CHAPTER 11

RECORDS AND SCHEDULING MAINTENANCE

FIGURES

INTRODUCTION

Scheduling preventive maintenance can be a time consuming and complex problem because of the detail involved. Some ideas will be presented in this chapter which should make planning scheduled maintenance a little easier.

The objective of any preventive maintenance program is to improve the operating conditions in problem areas by scheduling the absolute minimum amount of maintenance. An effective preventive maintenance program tries to predict what problems will be encountered and what measures must be scheduled to prevent the problems from occurring. Preventive maintenance schedules must be flexible and should be periodically revised based on their effectiveness and the ability to accomplish the maintenance objectives. An outline prepared by the ICAP Technical Advisory Panel of a suggested continuous sanitary sewer system maintenance program is included in Appendix D. The ICAP Technical Advisory Panel is an interagency committee consisting of members elected by local officials, sanitary districts, and utility companies tributary to the Metropolitan Sanitary District of Greater Chicago's facilities.

Several forms for keeping records of sewer maintenance activities have been included throughout this chapter and in other chapters of this manual. The forms should be modified as required to fit the needs of each agency. The forms contained herein are only guides to stimulate agencies in developing forms they feel most comfortable with.

RECORDS

General

Preventive maintenance activities cannot be scheduled effectively without the use of sewer system operation and maintenance records. Records are important because they document past work and provide a reasonable base for planning future needs. When reviewing past records of conditions requiring emergency attention, maintenance can be scheduled in time to prevent or reduce the number of emergency situations.

Types of Records

There are many types of records which when kept up to date and filed in useful categories can provide the information needed to schedule maintenance, predict personnel requirements, prepare budgets, estimate operating costs, and assess the performance of the sewer system. These records include the following categories:

1. Main Sewer Line.

    A. Inventory.

        1. Identification of each line segment.
        2. Size, length, and material of each line segment.
        3. Invert elevations at upstream and downstream manholes.

    B. Maintenance history.

        1. Date of maintenance activity.
        2. Type of equipment used for each maintenance activity.
        3. Labor required for each maintenance activity.
        4. Material required for each maintenance activity.
        5. Time required to perform maintenance tasks.
        6. Reason for the maintenance activity.

    C. Inspection history.

        1. Sewer lamping.
        2. Closed circuit television inspection.

    D. History of stoppages.

        1. Date.
        2. Reason for stoppage.

2. Manholes.

    A. Inventory.

        1 Identification of each manhole.
        2. Locations.
        3. Manhole data.

B. Maintenance history.

1. Date and type of maintenance activity.
2. Reason for maintenance activity.
3. Labor, equipment, and materials required for each maintenance activity.
4. Time required to perform maintenance tasks.

C. Inspection history.

3. Appurtenant Structures (siphons, junction chambers, etc.).

A. Inventory.

1. Identification of each structure.
2. Location.
3. Structure data.

B. Maintenance history.

1. Date and type of maintenance activity.
2. Reason for maintenance activity.
3. Labor, equipment, and material required for each maintenance activity.
4. Time required to perform maintenance tasks.

C. Inspection history.

4. Lift Stations.

A. Inventory.

1. Identification.
2. Location.
3. Lift station data.

B. Equipment.

1. Equipment operating logs.
2. Preventive maintenance requirements.

C. Maintenance history.

1. Date and type of maintenance activity.
2. Reason for the maintenance activities.
3. Labor, equipment, and material required for each maintenance activity.
4. Time required to perform maintenance tasks.

D. Inspection history.

E. Emergency situations.

5. Building Service Laterals and Related Plumbing.

A. Inventory.
B. Maintenance history.
C. Inspection history.
D. Illegal connections.

6. Miscellaneous Sewer System Inspections.

A. Smoke testing.
B. Dye water tests.

7. Equipment.

A. Inventory.
B. Depreciation records.
C. Equipment operating logs.
D. Preventive maintenance requirements.

8. Personnel.

A. Employee file.
B. Attendance file.
C. Work assignments.
D. Pay records.

9. Miscellaneous records.

A. Accident reports.
B. Emergency calls.
C. Complaints.
D. Safety training activities.
E. Job related training.
F. Budget request documentation.
G. Sewer system maps.
H. Engineering studies.
I. Construction plans and specifications.
J. Contracts
    1. Engineers.
    2. Contractors.

SCHEDULING MAINTENANCE

General

The outline for a continuous sewer system maintenance program prepared by the ICAP Technical Advisory Panel has been included in Appendix D of this manual. The outline provides suggested preventive maintenance frequencies for the various aspects of a preventive maintenance program. However, a large number of variables must be considered by each agency in order to develop the type of preventive maintenance program that works best for their system. Preventive maintenance scheduling will depend on several factors including but not limited to the:

1. Type of system users (residential, commercial, or industrial).
2. System age.
3. Construction methods used.
4. Quality of construction.
5. Past maintenance activities.

Since the characteristics of the sub-areas within an agency's system can be very different, many agencies may need to develop different preventive maintenance schedules for each sub-area. For example, an agency with both new sewer areas and old sewer areas may need to schedule sewer cleaning and closed circuit TV inspections more frequently in the older sewer area.

Long-term Planning

Because of the many variables that must be considered when preparing a preventive maintenance schedule, it is not likely that any two agencies will develop identical long-term maintenance schedules. Each agency must review and use past records to develop a long-term preventive maintenance program that schedules just enough maintenance to provide maximum protection against the entry of excessive infiltration and inflow, equipment failures, sewer line blockages, pavement collapse, and other emergency conditions.

As guidance to each agency, suggested long-term preventive maintenance schedules have been provided in Figures 11-1, 11-2, and 11-3 for a typical old, stable, residential community, a new, growing residential community and a mostly industrial and commercial community, respectively.

Unscheduled Maintenance

Certain types of maintenance activities cannot be scheduled into a long-term preventive maintenance program. Maintenance activities that fit into this category include responses to complaints and emergency situations such as sewer line blockages and equipment failures.

Scheduling specific repairs for deteriorated portions of the sewer system is also difficult to include in a long-term maintenance schedule. An effective preventive maintenance program allows for early detection of sewer system deterioration so that minor repair work can be completed as necessary instead of waiting for major repairs and full-scale sewer rehabilitation program. Effective preventive maintenance should also reduce but probably not eliminate the number of complaints and emergency situations that may occur. Therefore, unscheduled maintenance activities must be planned for each year and included as part of the annual budget.

Estimating sewer system repair requirements and the number of responses to complaints, sewer blockages, equipment malfunctions and other emergency situations may seem like a difficult task. However, when using past records as the basis for making the estimates, the "guess-work" can usually be relatively accurate.

Records should be kept for each occurrence of a complaint, equipment malfunction, and emergency condition. Figures 11-4, 11-5, and 11-6 are example forms that can be used to record the equipment malfunctions, emergency conditions, and complaints, respectively.

Type of Community: Old, Stable, Residential Community
Some Typical Characteristics Affecting
Long-term Sewer Maintenance Requirements:
- High Infiltration Potential
- Potential for Illegal Building Connections
- Little Potential for Sewer System Growth

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Sewer Map Updating	1 year	- Very few if any changes to sewer maps each year. - Primarily changes will be related to sewer system rehabilitation.
Sewer Cleaning	1-5 years	- Problem areas may require more than 1 cleaning per year. - Areas recently rehabilitated may require less frequent cleaning than unrehabilitated areas. - Some areas may be "self-cleaning" allowing for a longer than 5-yr. cleaning cycle. - Frequency of sewer cleaning should be adjusted over time to provide minimum amount of cleaning necessary to prevent blockages. - Root removal or control may be necessary because of older sewer and established trees.
Inspections:		
Sewer Lamping	5 years	- Should be done in conjunction with manhole inspections. - Additional maintenance, such as TV inspections or sewer cleaning may be required as a result of the sewer lamping.

FIGURE 11-1. SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR AN OLD, STABLE, RESIDENTIAL COMMUNITY.

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Inspections:		
Manhole Inspections	5 years	- Should be done in conjunction with sewer lamping. - More frequent inspections may be required where manholes are located in heavily used roadways. - Defects should be noted and scheduled for repairs.
Exterior Private Building Inspections	5 years	- Inspections can be done in conjunction with manhole inspections and sewer lamping. - Building exteriors should be checked for downspouts that have been connected to below grade discharge. Overland sump pump discharges should be checked for evidence of operation. - Inspections may be initiated by observing excessive wet weather sewer flows.
Lift Stations	As Needed	- See Chapter 4 for some suggested cycles for lift station inspections. Inspection cycles can vary from daily inspections to annual inspections. - Follow the manufacturers recommendations for maintaining all lift station equipment.
Closed Circuit TV Inspections	10 years or as needed	- Overall condition of the sewer system and service connections should be assessed using CCTV at least every 10 years. - Should be done if sewer cleaning debris includes pieces of broken pipe. - Should be done more frequently in areas where flow metering indicates that an excessive infiltration problem exists.

FIGURE 11-1 (Cont.). SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR AN OLD, STABLE, RESIDENTIAL COMMUNITY.

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Inspections:		
Smoke Testing	As Needed	- Helpful for locating sources of inflow. Should be done if flow metering indicates an inflow problem.
Dye Water Tests	As Needed	- Can be done if flow metering indicates an inflow problem. - Can be used to confirm suspect private sector inflow sources such as sump pumps and down-spouts that discharge below ground.
Interior Private Building Inspections	5-10 years	- Interior plumbing can be inspected at changes in ownership. - Required in all homes with sump pumps. - More frequent inspections required in areas with known sump pumps when flow monitoring indicates increased wet weather flows.
Flow Monitoring:		
Manual Spot Checks	Several times per year at key manholes	- Several quick flow measurements should be taken for different dry weather and wet weather conditions each year. - When flows appear to increase excessively, spot checks should be followed up with continuous flow monitoring and/or system investigations as needed.

FIGURE 11-1 (Cont.). SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR AN OLD, STABLE, RESIDENTIAL COMMUNITY.

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Flow Monitoring:		
Continuous	10 years or as needed	- Continuous flow monitoring may be needed in isolated areas of the system if the manual spot checks indicate a potential problem. - The entire system should be monitored on a 10 year cycle to more accurately assess the effectiveness of the maintenance program.
Sewer System Repairs	As needed	- Common repairs for an older community can include: - Manhole replacement. - Manhole well repairs. - Manhole bench and channel repair. - Manhole frame sealing. - Manhole rim elevation adjustment. - Spot replacement of sewers. - Sewer grouting. - Sewer lining.

FIGURE 11-1 (Cont.). SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR AN OLD, STABLE RESIDENTIAL COMMUNITY.

Type of Community: New, Growing, Residential Community
Some Typical Charateristics Affecting
Long-term Sewer Maintenance Requirements:

- Low potential for infiltration if construction was monitored adequately.
- Low potential for illegal building connections.

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Sewer Map Updating	1 year	- Many changes may need to be made to the sewer maps each year. - Important to note changes on a working set of maps as the changes occur. - New updated maps should be reprinted at least once a year.
Sewer Cleaning	1-5 years	- Problem areas must be identified/ - Past records will not be available to use when scheduling sewer cleaning frequencies. Effective frequencies must be developed. - Newer sewers may require more frequent cleaning than older sewers if there is minimal I/I because I/I can flush solids from the sewer system during wet weather. - Less root intrusion expected for newer sewers.
Inspections:		
Sewer Lamping	5 years	- Should be done with manhole inspections. - Sewer lamping may reveal areas that require cleaning or internal TV inspections.

FIGURE 11-2. SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR A NEW, GROWING RESIDENTIAL COMMUNITY.

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Inspections		
Manhole Inspections	5 years	- Should be done with sewer lamping. - Newer manholes should not exhibit significant structural damage. - More frequent inspections may be required where manholes are located in the path of construction traffic.
New Construction	Before Acceptance of Work	- Verify that sewers pass infiltration tests. - Verify proper service connection construction. - Make sure rim elevations of manholes are correct. - Make sure all manholes can be located. - Verify performance of all lift station equipment. - Check buildings for illegal connections to the sanitary sewer.
Exterior Private Building Inspections	5 years	- Inspections can be done with manhole inspections and sewer lamping. - Downspouts and sump pump discharges should be checked for changes in discharge points from above ground to below ground.

FIGURE 11-2 (Cont.). SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR A NEW, GROWING RESIDENTIAL COMMUNITY.

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Inspections:		
Lift Stations	As needed	- See Chapter 4 for some suggusted cycles for lift station inspections. Inspection cycles can vary from daily inspections to annual inspections. - Follow the manufacturers recommendations for maintaining all lift station equipment.
Closed Circuit TV Inspections	10 years	- Overall conditions of the sewer system and service connections should be assessed using CCTV at least every 10 years. - More frequent TV inspections would be required if infiltration became excessive or if it was needed to verify a damaged section of the sewer system.
Smoke Testing	As Needed	- Can be done if flow metering indicates there is an inflow problem.
Dye Water Tests	As Needed	- Can be done if flow metering indicates there is an inflow problem. - Can be useful for verifying suspect private sector inflow sources such as sump pumps and downspouts that discharge below ground.

FIGURE 11-2 (Cont.). SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR A NEW, GROWING RESIDENTIAL COMMUNITY.

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Inspections:		
Interior Private Building Inspections	10 years	- Interior plumbing can be inspeced at changes in ownership. - Only necessary if sewer flows become excessive and flow reduction cannot be achieved through public sector maintenance work.
Flow Monitoring:		
Manual Spot Checks	Several times per year at key manholes	- Several quick flow measurements should be taken for different dry weather and wet weather conditions each year. - When flows appear to increase excessively, spot checks should be followed up with continuous flow monitoring and/or system investigations as needed.
Continuous	10 years or as needed	- Continuous flow monitoring may be needed in isolated areas of the sewer system based on manual spot check results. - The entire system should be monitored on a 10 year cycle to more accurately assess the effectiveness of the maintenance program.
Sewer System Repairs	As Needed	- Common repairs for a newer community can include: - Adjust manhole rim elevations. - Seal manhole frames. - Repair settled areas over pipe trenches.

FIGURE 11-2 (Cont.). SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR A NEW, GROWING RESIDENTIAL COMMUNITY.

Type of Community: Established Industrial/Commercial Community
Some Typical Characteristics Affecting
Long-term Sewer Maintenance Requirements:

- More rapid sewer system deterioration expected when compared to residential areas.
- Infiltration potential high.

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Sewer Map Updating	1 year	- For an established community, very few map changes are expected. Changes will primarily be related to sewer system rehabilitation.
Sewer Cleaning	1-5 years	- Make sure sewer cleaning chemicals do not react adversely with industrial or commerical discharges. - Frequency of cleaning can be determined by reviewing past records. - Problem areas may require more than one cleaning per year. - Grease may be a significant problem downstream of restau rants.
Inspections:		
Sewer Lamping	3-5 years	- Because sewer deterioration can occur at a faster pace in sewers carrying industrial discharges, more frequent sewer lamping may be necessary. - Sewer lamping may identify sewer sections in need of cleaning, TV inspections, or repair.

FIGURE 11-3. SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR AN ESTABLISHED INDUSTRIAL/COMMERCIAL COMMUNITY.

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Inspections:		
Manhole Inspections	3-5 years	- Should be done with sewer lamping. - More frequent inspections may be required in areas of heavy industrial traffic.
Lift Stations	As Needed	- See Chapter 4 for some suggested cycles for lift station inspections. Inspections can vary from daily to annual inspections. - Follow the manufacturers recommendations for maintaining all lift station equipment.
Closed Circuit TV Inspections	5-10 years	- In areas where industries discharge aggressive chemicals to the sewer system TV inspections should be perform on a 5 year cycle to assess the condition of the sewers. - TV inspection can be performed on a 10 year cycle in areas where industrial or commercial discharges are neutral and non-aggressive. - More frequent inspections may be required if flow monitoring indicates an excessive infiltration problem. - Should be performed if sewer lamping indicates possible structural damage to the sewers.

FIGURE 11-3 (Cont). SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR AN ESTABLISHED INDUSTRIAL/COMMERCIAL COMMUNITY.

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Inspections:		
Smoke Testing	As Needed	- Can be done if flow monitoring indicates an inflow problem.
Dye Water Tests	As Needed	- Can be done if flow monitoring indicates an inflow problem. - Can be used to confirm suspect private sector inflow sources such as sump pumps and down-spouts that discharge below ground. Can also be used to confirm illegal plumbing on loading dock trench drains.
Private Building Inspections	10 years	- Should be done more frequently if flow monitoring indicates an excessive inflow problem that cannot be accounted for in the public sector. - Interior and exterior plumbing on all buildings should be in-pected at changes in building ownership.
Flow Monitoring:		
Manual Spot Checks	Several times per year at key manholes	- Several quick flow measurements should be taken for dry weather and wet weather conditions each year. - When flow appear to increase excessively, spot checks should be followed up with continuous flow monitoring and/or system investigations as needed.

FIGURE 11-3 (Cont). SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR AN ESTABLISHED INDUSTRIAL/COMMERCIAL COMMUNITY.

MAINTENANCE TASK	SUGGESTED CYCLE	COMMENTS
Flow Monitoring:		
Continuous	10 years	- More frequent continuous flow monitoring may be required in isolated areas where spot checking of flows resulted in higher than expected flows. - The entire sewer system should be accurately monitored for flow on a 10 year cycle in order to evaluate the overall effectiveness of the long-term maintenance activities.
Sewer System Repairs	As Needed	- Common repairs for an established industrial/commercial community can include: - Adjustment of manhole rims. - Manhole frame sealing. - Manhole wall repairs. - Manhole bench and channel repairs. - Sewer replacement. - Sewer lining.

FIGURE 11-3 (Cont). SUGGESTED LONG-TERM MAINTENANCE SCHEDULE FOR AN ESTABLISHED INDUSTRIAL/COMMERCIAL COMMUNITY.

EQUIPMENT NAME AND NUMBER	SERIAL NO.	LOCATION

DATE OF TROUBLE	TIME	REPORTED BY	SHIFT

INDICATION OF TROUBLE

- ☐ BROKEN PART
- ☐ WORN PART
- ☐ HEAT
- ☐ NOISE
- ☐ SMELL
- ☐ VIBRATION
- ☐ LEAKING
- ☐ DIRTY, FOULED
- ☐ VOLTAGE
- ☐ CURRENT
- ☐ RESISTANCE
- ☐ FLOW RATE
- ☐ PRESSURE
- ☐ SPEED
- ☐ OTHER _____

WHEN DISCOVERED

- ☐ STARTING
- ☐ STOPPING
- ☐ DURING OPERATION
- ☐ DURING PREVENTIVE MAINT.
- ☐ DURING CORRECTIVE MAINT.
- ☐ DURING OVERHAUL
- ☐ OTHER _____

CAUSE OF TROUBLE

- ☐ HEAT/COLD/WEATHER
- ☐ HUMIDITY/MOISTURE
- ☐ FOREIGN OBJECT
- ☐ SHOCK/VIBRATION
- ☐ WEAR
- ☐ EQUIPMENT DEFECT
- ☐ IMPROPER INSTALLATION
- ☐ IMPROPER LUBRICATION
- ☐ IMPROPER OPERATION
- ☐ OTHER _____

REMARKS AND RECOMMENDATIONS _____

CHECK IF EQUIPMENT WAS TAGGED OUT OF SERVICE ☐

FIGURE 11-4. EXAMPLE EQUIPMENT MALFUNCTION REPORT

DATE _____ OPERATOR _____

UNUSUAL CONDITION: CHECK (✓)

- ☐ EXPLOSION
- ☐ FLOODING
- ☐ VANDALISM
- ☐ EQUIPMENT FAILURE
- ☐ POWER FAILURE
- ☐ FIRE
- ☐ LINE COLLAPSE OR BLOCKAGE
- ☐ OTHER

REASON FOR CONDITION _____

DAMAGES, INJURIES, ETC. _____

ACTION TAKEN (WHO NOTIFIED, WHAT DONE) _____

REMARKS _____

SIGNED _____

OPERATOR ON DUTY

FIGURE 11-5. EXAMPLE EMERGENCY CONDITIONS REPORT

DATE _____ TIME _____

COMPLAINT BY _____

ADDRESS _____

TELEPHONE _____

LOCATION OF COMPLAINT _____

_____

DETAILS OF COMPLAINT _____

CHECK (✓) COMPLAINT

SEWER SYSTEM COMPLAINTS

- ☐ MANHOLE COVER MISSING
- ☐ MANHOLE COVER LOOSE OR NOISY
- ☐ ODORS-GASES
- ☐ MANHOLE CAVE-IN
- ☐ LINE CAVE-IN
- ☐ MANHOLE FLOODED
- ☐ STREET FLOODED
- ☐ YARD FLOODED
- ☐ BUILDING FLOODED
- ☐ OTHER

LIFT STATION COMPLAINTS

- ☐ ODORS
- ☐ FLOODING
- ☐ STOPPAGES
- ☐ UNKEPT GROUNDS
- ☐ SPILLS
- ☐ OTHER

_____

ACTION TO BE TAKEN:

- ☐ IMMEDIATE INSPECTION
- ☐ IMMEDIATE REPAIR
- ☐ OWNER'S REPAIR
- ☐ FUTURE REPAIR
- ☐ WATER DEPARTMENT NOTIFIED
- ☐ HEALTH DEPARTMENT NOTIFIED
- ☐ OTHER _____

_____

COMPLAINT RECEIVED BY: _____ DATE: _____

FIGURE 11-6. EXAMPLE COMPLAINT FORM

Records from previous years can be reviewed and used to make the estimate necessary to plan for the probable number of unscheduled maintenance activities for a given year.

SCHEDULING ANNUAL MAINTENANCE

In order to prepare an annual budget or make a determination if the current level of personnel is adequate to carry out the preventive maintenance program for the upcoming year, an annual schedule must be developed at the beginning of each year which identifies the maintenance tasks and the estimates of the manhours required to complete the tasks. Preventive maintenance activities that will be done by outside contractors should also be included on the annual schedule so they can be included in the budget.

When preparing the annual schedule, the long-term maintenance schedule should be used to determine which scheduled work items need to be done for a particular year. Work items that can definitely be scheduled include activities such as lift station inspections, routine maintenance on lift station equipment, routine sewer cleaning, manhole inspections, sewer lamping, closed circuit television inspections, flow monitoring, and sewer map updating to name a few.

Past records should be examined to determine the quantity of unscheduled maintenance activities that must be planned such as sewer system repairs, smoke testing, dye water tests, and emergency responses.

Figure 11-7 shows an example form which can be used to summarize all of the expected annual preventive maintenance activities. The example form has been filled out as it would appear for a typical small established residential community with a population of 1100. There are 24,000 linear feet of public sector sewers in the community along with 64 manholes. There are also 3 lift stations which require periodic maintenance. It is apparent from looking at Figure 11-7 that a form of this type can be very helpful for preparing the annual budget or determining if the current staff level is adequate for completing the annual program.

One type of record that can be used to assign the productivity rates to the different types of work is a daily progress report. An example daily progress report is shown in Figure 11-8. The daily progress report summarizes all work completed in one day and the number of hours spent by the work crew for completing each task.

SCHEDULING PREVENTIVE MAINTENANCE WORK USING A CARD SYSTEM

Introduction

A card system can be a very effective way to organize a preventive maintenance program if implemented properly. The purpose of a card system is to make sure maintenance work is completed on schedule and that accurate records of the work are kept.

Organization

A card system can be organized in many different ways. The following is a suggested format for organizing a card system. Each agency should customize their format to their

Annual Preventive Maintenance Schedule

Year: _____

Prepared by: _____

Approved by: _____

O & M Activity	Total System Quantity	Scheduled Work J F M A M J J A S O N D	Productivity Rate	Total Mandays Required
Sewer Mapping:				
Updating	1 Set	1 Set	80 hrs/set	10.0
Flow Metering:				
Spot Checks	3 Key MH	72 Spot Checks	0.5 hr/MH	4.5
Continuous	6 Key MH	2 Key MH	80 hrs/MH	20.0
Inspections:				
Manholes	64	16 MH	0.5 hr/MH	1.0
Sewer Lamping	24,000 LF	6000 LF	0.0025 hr/LF	1.9
Private Bldg.	300	30	0.75 hr/Bldg.	2.8
TV Inspections	24,000 LF	2000 LF	0.03 hrs/LF	7.5
Dyed Water	24,000 LF			
Smoke Testing	24,000 LF	1000 LF	0.024 hrs/LF	3.0
Lift Stations	3	156 Inspections/YR	2.0 hrs/Insp.	39.0
Inv. Siphons	1	12 Inspections/YR	2.0 hrs/Insp.	3.0
Junction Chamb.	0			
Div. Structures	0			
New Const.	—			
Sewer Cleaning	24,000 LF	8000 LF	0.024 hrs/LF	24.0
Rehabilitation: Manholes:				
Replace	64	2	24 hrs/MH	6.0
Seal Frame	64	6	12 hrs/MH	9.0
Replace Cover	64			
Seal Walls	64			
Pipe Seal	64			
Sewers:				
Grout	24,000 LF	1000 LF	Contract Out	0
Replace	24,000 LF	800 LF	Contract Out	0
Line	24,000 LF			
Service Repairs	300	2	Contract Out	0
Lift Station Main.	3	36 Maint. Visits/YR	10 hrs/Visit	45.0
Emergency Response:				
Complaints	—	5/YR	8 hrs/comp.	5.0
Blockages	—	2/YR	24 hrs/blck.	6.0
Equip. Fail.	—	2/YR	32 hrs/Fail.	8.0
TOTAL				195.7

FIGURE 11-7. EXAMPLE ANNUAL PREVENTIVE MAINTENANCE SCHEDULE

NAME _____ DAY _____ DATE _____ 19__

NAME	PRODUCTION	STAND BY	FIELD REPAIR	TRAVEL	SHOP	OTHER	HRS	TOTAL
CREW CHIEF								
SECOND MAN								
THIRD MAN								
FOURTH MAN								
TOTAL HOURS								

WEATHER CONDITIONS _____

WORK PHASE	DISTRICT	MANHOLE REACH	EQUIPMENT USED	MILEAGE	TIME SPENT

SIGNED _____

FIGURE 11-8. EXAMPLE DAILY PROGRESS REPORT

collection system. In this format the card system is used in conjunction with maintenance forms. The card system ensures that maintenance work is scheduled in a timely manner. The maintenance forms ensure that accurate records are kept for future reference.

Using this format a maintenance card is filled out for each component of the sewer system. This means that every manhole, sewer segment, lift station, junction chamber, siphon, building, etc. is assigned a card. In addition, a maintenance card for each piece of sewer equipment and a card for sewer map updating will need to be developed. It is recommended that 2 identical cards be filled out for each sewer system component, so that 2 sets of cards can be stored in separate filing systems. One set of cards should be filed chronologically with respect to the next scheduled maintenance date. The other set of cards should be filed by sewer system categories in order of component identification number. For example, all manhole cards would be filed together in either increasing or decreasing order according to the manhole identification numbers. The purpose of the second set of cards is to enable the supervisor to locate a sewer system component card without knowing when it is scheduled next for maintenance. The importance of both card files can be illustrated by the following example. Three homeowners call the Public Works Department to report that they have sewage backing up in their basements. All of the homeowners who call live in the same general area. The sewer system supervisor assumes that there is a blockage or a partial blockage in one of the sewer lines in the vicinity of where the complaints came from. The supervisor will want to schedule these lines immediately for lamping and cleaning to locate and relieve the problem. Since it would be difficult to quickly find the maintenance cards for the sewer line segments near the complaining homeowners in the card system filed chronologically by next scheduled maintenance date, the supervisor can go directly to the card system filed in categories by component number. By referencing the sewer map the supervisor will be able to identify which sewer segments are in the area of the blockage. The cards for these sewer segments can be pulled and the next scheduled maintenance date which appears at the top right-hand corner will indicate where in the chronologically ordered file the duplicate card is located. This card can be pulled from the chronologically ordered file and scheduled for immediate maintenance. After the sewer blockage is cleared, a future maintenance task for the sewer segment that was blocked will be scheduled. The future maintenance date will be placed in the upper right-hand corner of both cards. Both cards will then be re-filed in their respective filing systems.

It should be noted that setting up the card system can be a labor intensive process, especially for large collection systems. A detailed sewer map and an equipment listing can be useful tools when filling out the cards. Each card will serve as a record for all inspection, maintenance, and rehabilitation work performed on the sewer system component. The maintenance form will serve as detailed records of the work completed.

Some suggestions for information that should appear on the cards are:

1. Top, right-hand corner should be reserved for the next scheduled maintenance date. The date should be written in pencil so it can be erased and re-entered, or typed on stickers so that stickers can be placed on top of the previous sticker to indicate the next maintenance date.

2. Component name (i.e. sewer segment, manhole, lift station, siphon, equipment name, etc.).

3. Component location, installation date, and material. Sewer segments should be identified as stretches between manholes. The manholes can be identified by street address and/or unique identification number. Installation date will

provide information regarding the age of the component. The component material is important when deciding what type of rehabilitation method to use.

4. Date maintenance work was scheduled.

5. Date maintenance work was completed.

6. Type of work completed. Examples of different types of work which could be applicable for the item to be maintained appear at the bottom of the card. If the work completed is not listed at the bottom of the card, write-in the type of work completed in the "type of work" or "work completed" column on the card.

7. Specific information that is important for the component. For example, for sewer segments and manholes the type of equipment used for the maintenance work is important for future reference in scheduling more maintenance work.

8. Comments/Recommendations. Each card should have a column for comments and recommendations. This column is very important for recording unusual conditions or observations. It is also important that a recommendation be made in this column for additional work or a change in maintenance frequency on the component if necessary.

Maintenance forms for record keeping should be developed for each type of maintenance work that is listed at the bottom of the cards. For example, maintenance forms for sewer segment cleaning, lamping, televising, and rehabilitation should be developed. Examples of these forms and other forms are referenced in the following example of how to use the card system. The data shown on the example cards is for informational purposes only. Each agency may find that different types of data are more useful for implementing their own preventive maintenance program.

How to Use the Card System

1. Initially all cards are marked with a date which indicates when maintenance is next scheduled to be performed. An agency's long term maintenance schedule should be used to determine the next scheduled maintenance date on each card.

2. One set of cards are arranged in chronological order with respect to scheduled maintenance, a second set of cards is arranged by component with respect to component number. Next scheduled maintenance dates are indicated on both sets of cards.

3. At the beginning of each week all cards for the week are removed from both sets of files.

4. The maintenance chief or supervisor writes out work orders for each work item scheduled for the week as indicated on the cards and distributes the work orders to the appropriate maintenance crews.

5. Crews complete the work and return the work slips and the associated maintenance forms to the supervisor.

6. The supervisor records the required data on both sets of cards and based on recommendations made by the crews, will schedule additional work for a given component or change the frequency that maintenance is completed on it if necessary. A new date is then placed in the top right-hand corner of both cards indicating the next date when the sewer system component should be maintained again.

7. The cards are then re-filed in the respective card filing system; chronologically with respect to the next scheduled maintenance date, or by component with respect to component number.

8. The maintenance forms are filed chronologically in a separate filing system by category.

Example Card System Setup

An Example of how cards can be used to schedule maintenance is presented on the following pages. The example hypothetical community is Beachwood, Illinois. A sanitary sewer map for Beachwood is presented as Figure 11-9.

Beachwood has a separate sanitary sewer system consisting of 2,700 feet of 8 inch vitrified clay pipe. There is one lift station located 175 feet north of manhole No. 7. There is also one inverted siphon where the sewer crosses under Black Creek. All components of the system were installed in 1951. No construction or major repairs have occurred on the system since then. In this example all the components of the system have been identified and the cards formatted as previously outlined under "Organization."

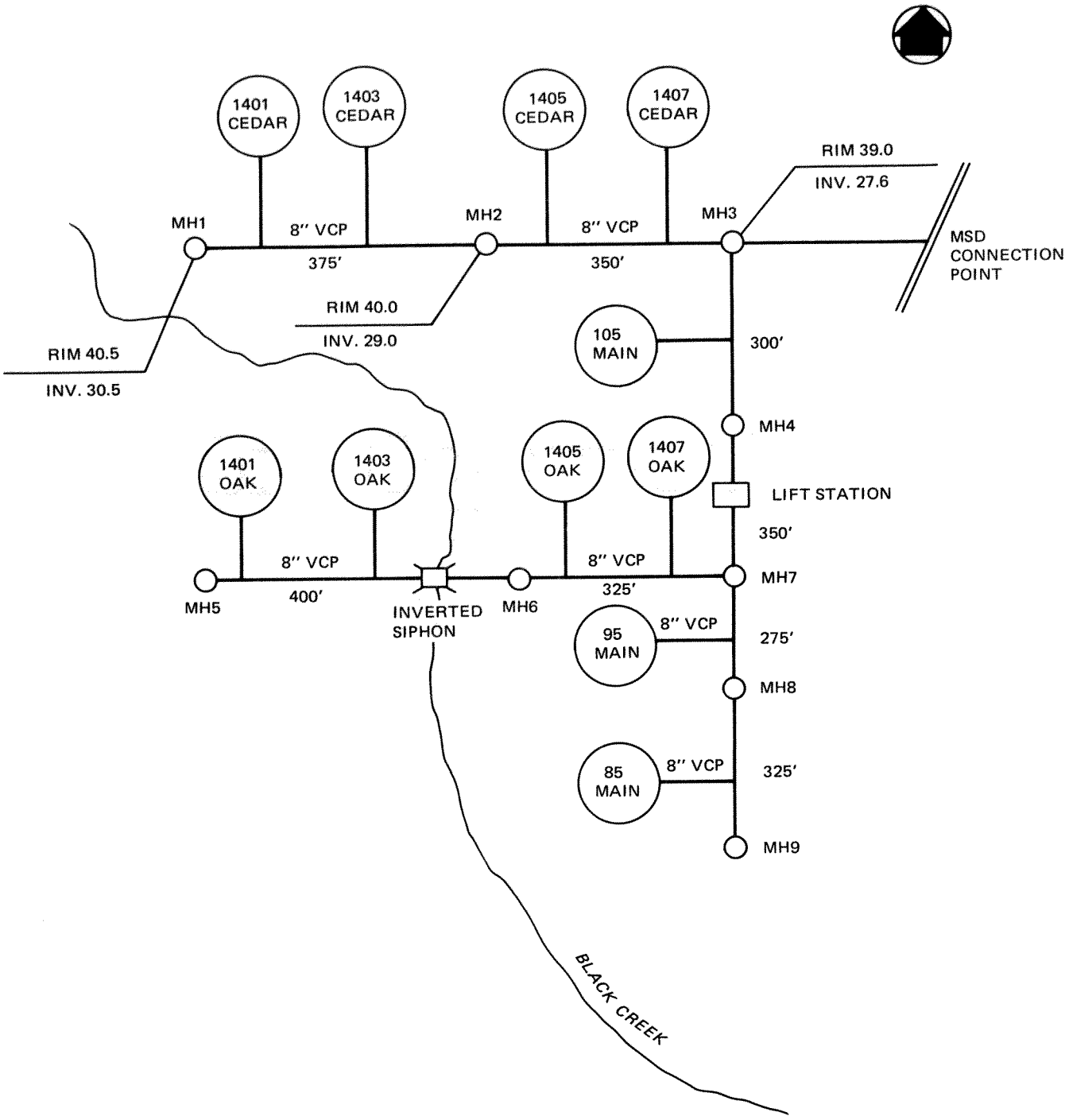
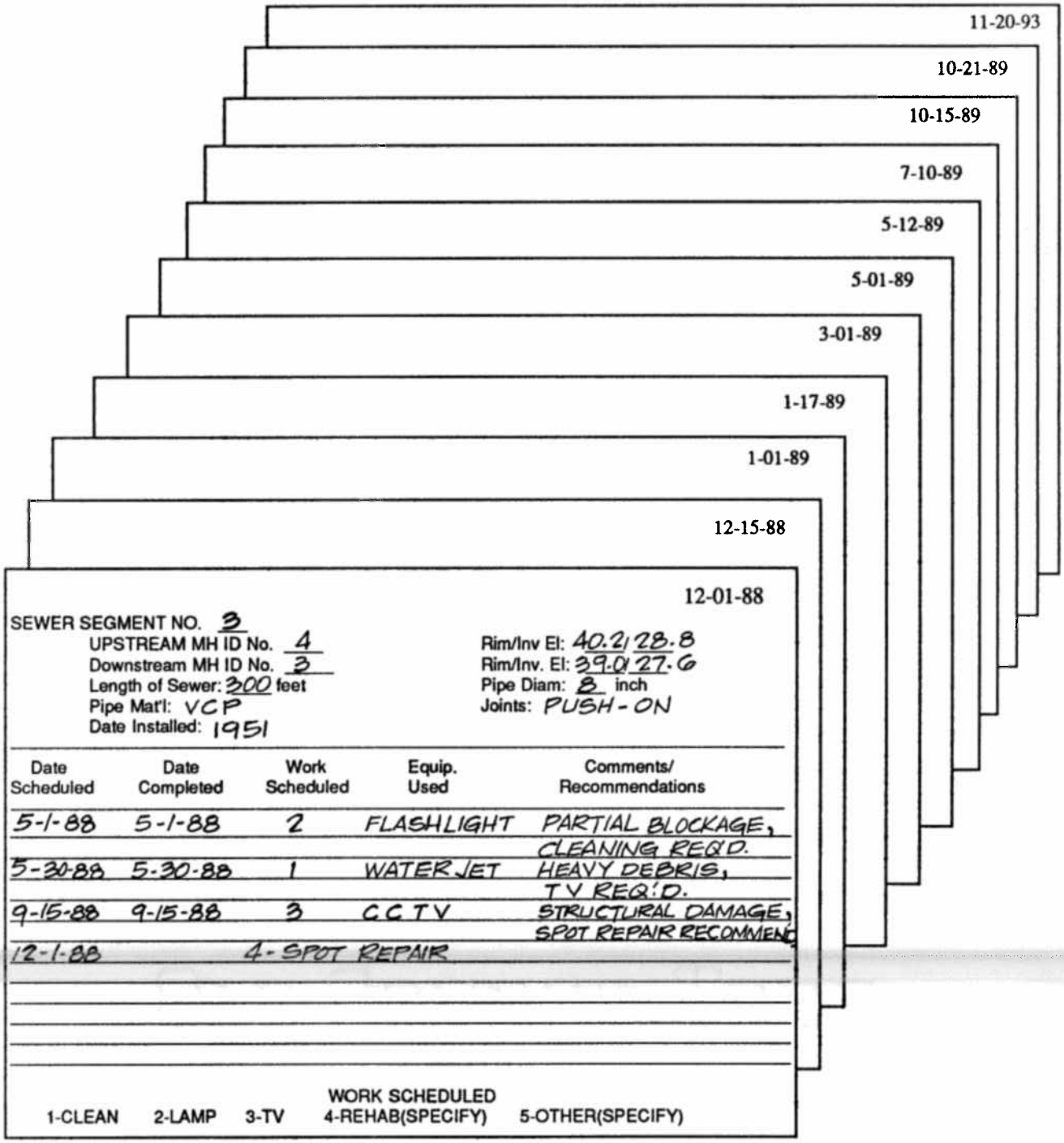
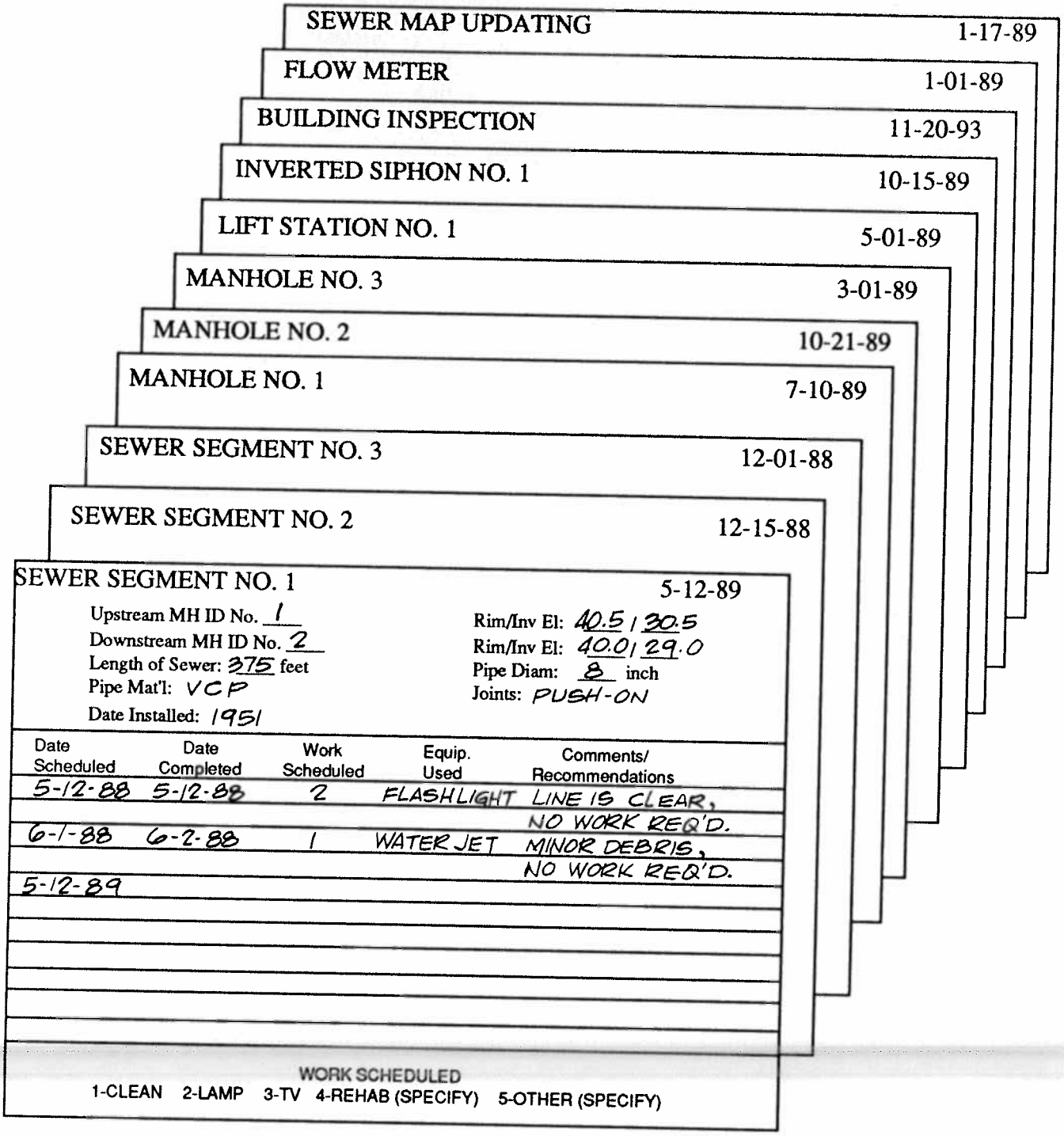


FIGURE 11-9. BEACHWOOD SANITARY SEWER MAP

One set of cards are placed in chronological order with respect to scheduled maintenance. For a new maintenance program the initial maintenance dates can be assigned from a rough long-term maintenance schedule. If some type of preventive maintenance program existed prior to implementing the card system, then initial maintenance dates for the cards can be based on the previous maintenance program. When the cards are all assigned dates and put in chronological order, they should be filed and look like this:



The second set of cards should be filed by component with respect to comonent number. For this example, the second set of cards would like like this:



The building inspection cards can be filed by street address. The equipment maintenance cards can be filed alphabetically.

Example Maintenace Task No. 1:

SEWER SEGMENT NO. 3 — 12-1-88

Upstream MH ID No. 4 — Rim/Inv El: 40.2 / 28.8
Downstream MH ID No. 3 — Rim/Inv El: 39.0 / 27.6
Length of Sewer: 300 feet — Pipe Diam: 8 inch
Pipe Mat'l: VCP — Joints: PUSH-ON
Date Installed: 1951

Date Scheduled	Date Completed	Work Scheduled	Equip. Used	Comments/ Recommendations
5-1-88	5-1-88	2	FLASHLIGHT	PARTIAL BLOCKAGE, CLEANING REQ'D.
5-30-88	5-30-88	1	WATER JET	HEAVY DEBRIS, TV REQ'D.
9-15-88	9-15-88	3	CCTV	STRUCTURAL DAMAGE, SPOT REPAIR RECOMMENDED
12-1-88	4 - SPOT REPAIR			

WORK SCHEDULED

1-CLEAN 2-LAMP 3-TV 4-REHAB (SPECIFY) 5-OTHER (SPECIFY)

According to this example the next component of the sewer system scheduled for maintenance is Sewer Segment Number 3. It is scheduled for work on December 1, 1988. Sewer segment number 3 is located between manholes numbered 3 and 4 (refer to the sewer map, Figure 11-9). Sewer Segment number 3 consistes of 300 feet of 37-year old 8 inch diameter vitrified clay pipe with push-on joints. The work scheduled for December 1, 1988 is rehabilitation, as indicated by the number 4 in the "work scheduled" column. The rehabilitation is specified as "spot repair". When the work is complete the "date completed" will be entered in addition to "equipment used" and any comments of recommendations for additional work. In addition, a maintenance form will be completed for the type of work that was scheduled. An example sewer rehabilitation form is shown in Figure 11-10. An example sewer rehabiltation form is schown in Figure 11-10. Other types of work commonly scheduled for sewer segments are: cleaning, televising, lamping, dye water flooding and smoke testing. Example maintenance forms for this work appear as figures 11-11, 4-3, 4-4, 4-6, and 4-7 respectively.

The history of Sewer Segment Number 3 is apparent by reviewing the work previously completed on the sewer sement and the recommendations made by the crew for additional work. Lamping was completed on this section on May 3, 1988. A partial

blockage was observed and cleaning of the line was recommended. Cleaning by water jet was scheduled for May 30, 1988. Cleaning the line removed heavy debris and therefore, the line was recommended for televising. Closed circuit televising was scheduled for and completed on September 15, 1988. Structural damage to the pipe was observed which was recommended for repair. The repair method recommended was sewer pipe spot replacement. The spot replacement was then scheduled for December 1, 1988 and the card was filed in chronological order with respect to other scheduled maintenance tasks. The maintenance form, upon completion, should be filed chronologically in a separate file.

DATE:_____

Sewer Segment No._____

Upstream MH ID No._____ Rim/Inv El:_____/_____

Downstream MH ID No._____ Rim/Inv El:_____/_____

Length of Sewer _____ feet Pipe Material:_____

Pipe Diameter_____inch Joints:_____

Date Installed:_____

Type of Rehabilitation Completed:

- ☐ Service Connection Repair
- ☐ Spot Replacement
- ☐ Sewer Grouting (indicate number of joints) Sliplining
- ☐ Inversion Lining
- ☐ Manhole-to-Manhole Replacement
- ☐ Other _____

Exact location of work:_____

Crew Size Used: _____

Manhours Used:_____

Equipment Used: _____

Replacement/Repair Materials Used:_____

_____

Comments:_____

_____

_____

FIGURE 11-10. EXAMPLE SEWER SEGMENT REHABILITATION FORM

DATE:_____

Sewer Segment No._____

Upstream MH ID No. _____ Rim/Inv El:_____/_____

Downstream MH ID No. _____ Rim/Inv El:_____/_____

Length of Sewer_____feet Pipe Material:_____

Pipe Diameter_____inch Joints:_____

Date Installed:_____

Cleaning Equipment Used: _____

_____

Debris Severity Observed:_____

Types of Debris Observed:

- ☐ Grit
- ☐ Grease
- ☐ Roots
- ☐ Broken Pipe
- ☐ Other _____

Comments: _____

_____

_____

Debris Severity

0 - None 1 - Minor 2 - Moderate 3 - Severe 4 - Blockage

FIGURE 11-11. EXAMPLE SEWER CLEANING FORM

Example Maintenance Task No. 2:

SEWER SEGMENT NO. 2 — 12-15-88

Upstream MH ID No. 2 — Rim/Inv El: 40.0 / 29.0
Downstream MH ID No. 3 — Rim/Inv El: 39.0 / 27.6
Length of Sewer: 350 feet — Pipe Diam: 8 inch
Pipe Mat'l: VCP — Joints: PUSH-ON
Date Installed: 1951

Date Scheduled	Date Completed	Work Scheduled	Equip. Used	Comments/ Recommendations
5-20-88	5-20-88	2	FLASHLIGHT	PARTIAL BLOCKAGE, CLEANING RECOMMENDED
6-15-88	6-15-88	1	WATER JET	CLEARED BLOCKAGE, LAMP MORE FREQ.
12-15-88		2		

WORK SCHEDULED

1-CLEAN 2-LAMP 3-TV 4-REHAB (SPECIFY) 5-OTHER (SPECIFY)

Lamping of Sewer Sement No. 2 is scheduled for December 12, 1988. This is the next scheduled maintenance item following the repair of Sewer Segment No. 3. A Sewer Lamping Data Sheet should be filled out for this work. Figure 4-4 shows an Example Sewer Lamping Data Sheet.

The history of Sewer Segment No. 2 indicates that this line segment is subject to blockages. More Frequent lamping has been recommended in order to monitor how fast debris builds up in the pipe. Televising or more frequent cleanings may be recommended based on observations from additional lamping.

Example Maintenance Task No. 3:

FLOW METER 1-1-89

Model: INSTA-FLO
Manufacturer: X Y Z MANUFACTURERS
Serial No.: AB-1234 CD
Date Purchased: 1988

Date Scheduled	Date Completed	Maintenance Completed	Comments
1-1-88	1-1-88	CALIBRATION CHECK	O.K.
6-1-88	6-1-88	CLEAN, CALIBRATION CHECK	O.K.
1-1-89		CLEAN, CALIBRATION CHECK	

The next scheduled maintenance item following the lamping of Sewer Segment No. 2 is the cleaning and calibration of the flow monitoring equipment. The scheduled maintenance date is January 1, 1988. This equipment maintenance card is for an XYZ INSTA-FLO flow meter which is used for manually spot checking sewer flow rates. A Maintenance Work Order Form (Figure 11-12) would be completed for this work along with an Equipment Service Record Card (Figure 11-13).

DATE	REQUESTED BY	REQUIRED COMPLETION DATE

EQUIPMENT NAME AND NUMBER	SERIAL NO.	LOCATION

INDICATION OF TROUBLE

- ☐ BROKEN PART
- ☐ WORN PART
- ☐ HEAT
- ☐ NOISE
- ☐ SMELL
- ☐ VIBRATION
- ☐ LEAKING
- ☐ DIRTY, FOULED
- ☐ VOLTAGE
- ☐ CURRENT
- ☐ RESISTANCE
- ☐ FLOW RATE
- ☐ PRESSURE
- ☐ SPEED
- ☐ OTHER _____

WORK TO BE DONE

- ☐ INSPECT
- ☐ REPAIR
- ☐ REPLACE
- ☐ SERVICE
- ☐ OVERHAUL
- ☐ PAINT
- ☐ OTHER _____

CAUSE OF TROUBLE

- ☐ HEAT/COLD/WEATHER
- ☐ HUMIDITY/MOISTURE
- ☐ FOREIGN OBJECT
- ☐ SHOCK/VIBRATION
- ☐ WEAR
- ☐ EQUIPMENT DEFECT
- ☐ IMPROPER INSTALLATION
- ☐ OTHER _____

WORK REQUESTED _____

ESTIMATED COSTS
LABOR _____
PARTS _____
CONTRACTOR _____
TOTAL _____

ESTIMATED DOWN TIME

APPROVED BY	DATE	JOB NO.

MAINTENANCE WORK RECORD RECAP

DESCRIBE WHAT WAS WRONG AND HOW IT WAS FIXED	OUTSIDE CONTRACTOR USED

RECOMMENDATIONS FOR AVOIDING REPEATED FAILURE	REASON

EQUIPMENT STATUS AT COMPLETION

- ☐ FULLY OPERATIONAL
- ☐ NON-OPERATIONAL
- ☐ REDUCED CAPABILITY
- ☐ AWAITING SPARE PARTS

SPARE PARTS AVAILABILITY

- ☐ IN STOCK
- ☐ OBTAINED LOCALLY
- ☐ DELAY IN PROCURING
- ☐ LENGTH

ACTUAL COSTS

LABOR _____
PARTS _____
CONTRACTOR _____

TOTAL DOWN TIME

WORK COMPLETED	WORK APPROVED
DATE _____ NAME _____	DATE _____ REQUESTOR _____

FIGURE 11-12. EXAMPLE MAINTENANCE WORK ORDER

EQUIPMENT NO. _____

DATE	MECHANICS NAME	REQ. HRS.	OT HRS.	PARTS OR MATERIALS	MANUFACTURER AND CATALOG NO.	COST

FIGURE 11-13. EXAMPLE EQUIPMENT SERVICE RECORD CARD

Example Maintenance Task No. 4:

SEWER MAP UPDATING — 1-17-89

Date of Original Map: 1951
Prepared By: E. REINER & CO.
Type of Map: AREA MAP

Date	Summary of Changes Made	Prepared by:
1-17-88	NONE	———
1-17-89		

Every January the sewer map for Beachwood is updated. This is the next scheduled work item. The map updating card indicates that no changes were made to the sewer map in 1988. Sewer map revisions are required when new construction is completed on the existing collection system. New construction could consist of extending the collection system, spot replacements, new service connections, manhole replacement, lift station installation, etc. Any new construction should be indicated on the sewer map. The scheduling cards and maintenance forms should be referenced for the details regarding new construction during the previous year.

Example Maintenance Task No. 5:

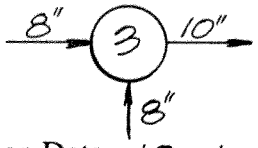
MANHOLE NO. : 3 — 3-1-89

Rim/Inv El: 39.0 / 27.6

Location: CEDAR & MAIN

Manhole Type: PRECAST CONCRETE

Cover: STANDARD — Installation Date: 1951



Date Scheduled	Date Completed	Work Scheduled	Equip. Used	Comments/ Recommendations
10-13-88	10-13-88	1	ATMOS. TESTER	VANDALIZED, RECOM. BOLT DOWN COVER
3-1-89		3- REPLACE COVER		

WORK SCHEDULED

1-INSPECTION 2-VISUAL FLOW CHECK 3-REHAB (SPECIFY)

The next scheduled maintenance item is to replace the manhole cover at Manhole Number 3 with a bolt down cover. This was recommended after the inspection on October 13, 1988 indicated that the manhole was being vandalized. A manhole rehabilitation form should be filled out when this work is completed. An Example Manhole Rehabilitation Form is shown as Figure 11-14. Example maintenance forms for Manhole Inspection and Visual Flow Checks are included as Figures 4-2 and 11-15, respectively.

The manhole identification number should be consistent with manhole numbers shown on the sewer system map. The street address or the location and the rim and invert elevations of the manhole should also be shown. In this example Manhole Number 3 is located at the intersection of Cedar and Main. The manhole construction is precast concrete and it currently has a standard cover.

Following the installation of the bolt down cover on March 1, 1989, the cover type will change from "standard" to "bolt down." The manhole was installed in 1951 and a diagram of the sewer pipes entering and leaving the manhole is indicated in the top center of the card. The different types of work that are commonly scheduled at a manhole are listed at the bottom of the card.

DATE:_____

Manhole ID No._____

Rim/Inv El:_____/_____

Street Address/Location:_____

Manhole Type:_____

Cover Type:_____

Installation Date:_____

Type of Rehabilitation Completed:

- ☐ Cover Replacement
- ☐ Frame Seal
- ☐ Wall Repairs
- ☐ Pipe Connection Repair
- ☐ Replacement
- ☐ Bench and Channel Repairs

Equipment Used:_____

Crew/Contractor:_____

Time Required to Complete:_____

Replacement/Repair Materials Used:_____

Comments: _____

_____

_____

FIGURE 11-14. EXAMPLE MANHOLE REHABILITATION FORM

DATE:_____

Manhole ID No._____

Rim/Inv El:_____/_____

Street Address/Location:_____

Manhole Type:_____

Cover:_____

Installation Date:_____

Sketch of Inlet and Outlet Piping:

Flow Measuring Equipment:

- ☐ Dip Stick
- ☐ Weir
- ☐ Flume
- ☐ Flow Monitor (specify type)

Flow Measurement:_____ gpd

Time of Reading:_____ Weather:_____

Indicate weather conditions on the 3 days prior to this measurement:

_____

Comments:_____

_____

_____

FIGURE 11-15. EXAMPLE VISUAL FLOW CHECK FORM

Example Maintenance Task No. 6:

LIST STATION NO. 1 — 5-1-89

Pump Manufacturer: A B C PUMPS, INC.
Type of Pumps: SUBMERSIBLE
No. of Pumps: 2
Date Built: 1951

Date Scheduled	Date Completed	Work Scheduled	Specific Work Completed	Comments/ Recommendations
11-1-88	11-1-88	3	LUBRICATE BEARINGS	NO PROBLEMS
5-1-89		1-ANNUAL		

WORK SCHEDULED
1-INSPECTION 2-REHAB (SPECIFY) 3-MAINTENANCE

On May 1, 1989, Lift Station Number 1 is scheduled for its annual inspection. This is the next maintenance item following the cover change on Manhole Number 3. The upper area of the card indicates the location of the pump station, the pump manufacturer, pump type, number of pumps, and the date the pump station was built. The bottom of the card indicates types of work which are commonly scheduled.

Example Lift Station Maintenance Forms for daily, weekly, monthly, and annual inspection appear as Figures 11-16, 11-17, 11-18, and 11-19, respectively.

DATE:_____

Lift Station No._____

Location:_____

Pump Manufacturer:_____

Type of Pumps:_____

No. of Pumps:_____

Date Lift Station was Built:_____

Inspector(s):_____

Time Arrived:_____ Time Departed:_____

TASK	COMPLETED
1. Check that electric power is on.	_____
2. Make sure no circuit breakers have been tripped.	_____
3. Read and record values on counters and timers.	_____

Pump No.	Running Time
1	_____
2	_____
3	_____

4. Inspect, clean, and lubricate motors and rings.	_____
5. Inspect and clean wet well level sensor electrodes and bubbler tubes.	_____
6. Inspect and clean motor starters and relays.	_____
7. Check the operation of the gland water pump motors and electric valves.	_____
8. Inspect and clean all automatic gate controls.	_____
9. Check kilowatt meters and charts and record data.	_____
10. Check the motor, heating elements and belts on auxiliary equipment. Replace any broken or worn parts. Parts Replaced _____	_____
11. Check the float switches and motors on lift station sump pumps.	_____

FIGURE 11-16. EXAMPLE DAILY LIFT STATION INSPECTION FORM

DATE:_____

Lift Station No._____

Location:_____

Pump Manufacturer:_____

Type of Pumps:_____

No. of Pumps:_____

Date Lift Station was Built:_____

Inspector(s):_____

Time Arrived:_____ Time Departed:_____

TASK	COMPLETED
1. Check all equipment, piping and valves for leakage.	_____
2. Operate each wastewater pump in the "manual" or "hand" position and inspect the pump and motor for excessive noise or vibration.	_____
3. Check all motors for excessive temperature increases.	_____
4. Check all pressure and vacuum gauges.	_____
5. Inspect and clean sump pump wells if necessary.	_____
6. Clean the wet well of accumulated grease, floating debris, and grit.	_____
7. Clean and reposition floats and level sensor electrodes in the wet well.	_____
8. Inspect wet well piping and ladders.	_____
9. Mow the lift station yard if necessary.	_____
10. Wipe down all equipment.	_____
11. Replace recording charts as required.	_____
12. Exercise standby equipment to dry out water, redistribute lubricant and ensure operational readiness.	_____
13. Check operation of all lift station alarm systems.	_____

Comments:_____

_____

FIGURE 11-17. EXAMPLE WEEKLY LIFT STATION INSPECTION FORM

DATE:_____

Lift Station No._____

Location:_____

Pump Manufacturer:_____

Type of Pumps:_____

No. of Pumps:_____

Date Lift Station was Built:_____

Inspector(s):_____

Time Arrived:_____ Time Departed:_____

TASK	COMPLETED
1. Operation all flow control gates and valves to prevent them from seizing.	_____
2. Remove the pump casing inspection plates and remove any debris that has accumulated.	_____
3. Check calibration and recalibrate flow meters.	_____
4. Clean all ventilation openings.	_____
5. Check first aid supplies.	_____
6. Take inventory of spare parts. Verify that depleted parts have been ordered.	_____
7. Check the condition of paint both inside and outside the lift station.	_____

Comments:_____

_____

_____

FIGURE 11-18. EXAMPLE MONTHLY LIFT STATION INSPECTION FORM

	TASK	COMPLETED
12.	Inspect and clean bar screen or communitor controls.	
13.	Inspect indicating lights on all equipment and telemetry equipment controls.	
14.	Inspect pumps and bearings. Lubricate and repack if needed.	
15.	Inspect and lubricate line shaft bearings.	
16.	Inspect and lubricate gland water pumps and bearings.	
17.	Make sure the pump packing is not leaking too much water and is not too tight.	
18.	Inspect check valves and verify that they are not stuck either open or partially closed.	
19.	Inspect sump pump floats and all discharge piping and valves.	
20.	Check the position and operation of all flow control gates.	
21.	Check the drives and screens on all mechanically cleaned bar screens.	
22.	Inspect communitors for proper operation.	
23.	Inspect, clean, and lubricate all air compressors.	
24.	Manually clean bar screens.	
25.	Make sure all vent fans and lights are operating properly.	
26.	Enter any observed problems into the lift station log books.	
27.	Pick up all debris inside and outside of the facility.	
28.	Before leaving the facility make sure it is secure.	
29.	Plow snow if necessary.	

Comments:_____

FIGURE 11-16 (cont.). EXAMPLE DAILY LIFT STATION INSPECTION FORM

DATE:_____

Lift Station No._____

Location:_____

Pump Manufacturer:_____

Type of Pumps:_____

No. of Pumps:_____

Date Lift Station was Built:_____

Inspector(s):_____

Time Arrived:_____ Time Departed:_____

TASK	COMPLETED
1. Dismantle the wastewater pumps to inspect the impellers, shafts, and shaft sleeves.	_____
2. Inspect and clean all components of the ventilating fans, heaters, sump pumps, and dehumidifiers.	_____
3. Inspect the condition of all electrical equipment.	_____
4. Paint areas both inside and outside of the lift station as needed.	_____
5. Inspect the inlet and outlet piping at the lift station. Clean the piping if needed.	_____
6. Check flowmeter calibration and recalibrate if necessary.	_____

Comments:_____

_____

_____

FIGURE 11-19. EXAMPLE ANNUAL LIFT STATION INSPECTION FORM

Example Maintenance Task No. 7:

SEWER SEGMENT NO. 1 — 5-12-89

Upstream MH ID No. 1 — Rim/Inv El: 40.5 / 30.5
Downstream MH ID No. 2 — Rim/Inv El: 40.0 / 29.0
Length of Sewer: 375 feet — Pipe Diam: 8 inch
Pipe Mat'l: VCP — Joints: PUSH-ON
Date Installed: 1951

Date Scheduled	Date Completed	Work Scheduled	Equip. Used	Comments/ Recommendations
5-12-88	5-12-88	2	FLASHLIGHT	LINE IS CLEAR, NO WORK REQ'D.
6-1-88	6-2-88	1	WATER JET	MINOR DEBRIS, NO WORK REQ'D.
5-12-89				

WORK SCHEDULED

1-CLEAN 2-LAMP 3-TV 4-REHAB (SPECIFY) 5-OTHER (SPECIFY)

The next card indicates that Sewer Segment Number 1 is scheduled for lamping on May 12, 1989. The Sewer Lamping Data Sheet (Figure 4-4) should be completed at the time of the inspection.

Example Maintenance Task No. 8:

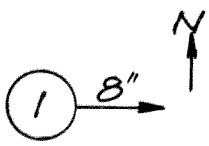
MANHOLE NO. : 1 — 7-10-89

Rim/Inv El: 40.5/30.5

Location: 1400 CEDAR

Manhole Type: PRECAST CONCRETE

Cover: STANDARD Installation Date: 1951



Date Scheduled	Date Completed	Work Scheduled	Equip. Used	Comments/ Recommendations
7-10-88	7-15-88	1	ATMOS. TESTER	O.K., NO WORK RECOMMENDED
7-10-88		1		

WORK SCHEDULED

1-INSPECTION 2-VISUAL FLOW CHECK 3-REHAB (SPECIFY)

This card indicates that Manhole Number 1 is scheduled for an inspection on July 10, 1989. A Manhole Inspection Form should be filled out during the inspection. Figure 4-2 shows an Example Manhole Inspection Form.

Example Maintenance Task No. 9:

INVERTED SIPHON NO. 1 — 10-15-89

Type: DOUBLE BARREL
Location: 100' WEST OF MH G(1404 OAK)
Length: 50FT.
Pipe Material: DUCTILE IRON — Pipe Diam's: 3"/6"
Pipe Invert: 32.1 FT. — Date Installed: 1951

Date Scheduled	Date Completed	Work Scheduled	Specific Work Completed	Comments/ Recommendations
10-15-89		1		

WORK SCHEDULED

1-INSPECTION 2-REHAB (SPECIFY) 3-CLEANING

Inverted Siphon Number 1 is scheduled for an inspection on October 15, 1989. It is a double barreled siphon 50 feet long. The pipe diameters are 3 inch and 6 inch and the pipe material is ductile iron. An Example Inverted Siphon Inspection Form is shown as Figure 11-20. Sewer Segment Rehabilitation and Cleaning Forms (Figures 11-10 and 11-11, respectively) can be used when cleaning or rehabilitating the inverted siphon.

DATE:_____

Inverted Siphon No._____

Type:_____ Pipe Diameters:

Location:_____ Pipe No. 1:_____inch

Length:_____ Pipe No. 2:_____inch

Pipe Material:_____ Date Installed:_____

Pipe Inverts:_____

Inspectors:_____

Time Arrived:_____ Time Departed:_____

Atmospheric Testing Results:

Inlet Structure:_____

Outlet Structure:_____

Flow measurement upstream of siphon:_____ gpd

Flow measurement downstream of siphon:_____ gpd

	TASK	COMPLETED
1.	Mechanical parts inspected for debris.	_____
2.	Check that hatches to inlet and outlet structures are secure.	_____
3.	Check that air vent piping between inlet and outlet structures is working properly.	_____
4.	Exercise slide gates.	_____

FIGURE 11-20. EXAMPLE INVERTED SIPHON INSPECTION FORM

Example Maintenance Task No. 10:

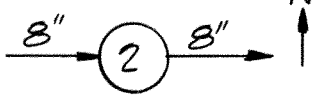
MANHOLE NO. : 2 — 10-21-89

Rim/Inv El: 40.0/29.0

Location: 1404 CEDAR

Manhole Type: PRECAST CONCRETE

Cover: STANDARD Installation Date: 1951



Date Scheduled	Date Completed	Work Scheduled	Equip. Used	Comments/ Recommendations
7-15-88	7-15-88	1	ATMOS. TESTER	FRAME NEEDS SEALING
10-21-88	10-21-88	3-FRAME SEAL	BUTYL RUBBER SEAL	
10-21-89		1		
10-21-89		2		

WORK SCHEDULED

1-INSPECTION 2-VISUAL FLOW CHECK 3-REHAB (SPECIFY)

This card indicates that Manhole Number 2 is scheduled for an inspection and a visual flow check with a V-notch weir on October 21, 1989. A Manhole Inspection Form (Figure 4-2) and Visual Flow Check Form (Figure 11-15) both should be completed.

Example Maintenance Task No. 11:

BUILDING INSPECTION 11-20-93

Building Address: 1401 CEDAR

Building Type:
- Residential
  - (single family)
  - duplex
  - apartment/condo
- Commercial/Industrial

Crawl Space: YES (NO)
Basement: (YES) NO
Sump Pump: (YES) NO
Year Built: 1940

Date	Violation?	Violation Type	Reinspection Date
8-20-88	YES	S	11-20-88
11-20-88	NO		11-20-93
11-20-93			

VIOLATION TYPE

S-SUMP PUMP D-DOWNSPOUT D-AREA DRAIN X-OTHER (SPECIFY)

The last maintenance item scheduled for this examle is a building inspection at 1401 Cedar Road. The inspection is scheduled for November 20, 1993. The building has a basement and a sump pump and has previously had one violation. When the inspection is complete a "reinspection date" will be assigned to the building. This reinspection date will be placed in the upper right-hand corner of the card and the card will be refiled in the filling system with respect to other scheduled maintenance work.

A Building Inspection Form should be filled out at the time of the inspection. An Example Building Inspection Form is shown in Figure 4-5.

OTHER TYPES OF MAINTENANCE SCHEDULING SYSTEMS

The card system for scheduling and keeping records of maintenance activities which was just described in the previous section is just one of many methods that can be used to help remind sewer system supervisors of the maintenance work required and when the work should be done. Other methods that can be used for scheduling maintenance include using sewer maps, bar charts, and commercially available computer software packages.

Sewer maps can be used effectively to schedule maintenance if an area map showing the entire community's sewer system can be clearly marked up each year to show specific maintenance requirements. The area maps are most effective if they are enlarged and attached to a wall in the supervisors office. Each type of maintenance activity can then be requested on the map by highlighting the area of the sewer system scheduled for a specific type of maintenance using a specific color. For example, sections of the sewer system scheduled for sewer cleaning can be highlighted in yellow and the sewers scheduled for closed circuit TV inspection can be highlighted in blue. Colored tape can be used to highlight the sewer sections so that when a maintenance activity has been completed, the tape can be removed from the map. At the end of the year no areas of the sewer system on the map should be highlighted with colored type if all of the scheduled maintenance has been completed.

Bar charts can also be used as a reminder of the maintenance activities that have been scheduled. The bar chart needs to include a list of all the annual maintenance activities and when they are scheduled to begin and end. As the maintenance activities are actually completed, the bar chart can be marked up to represent that the maintenance activities have been completed.

Another method for scheduling maintenance and storing records that is growing in popularity because of the increasing use of personal computers is the use of commercially available computer software packages specifically designed for the operation and maintenance of wastewater collection systems. Providing a description of the various software packages currently available for scheduling sewer system maintenance is beyond the scope of this manual. Information regarding the commercially available software packages can be found in Microcomputers In Public Works, published by the American Public Works Association, 1313 East 60th Street, Chicago, Illinois 60637.