2. Enforce their legal authority.
3. Administer their utility's finances.
4. Recruit and motivate personnel.
5. Promote training and certification.
6. Support the safety program.
7. Maintain warehouse and inventory.
8. Design collection system facilities.
9. Construct and inspect facilities.
10. Perform a sewer system evaluation survey (SSES).
11. Conduct a system capacity assurance program.
12. Supervise and evaluate a water quality monitoring program.
13. Schedule maintenance.
14. Manage a collection system O&M program.
15. Supervise a sewer cleaning program.
16. Control and monitor hydrogen sulfide.
17. Operate and maintain lift stations.
18. Inspect and rehabilitate manholes.
19. Televisе collection system sewers.
20. Reduce infiltration/inflow (I/I).
21. Conduct smoke testing and dyed water flooding.
22. Repair and rehabilitate sewers.
23. Maintain right-of-ways.
24. Minimize SSOs and CSOs.
25. Comply with their NPDES permit and applicable rules and regulations.

TIME ASSIGNMENT

Text Pages: The course uses the training manual *Operation and Maintenance of Wastewater Collection Systems, Volume 2* (720 pages). The average word count on a page from the training manual is 950 words. Some pages contain tables, graphs, or illustrations to enhance the presentation of information. It is assumed that readers spend equal time studying tables, graphs, and illustrations as they would spend reading the equivalent amount of text. Therefore, each page is assumed to contain the equivalent of 950 words. Accepted average adult reading speed is 200 – 250 words per minute. Therefore, each page is projected to require four minutes of student time for each reading.

Questions: The course contains 487 assessment questions integrated into the reading. Each question requires a written response consisting one or more sentences. Projected average review question time is two minutes per question.

Discussion questions: The course contains 188 discussion questions. Each discussion question requires a written response consisting one or more sentences. Projected average discussion question time is two minutes per question.

Review questions: The course contains 152 comprehensive review questions. Projected average response time is one minute per question.

Objective test questions: The course contains 289 objective test questions. Projected average response time is one minute per question.

Component	Minutes per Component Unit	Number of Component Units	Time to Complete Units
Text pages	4	720	2,880
Questions	2	487	974
Discussion questions	2	188	376
Review questions	1	152	304
Objective test questions	1	289	289
Total (minutes)			4,823
Total (hours)			80