SEWERAGE AND WATER BOARD

OF

NEW ORLEANS

MODIFIED EXHIBIT 3
MODIFIED PREVENTIVE MAINTENANCE PLAN
(April 27, 2010)

MODIFIED EXHIBIT 3

Modified Preventive Maintenance Plan

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PLAN OVERVIEW

The Preventive Maintenance Plan for the collection system of the Sewerage and Water Board of New Orleans ("Board") was developed from extensive research and data collection, and revised based on field experience. The Board's Operational Implementation Review Team, under the guidance of the General Superintendent's Office, has reviewed this plan. The Team is composed of operational experts from all areas involved in performing preventive maintenance.

SECTION 1 - INTRODUCTION explains the scope of the plan and its basic elements, the tools to be used to implement and monitor the plan, and the quantifiable measures/goals to be achieved by the plan.

SECTION 2 – DATA COLLECTION describes the data sources used to establish a baseline condition of data and the basis for data revision.

SECTION 3 - STAFFING identifies the staffing structure for operation and maintenance of the Board's Sewer Collection System using organizational charts to support preventive maintenance requirements, Infiltration/Inflow Reduction, and Sewage Collection System Rehabilitation Program.

SECTION 4 – NETWORKS DEPARTMENT discusses the departmental resources to be used in support of preventive maintenance of the gravity and pressure systems. Supporting information is provided in the form of work flow charts, routinely scheduled preventive maintenance procedures, and inspection checklists used by the Networks Department.

SECTION 5 – OPERATIONS DEPARTMENT discusses the use of departmental resources to be used in support of scheduled preventive maintenance. Supporting information is provided in the form of work flow charts, routine scheduled preventive maintenance procedures, and inspection checklists used by the Operations department in sewage-pumping stations. Projected preventive maintenance schedules are summarized in tables.

SECTION 6 – FACILITY MAINTENANCE DEPARTMENT summarizes the comprehensive maintenance program and tracking system used by the Facility Maintenance Department for major mechanical, electrical and instrumentation equipment. The preventive maintenance schedules have been summarized in tables.

SECTION 1
INTRODUCTION

1.1 OVERVIEW

The Sewerage and Water Board of New Orleans ("Board") is responsible for providing water, sanitary sewer and storm drainage services throughout the City of New Orleans. The Board operates and maintains an extensive network of water and sewer lines, canals, electrical power generators and dispatchers, draining and sewage pumping stations, and water and wastewater treatment plants. This document explains the preventive maintenance plan for the sanitary sewer collection system.

This preventive maintenance plan is intended to establish specific preventive maintenance tasks, procedures and auditable performance indicators for the wastewater collection system including sewer lines, sewer trunk lines, sewer pumping stations and sewer force mains. The goal of this plan is to improve the consistency of performance of the wastewater collection system and pumping stations. By improving the consistency of system operation, the plan is intended to reduce the number and severity of untreated wastewater overflows, reduce customer complaints and lower operating costs. This modified preventive maintenance plan replaces the preventive maintenance plan the Board has operated under since 1997.

Preventive maintenance procedures and checklists shown in this document have been developed from a review of the Board's wastewater facilities, equipment manufacturers' recommendations and accepted industry practices. Work flow charts have also been prepared showing step-by-step procedures to be used by Board's personnel when performing routine preventive maintenance.

The activities of the Networks and Operations Departments are to be tracked utilizing the Asset and Facility Maintenance System, currently CASSWORKS. CASSWORKS is set up to generate routine (preventive) maintenance work orders for the sewage pumping stations and to track specific gravity sewer lines, manholes and force mains where preventive maintenance has been performed.

1.2 QUANTIFIABLE MEASURES/GOALS

Below are the stated overall quantifiable measures/goals established for the preventive maintenance program:

<u>Gravity System</u>

- Sewer Inspection – Inspection of at least 9% of the system every year and 100% in 8 years

- Sewer Cleaning – Clean at least 7% of the system every year and 100% in 10 years

- Sewer Manhole Inspections – Inspection of at least 25% of sewer manholes per year and 100% in 3.3 years

Pumping Station Operations

- Perform all preventive maintenance work within two weeks of scheduled date for accomplishment

- Force Main Isolation Valves – Inspect and exercise sewer force main isolation valves annually

Pressure System

- Air Release Valves – Perform semi-annual inspection maintenance of air release valves

- Force Main Alignment – Visually inspect all force main alignments annually

- Cathodic Protection – Conduct cathodic protection surveys annually

SECTION 2
DATA COLLECTION, CATHODIC PROTECTION AND QUALITY CONTROL

2.1 DATA COLLECTION

Data to document the maintenance procedures contained in this manual was gathered through an inventory of sewer collection system equipment and facilities through interviews with department heads, Superintendents and Supervisors, in addition to reviews of equipment vendors' operation and maintenance manuals. This data is incorporated into the Asset and Facility Maintenance System, currently CASSWORKS.

It is important to stress that the data contained in this document will change over time, as equipment is replaced, as new equipment or systems are installed, and as the computer software is updated and modified. Therefore, this manual should be viewed as a "living document", the contents of which will be modified as necessary to stay current. It is anticipated that some non-significant changes to the document will be necessary. Such changes, at outlined in Paragraph 30 of the Modified Consent Decree, may be made when the need arises and will be considered in conformance without EPA review. The Board will report such non-significant changes in the first Annual Report following the changes. For significant changes, as identified in Paragraph 27 of the Modified Consent Decree, the Board will submit to EPA a Request for Modification together with its Annual Report. Paragraphs 28 and 29 of the Modified Consent Decree outline the process for such change requests.

To the maximum extent possible, all maintenance related data will be embodied into the Asset and Facility Maintenance System, currently CASSWORKS. The generation of work orders will be done on a weekly basis for all preventive maintenance activities.

2.2 CATHODIC PROTECTION

The Board installs and maintains cathodic protection systems to prevent corrosions damage to underground coated steel water and sewer mains, elevated water storage tanks, and submerged discharge structures. Aggressive application of cathodic protection has been the Board's standard practice in pipeline construction dating back to the 1940's.

The Board's cathodic protection system consists of sacrificial anodes attached to the structure to be protected or impressed current systems. The anode method is used on short sections of coated steel sewer force mains. For longer sections of steel sewer force mains, the positive impressed current system employs a rectifier assembly in a deep well ground bed. At present, the Board operates sacrificial anode systems and impressed current systems. The impressed current systems also contain sacrificial anode protection to prevent corrosion if the rectifier fails.

All systems are checked, inspected and maintained to insure proper maintenance. A yearly survey is conducted on all ground beds to record their effective remaining life and to plan for

replacement prior to failure. The Board has no record of pipeline failure due to exterior corrosion.

2.3 QUALITY CONTROL

The responsibility for quality control lies with Board management and supervision. Quality control has a direct relationship to the long-term cost to maintenance and operation of the sewer collection system. The Asset and Facility Maintenance System, currently CASSWORKS, will be checked by management in addition to onsite field visits to ensure that programmed maintenance is accomplished. The SCADA system will be monitored to ensure that monitored system maintenance trends are improving or steady.

SECTION 3
STAFFING AND RESOURCE COMMITMENTS

3.1 OVERVIEW OF STAFFNG AND RESOURCE COMMITMENTS

The Board is responsible for the operation and maintenance of the wastewater collection system within the City of New Orleans. The wastewater collection system includes sewer house connections (only to the private property line), gravity sewers, trunk sewers, sewage lift and pumping stations and sewer force mains.

Key departments for the operation and maintenance of the wastewater collection system are identified in the following organization charts. These charts are continually updated and will be replaced as newer versions become available. These departments are responsible for all in-house preventive and corrective (unscheduled) maintenance. Other maintenance is obtained through outside service contracts for operations, maintenance and construction.

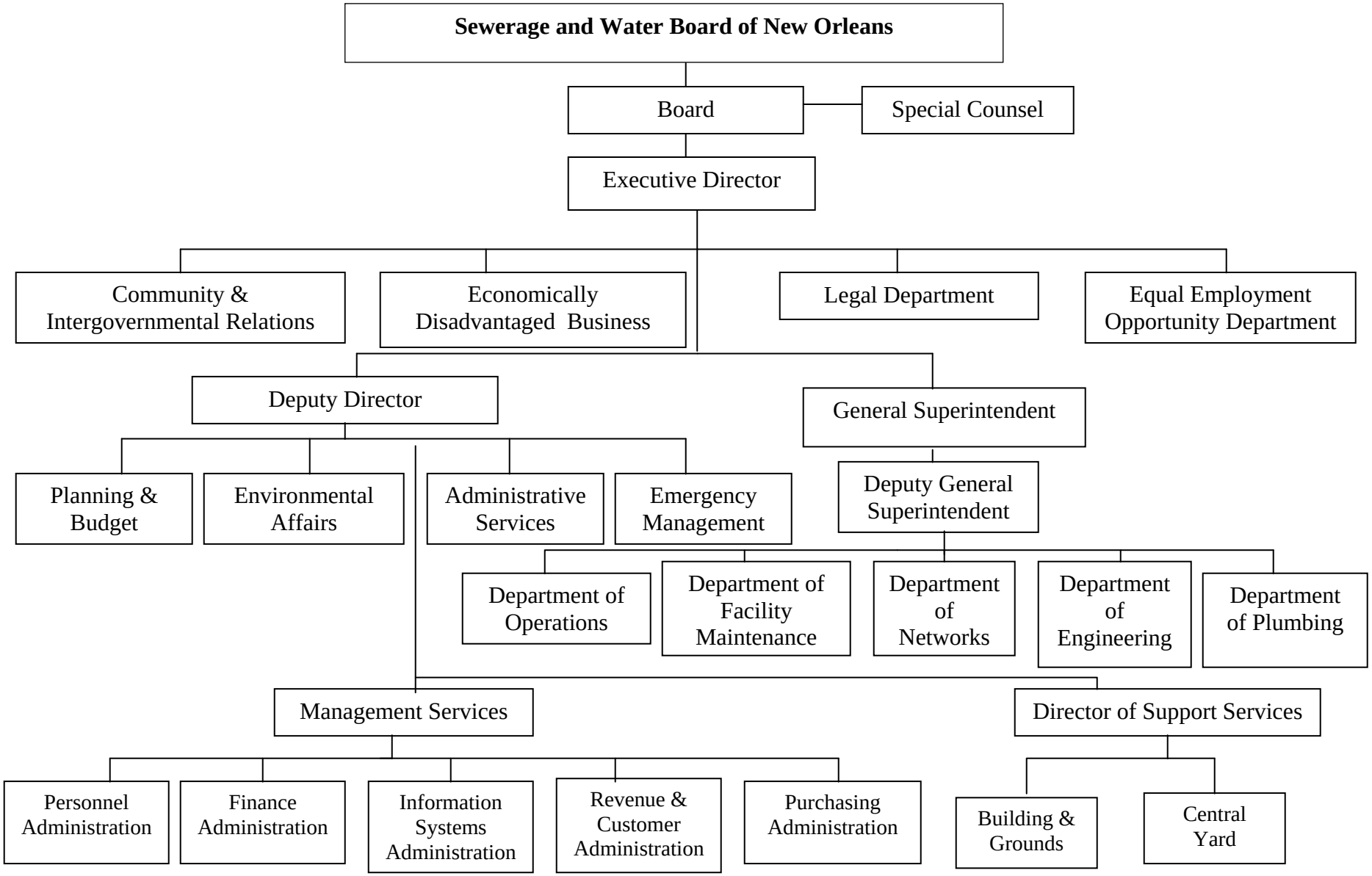
- Sewerage and Water Board of New Orleans – Figure 3-1 contains the overall organization for the Board.

- Operations Department – Figure 3-2 contains the organizational structure for the Operations Department. The responsibilities of this department include the operation of the Board's sewage pumping stations and all sewer force main isolation valves.

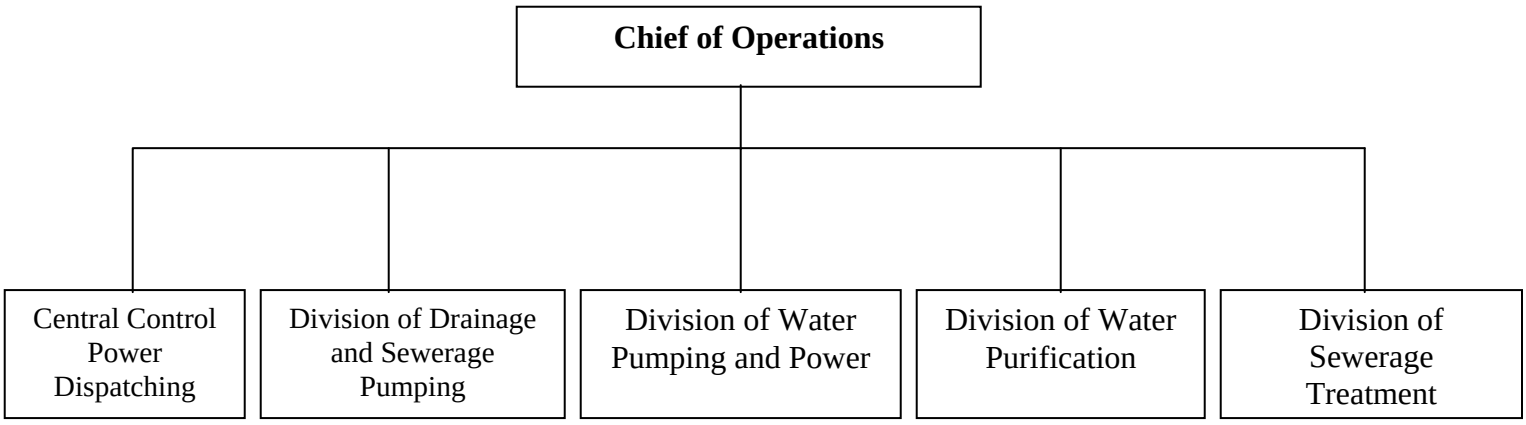
- Facility Maintenance Department – Figure 3-3 contains the organizational structure for the Facility Maintenance Department. The responsibilities of this department include providing maintenance to the sewage pumping stations.

- Networks Department – Figure 3-4 contains the organizational structure for the Networks Departments. Among other duties, this department's responsibilities include maintaining gravity sewer lines, sewer house service connections, manholes, sewer force main air release valves and sewer force mains.

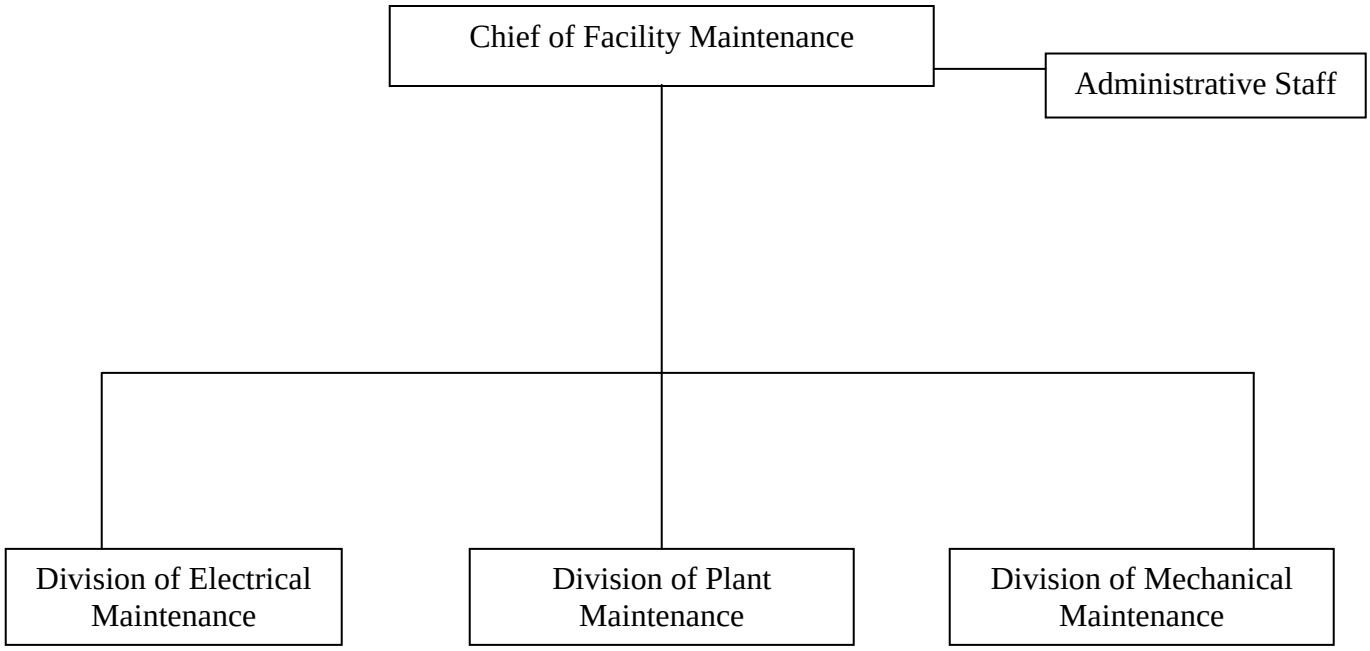
SEWERAGE AND WATER BOARD OF NEW ORLEANS ORGANIZATIONAL CHART
FIGURE 3-1



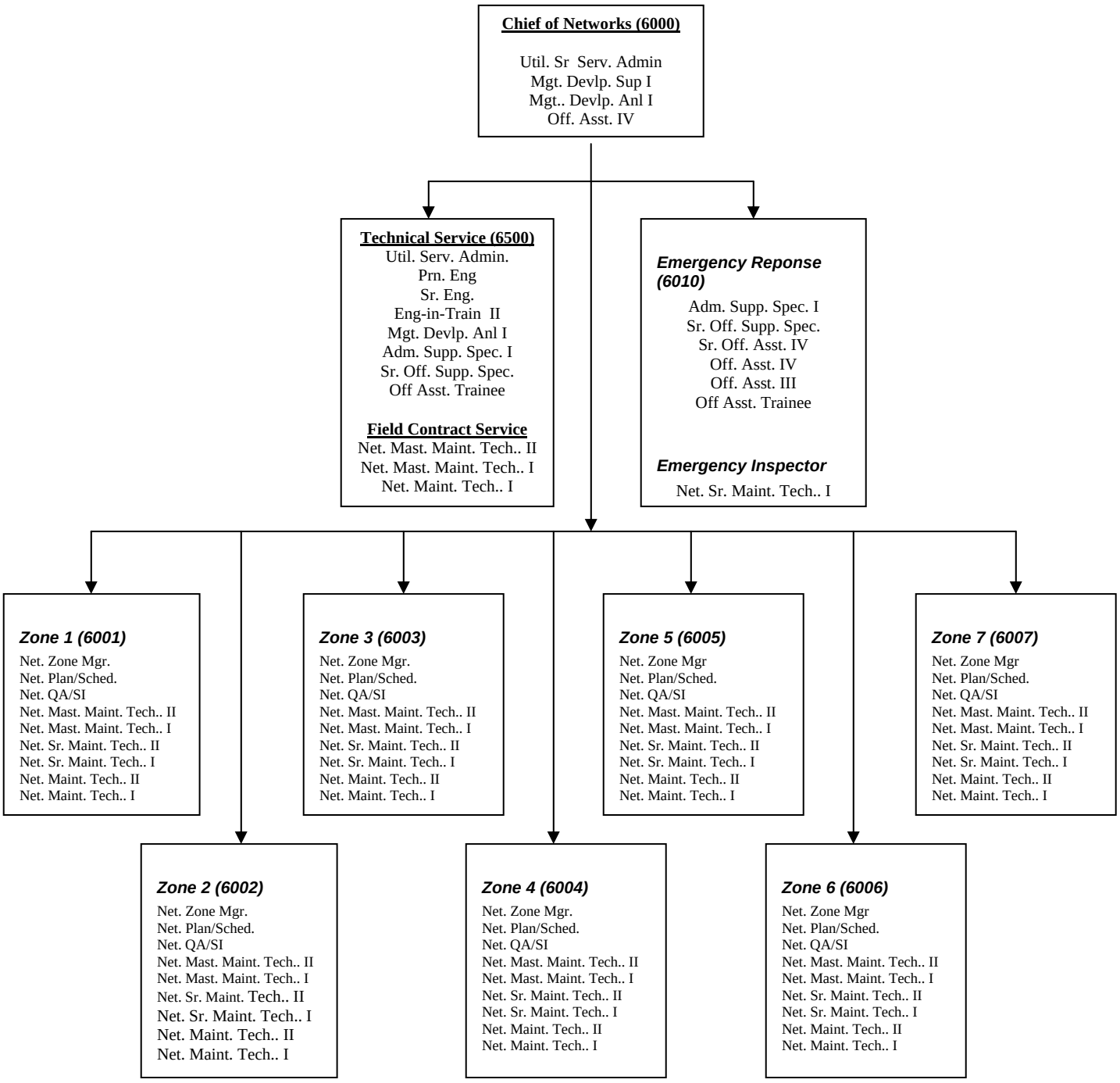
DEPARTMENT OF OPERATIONS
FIGURE 3-2



DEPARTMENT OF FACILITY MAINTENANCE
FIGURE 3-3



DIVISION OF NETWORKS
TECHNICAL SERVICES AND SUPPORT
FIGURE 3-4



3.2 OPERATIONS DEPARTMENT

The Operations Department organization chart, previously shown as Figure 3-2, shows the overall organization of the department.

Figure 3-5 shows a more detailed view of the Division of Drainage and Sewerage Pumping.

The Division of Drainage and Sewerage Pumping is responsible for the operation of sewage pumping stations throughout the service area. Three (3) of the large sewage pumping stations: "A", "C", and "D" are manned continuously by a watch-standing organizational staff. Note that Station "C" is maintained and operated by staff from Division of Pumping and Power, all under the direction of the Chief of Operations. All other unmanned stations are visited at least every other day during the normal work week. Teams are assigned preventive maintenance work orders (from Asset and Facility Maintenance System, currently CASSWORKS) to be performed at the station.

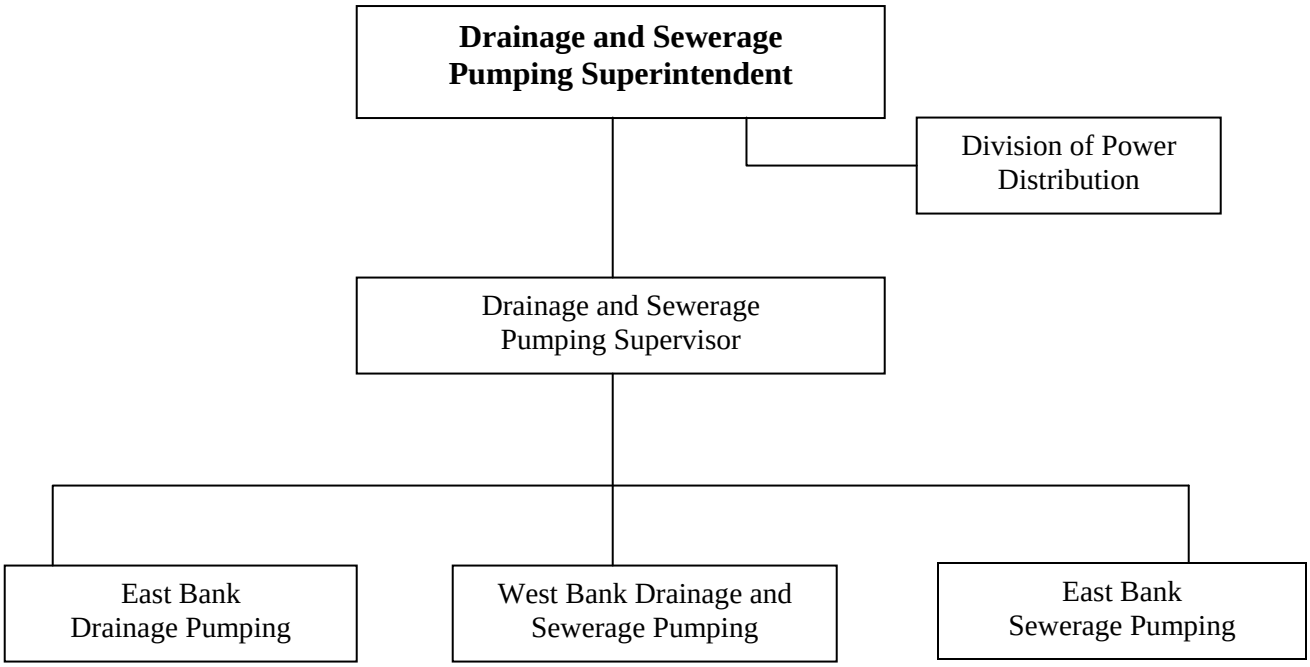
Their work orders include, but are not limited to:

- Seal packing adjustment and replacement;
- Alternating pump usage;
- Monitoring equipment and temperatures;
- Monitoring and cleaning probes and instruments for the SCADA System;
- Performing yard maintenance.

These tasks have been loaded into self-generating work order on the Asset and Facility Maintenance System, currently CASSWORKS. New items of maintenance will be added to this list of work orders as necessary.

Virtually all major electrical maintenance is referred to the Facility Maintenance Department. Exceptions to this include resetting of tripped circuit breakers, locking out and tagging of equipment for maintenance, and re-lamping of the stations, which is performed by Operations personnel.

DIVISION OF DRAINAGE AND SEWERAGE PUMPING
FIGURE 3-5



3.3 FACILITY MAINTENANCE DEPARTMENT

The Facility Maintenance Department is further divided into three (3) Divisions, as follows:

- The Division of Electrical Maintenance as shown in Figure 3-6
- The Division of Mechanical Maintenance as shown in Figure 3-7
- The Division of Plant Maintenance as shown in Figure 3-8

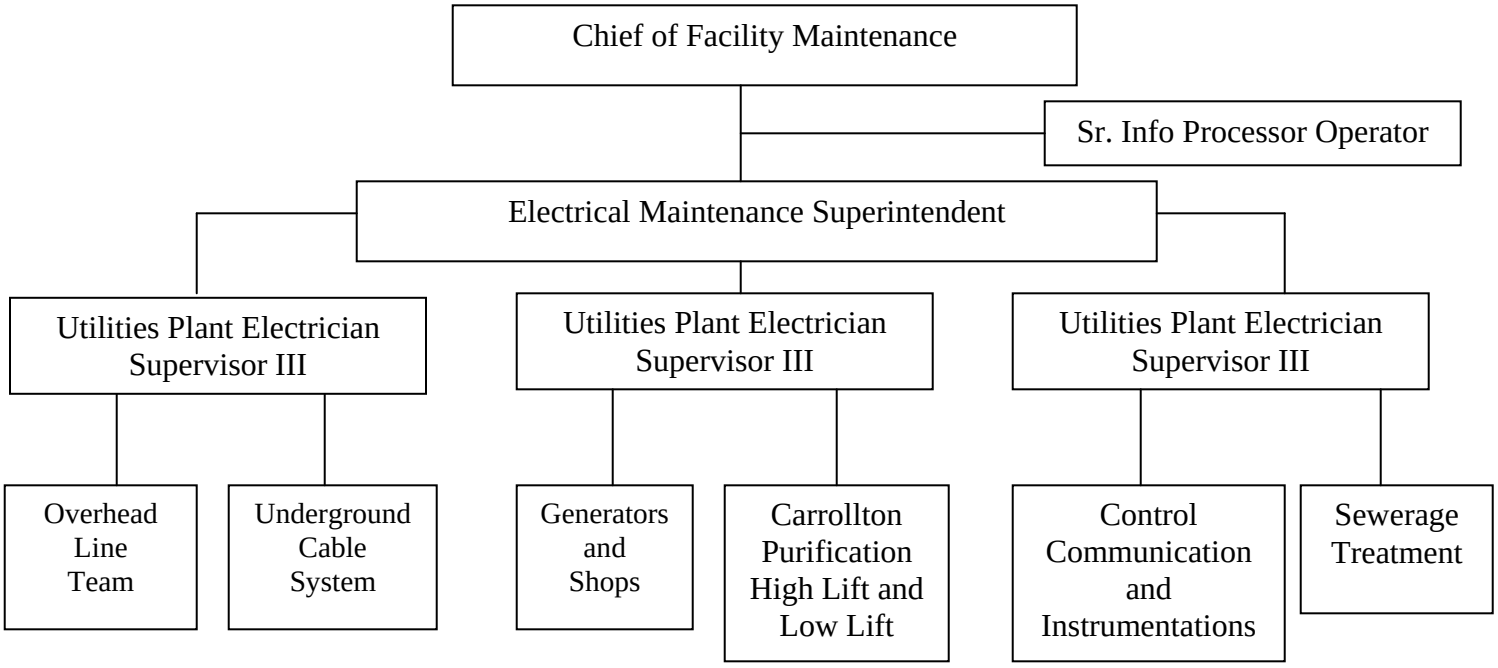
The Facility Maintenance Department is located at the Carrollton Water Purification Plan. All major maintenance and repairs are performed at the maintenance yard or at the stations. The preventive maintenance work orders for the Department are generated by Asset and Facility Maintenance System, currently CASSWORKS. Corrective maintenance work orders for the Facility Maintenance Department are generated by CASSWORKS from input from the Operations Department derived during their routine inspection visits, or from input from the Facilities Maintenance Department.

Figure 3-6 shows the organization of the Electrical Maintenance Division. This Division is responsible for all major preventive and corrective maintenance for electrical equipment and instrumentation in the sewage pumping stations. Some elements of electrical and instrumentation maintenance may be "contracted out" by the Electrical Maintenance Division to outside contractors.

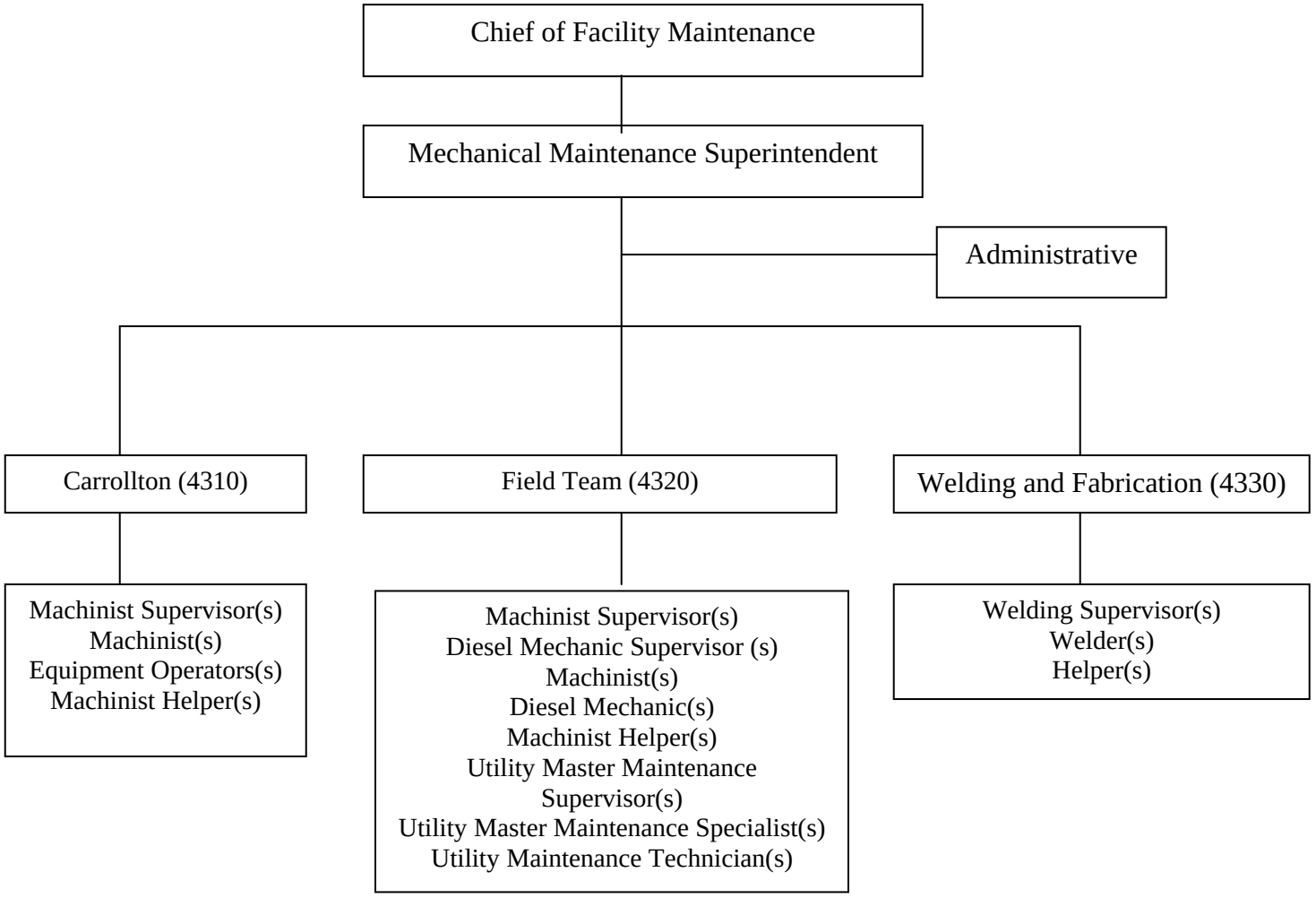
Figure 3-7 shows the organization of the Mechanical Maintenance Division. This Division is responsible for all major preventive and corrective maintenance for mechanical equipment in the sewage pumping stations. This includes all pump rebuilding, bearing replacement, coupling alignment, and motor and pump replacement.

The Division of Plant Maintenance plays a lesser role in the maintenance of the wastewater collection system, primarily in performing painting and minor structural repairs at the sewage pumping stations. The organization for the Plant Maintenance Division is shown in Figure 3-8.

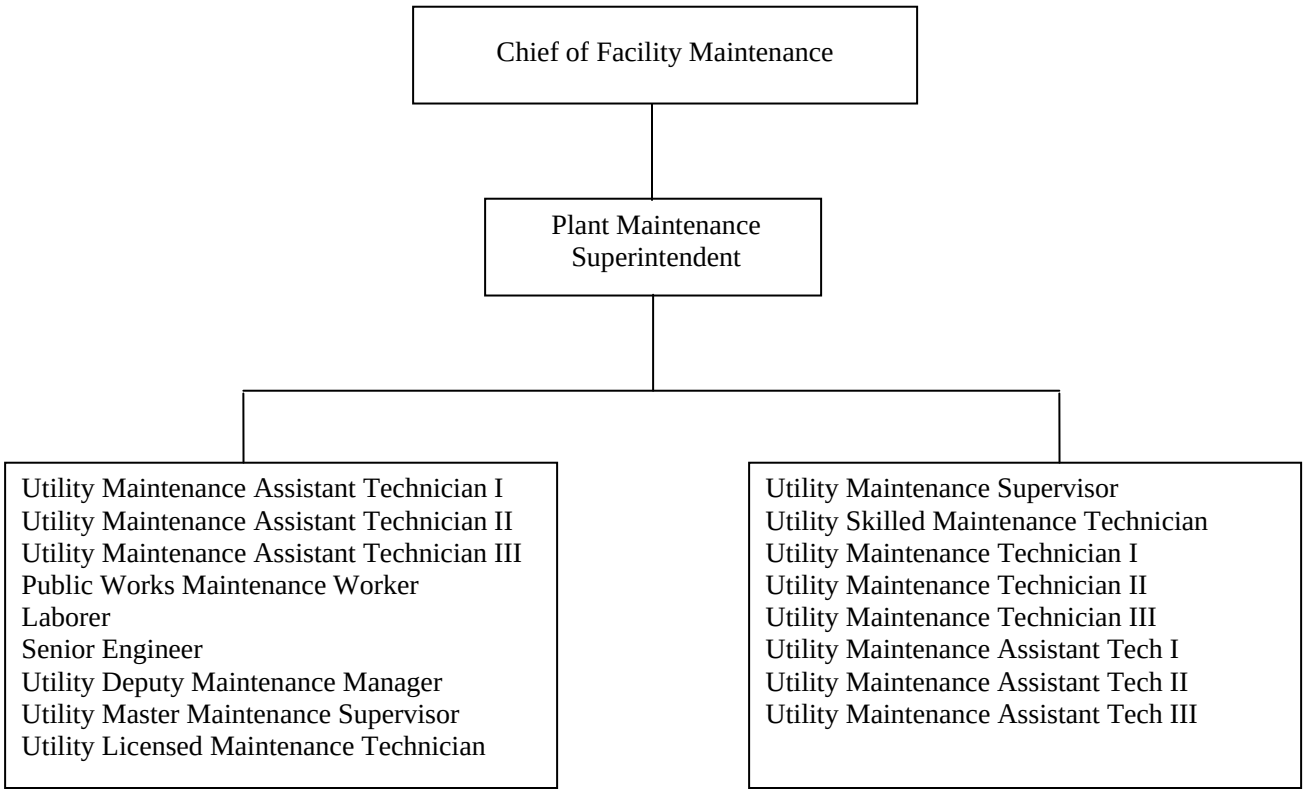
ELECTRICAL MAINTENANCE DIVISION
FIGURE 3-6



MECHANICAL MAINTENANCE DIVISION
FIGURE 3-7



DIVISION OF PLANT MAINTENANCE
FIGURE 3-8



3.4 NETWORKS DEPARTMENT

The Networks Departments maintains the Asset and Facility Maintenance System, currently CASSWORKS, supports requirements for zone maintenance requirements and also maintains other duties as assigned by the Manager.

The Technical Services Department's role in the maintenance of the wastewater collection system involves the restoration of sidewalks, driveways, and streets required as a result of collection system repairs. This work is performed both by in-house teams and by outside contractors. In the case of contract paving, this department is responsible for providing inspection of the work performed by the contractor. The organizational structure for this department was previously shown as Figure 3-4.

SECTION 4
NETWORKS DEPARTMENT

4.1 OVERVIEW

The Board has fully implemented the Preventive Maintenance Program ("PMP") for its collection system including gravity sewers, pumping stations and force mains. A major component of the PMP is the preventive cleaning of the gravity system. The East Bank gravity system consists of approximately 6.6 million feet of sewer pipe, the majority of which (over 5.5 million feet) is eight inches or more.

The Board currently has several tools to provide the necessary information for prioritizing the sewer system cleaning. The Board conducted the Preliminary Collection System Evaluation Study based upon findings of the Interim and Final System Characterization Reports, the Pump Stations and Force Main Capacity Plan, and the Flow Measurement Plan. The study provided a listing of nine basins to be studies, the order in which they were to be studied, the type and technologies to be used, and common criteria for study of the individual basin studies.

The Board conducted Collection System Evaluation Studies ("CSES") that provided information for the prioritization of the sewer cleaning. The studies, which were basin by basin reports that set forth the problems within each area requiring attention, were conducted in accordance with the EPA-approved Collection System Evaluation Criteria (Original Exhibit 10).

The Board submitted to EPA, and EPA approved, a Final Plan for the Collection System Evaluation Studies identifying those modifications sought by the Board with justifications and modifications, based upon its implementation of the Computerized Collection System Model.

EPA has approved a Remedial Measures Action Plan ("RMAP") for each of the nine basins in the CSES, identifying the remedial measures needed for each basin to ensure that condition and capacity of the East Bank Collection System were sufficient to prevent unauthorized discharges. The RMAPs include descriptions of the proposed remedial measure to be implemented for the particular basin, an implementation schedule for the proposed remedial measures, an estimate of the resources and costs to be committed to the proposed remedial measures, and whether the proposed remedial measures were to be performed by Board staff or by outside contractors.

In addition, the Board correlated information relating to sewer manhole overflows, house connection overflows, chokes, odors, and other complaints, in an effort to identify sewer sections which have a high probability to be most positively influenced by cleaning. Historical information, as well as recent information currently available within Asset and Facility Maintenance System, currently CASSWORKS will be utilized in a statistical approach. Where relationships exist relative to age of pipe, materials of construction,

types of chokes, soil conditions, etc., they will also be used to prioritize the sewer cleaning program and develop cleaning frequencies.

These direct and extremely accurate measures provide the basis to dispatch either Board teams, existing Board contractors, or develop site specific contracts for the timely cleaning of significantly impacted areas.

4.2 GRAVITY SYSTEMS

Three (3) types of scheduled preventive maintenance activities are performed under the direction of Networks Department, either by contract or by in-house teams. Specifically these activities include:

- Sewer Main Line Cleaning
- Sewer Manhole Inspection
- Sewer Main Line Inspection

4.3 SEWER MAIN LINE CLEANING

The Board utilizes high velocity jet cleaners and sewer cleaning combination trucks for preventive maintenance. All tools and equipment required to route traffic, remove manhole covers, and for safety of the job site are carried on the truck, as are the various nozzles and hoses required for proper operation.

The larger machines operate at higher pressures and deliver high volumes of water also use more water, but are capable of handling tougher blockages or more severe buildups of grease, roots or sludge in the sewer lines.

An enhancement to the high-velocity machine is the addition of a vacuum unit for removal of debris from the manhole. When sand, silt and other material is brought back to the manhole, it can be removed easily with the vacuum unit instead of manually removing it. When a vacuum unit is combined with a high-velocity cleaner on the same vehicle, it is frequently referred to as a combination truck.

The Board is currently utilizing in house personnel and contractors to clean and televise the sanitary sewer mains within the system. Also, in almost all cases where Board teams respond to chokes or manhole overflows, they proceed to clean an entire manhole-to-manhole section as a part of their response. This is a usual procedure followed by the Board when servicing smaller diameter sewer lines and mains. In such cases the results of this coincident preventive maintenance is recorded in the Asset and Facility Maintenance System, currently CASSWORKS, and is used to aid in the prioritization of subsequent sewer cleaning activity.

Flushing trucks can clear most obstructions in a sewer main. The high-pressure nozzle is effective in cleaning roots and grease, as well as cleaning or opening stoppages in the

main line. This method is not as effective when working with deposits of solids such as sand or gravel because the tools do not have the ability to move the material. The tools are designed to cut or scrape materials from the pipe walls and are most effective on hardened grease and roots.

At this time, all choke remediation activities also include manhole-to-manhole mechanical cleaning as a standard procedural activity. These activities typically address those areas of the sewer system that have been and continue to be recurrent problems and therefore are only recognized to contribute fractionally to system preventive maintenance.

In order to provide the most immediate improvement to the performance of the Sanitary Sewer System, the Board addresses those areas that can be identified as having the greatest detrimental effect on the system. It is the Board's intention to ultimately address all affected sewer mains. In processing many of these mains and structural defects creating blockages and deposition of silt or debris, the initial cleaning effort is anticipated to take significantly longer than lines having received periodic cleaning.

The cleaning units carry a supply of water, generally one thousand (1000) to two thousand (2000) gallons. The pump has a capacity of fifty (50) to one hundred (100) gallons per minute (g.p.m.) delivering water at a pressure of one hundred to two thousand pounds per square inch (psi). The cleaner is supplied with five hundred (500') to six hundred (600') feet of high-pressure hose.

The nozzle provides the cleaning action. The nozzle has a backward spray that propels the hose up the sewer to be cleaned. When the operator retrieves the hose, the water jets scour the sewer and move the debris to the downstream manhole.

The vacuum function is used for removal of materials from manholes when other cleaning equipment is used to dislodge and transport the materials to the access point. Some vacuum machines can remove heavy materials such as bricks. Most machines can separate solid materials from cleaning water and transport the debris to the wastewater treatment facility.

4.3.1 - Work Flow Procedures – The below is a work flow chart for preventive maintenance gravity sewer cleaning.

1. The area to be cleaned will be identified by Technical Services and scheduled by the Zone Planner/Scheduler at the direction of Zone Management.
2. Map(s) and the appropriate corresponding work orders are generated for the maintenance teams.
3. The Lead Technician receives the map(s) and work orders, and schedules the preventive maintenance activities.
4. The maintenance teams perform the cleaning authorized by the work orders received. In most cases, in-house personnel utilizing combination cleaners will perform the work.

5. The maintenance team technician records a description of the activities performed on site, noting any unusual circumstances involved. This record is entered on the "Action Taken" portion of the work order authorizing the work.
6. At the end of the shift, the completed work orders are delivered to the Zone Manager or Planner/Scheduler for review. The work order is reviewed for content, completeness of information, as well as any abnormalities or problems encountered by the cleaning team.
7. If no other action is required after a review of the report, the work is complete and the work order is closed out after being recorded in the Asset and Facility Maintenance System, currently CASSWORKS. Similar work performed by contractors will be entered into CASSWORKS.
8. If additional action is required, (for example, repairs or TV inspection), the designated supervisor checks if there is an outstanding work order for the problem. If not, a work order is issued and the appropriate team is scheduled.

4.3.2 - Selection of Cleaning Equipment and Accessories: Cleaning equipment differs in capacity to handle debris in the sewer lines, depending on applicable pipe size ranges, manhole accessibility requirements and methods of operation. To select the proper type of cleaning equipment and accessories for the preparatory cleaning of a sewer system, many factors have to be considered, including:

- Access to manholes
- Condition of manholes
- Size of pipe
- Depth of deposition
- Type of solids to be removed
- Degree of root intrusion
- Amount of flow
- Structural integrity of pipe
- Availability of hydrant water
- Degree of cleanliness required

4.3.3 - Sewer Cleaning Procedure

1. The Planner/Scheduler identifies the sewer line segments for preventive maintenance sewer cleaning
2. A work order is prepared with the necessary information for activity (location, line segment identification, manhole numbers, etc.)
3. The Planner/Scheduler assigns a cleaning team to complete the work order.
4. Inventories are checked by the Lead Technicians to ensure that proper supplies and equipment are available.
5. Prior to departure, daily maintenance is performed on the cleaning equipment and/or vehicles, in accordance with the Operators Manual.

6. Work order forms are obtained for the day's activities from the Planner/Scheduler.
7. Upon arrival at the work site, all vehicles are parked in the most unobtrusive manner to traffic while filling the tank with water.
8. The cap on the fire hydrant is removed and the fire hydrant is flushed until water is clear and no scaly or rusty water appears.
9. The water tank is filled in accordance with the level gauge on the tank.
10. Manholes to be opened are located on the line segment to be cleaned.
11. Precautions regarding traffic safety and manhole entry are followed (Refer to Board's Safety Manual).
12. The cleaning equipment and/or vehicle is set up at the operating manhole in accordance with the Operators Manual. All sanitary sewer line segments should be cleaned from upstream manhole to downstream manhole whenever possible.
13. The proper type of nozzle or cleaning tool is selected for the debris to be removed and pipe size to be cleaned.
14. A rake or screen is used if necessary to remove debris from the operating manhole. The sewers cleaned should be free to grease, sludge, debris roots and other obstructions to provide an unobstructed passage.
15. The equipment is never operated in excess of its rated capacity (speed, pressure, etc.). Exceeding or abusing the equipment's intended use can only result in failure of equipment, damage to pipes, and subsequent work delay.
16. Extreme caution is used if the nozzle is to be inserted in a pipe through the surcharged manhole, when applying pressure to the hose. The nozzle can hit an obstruction and deflect upward through the water and out of the manhole. This could cause injury to the persons close to the manhole before pressure on the hose could be relieved by the operator.
17. The cleaning operation is performed in a step-wise manner if the sections are heavily loaded with debris. This may be done by first cleaning 25-100 feet; then 100-200 feet, etc. When the return of the cleaning tool fails to bring additional debris to the manhole, the line is clean.
18. A hydraulic water pressure root-cutter is always used in sections suspected of having heavy root and grease problems.
19. The line is attempted to be cleaned in reverse when obstructions prevent the passage of the cleaning tool or root-cutter through the entire line. During reverse cleaning it is necessary to reduce the pressure and speed. Extreme care should be taken to avoid equipment failure and pipe damage.
20. If the line cannot be cleaned with the hydraulic cleaning equipment, the Lead Technician is contacted to determine what should be done.

4.3.4 - Cleaning Precautions: The team should be aware of several precautions to be taken during cleaning operations.

Occasionally a blockage in the line during high velocity jet cleaning causes a pressure build up that is released through a service lateral into a consumer's home. If this does occur, the team should alert the supervisor immediately and call the Claims Department. The consumer needs to be assured that any problem or damage will be addressed by the Claims Department of the Board.

Eroded, corroded, or otherwise structurally deteriorated piping may collapse during cleaning operations. Visible inspection must be used to ascertain the advisability of cleaning. Sometimes a television inspection should be made prior to cleaning in such situations.

Clean soil and pieces of broken tile observed in a manhole trough are strong indications of broken, crushed, or collapsed pipe in the upstream section.

4.3.5 - Variables Which Affect the Difficulty of Sewer Cleaning: The teams are familiar with the many variables which impact the performance, production and cost on any particular sewer-cleaning job. Some variables apply to each line segment to be cleaned.

- Locating, exposing, and removing manhole covers. Access to manholes, terrain, traffic control requirements.
- Condition of the manholes – steps, cleanliness, structure.
- Depth of the sewer – difficulty of entry and debris removal.
- Structural integrity of the pipe.
- Offset joints, intruding service connections, curved pipes.
- Availability of hydrant water upstream of the site.
- Depth and density of deposition in the pipe.
- Type of soil materials to be removed are sludge, mud, sand, gravel, rocks, grease, bricks, and roots. Roots are difficult to remove completely and may be a significant factor.
- Productivity differences in cleaning successive vs. random manhole sections.
- Requirements for transportation and disposal of solid materials and distance to the disposal site.
- Weather conditions – rain can affect the production rate.

4.3.6 - Grease Chokages: The Board recognizes that the reduction of grease in the sanitary sewer system will have a positive impact on the ability of the sewer mains to function as a self scouring system, and will eliminate some chokes from occurring in the system. Towards that end, the Board has established rules and enforcement procedures for dealing with chokes, such as grease or other obstructive material.

4.3.7 - Enforcement Authority: The prevention of grease from introduction into the sewerage system will be enforced by the Board's Environmental Affairs Division in accordance with the Plumbing Code of the Board, specifically Section

16, entitled “Rules Governing Discharges Into The Sanitary/Sewerage System,” as well as the “Enforcement Response Plan” of the Board. Both of these documents have been previously approved by the Environmental Protection Agency (“EPA”), and the authority set out in Louisiana R.S. 33:4801, et seq.

4.3.8 - Investigation: Upon notification of a grease chokage problem, the Environmental Affairs Division personnel will investigate to determine the source of the grease or other obstructive material. This investigation will include:

- a review of the local collection system design;
- determination of patterns of flow in the area of chokage;
- determination of the location and/or source of the obstructive materials including the possible sources of grease, such as garbage grinders, pot sinks, floor drains, garbage can wash areas, etc.;
- the location of grease traps, if they exist as required by the Plumbing Code, and inspection to determine whether they are in working order as required by the Plumbing Code;
- completion of an “interceptor Inspection” form indicating the nature of the chokage, the causes, and the deficiencies;
- identification of the remedies available and action taken to remove the obstruction;
- sampling and retention of samples of the discharge from the site, if necessary, to determine compliance with the Plumbing Code discharge limits for oil and grease, and in order to confirm the source of the grease for purposes of evidence should court or disciplinary action be required to prove responsibility;
- a review of all receipts of grease trap cleaning to confirm that the trap is being serviced frequently enough to prevent grease from passing into the main sewer, whenever grease is the cause of a sewer chokage.

4.3.9 - Statistical Data: All information obtained in the above investigations shall be reviewed for the purposes of establishing the location and nature of chronic chokages due to violations of existing plumbing code requirements.

4.3.10 - Enforcement: If an establishment has been found responsible for two (2) or more incidents of grease chokages in a twelve (12) month period, that establishment will be notified in writing of the seriousness of the violation. The written notice will require all deficiencies to be corrected within thirty (30) days, and enforcement shall advise that failure to comply with the directive will result in an escalating response as described in the Enforcement Response Plan. In addition, the establishment may also be charged for any and all work performed under the Board’s direction in order to remedy the problem.

4.3.11 - Staffing: The Environmental Affairs Division has developed and implemented a Grease Action Squad (“GAS”). This Squad consists of two (2) Environmental Enforcement Technical I’s, supervised by an Environmental Technician II, all of who will be qualified and trained in the procedures for

investigating the above and the authorities set out in Chapter 16 and R.S. 33:4801 and as certified in their positions. They will report to the Environmental Supervisor responsible for the Sewerage and Water Pretreatment Program. GAS has available to it as necessary rod trucks for clearing chokages, and flushing teams who clean lines and remove obstructions. In the event the chokages persist, the Board shall rely on its own repair teams to excavate down to the line for the purpose of relieving obstructions. As many as one hundred fifty (150) Board personnel will be available to support GAS.

4.3.12 - Root Removal: Roots are removed in the designated line segments where root intrusion is a problem. Special attention is given during the cleaning operation to maximize the removal of roots. It may become necessary to use procedures that include the use of mechanical equipment such as rodding machines, root cutters, root saws and jet machines equipped with hydraulically driven cutters. Note that in most cases roots are not a problem in New Orleans because the water table is so high as to make roots in the sewers not a significant problem.

4.3.13 - Disposal of Materials: Solids or semi-solids resulting from the cleaning operations are removed from the site and disposed of at a site designated by the Board. All materials are removed from the site at the end of each workday.

For a complete list of typical solutions to cleaning and maintenance problems and their effectiveness see Figures 4-1 and 4-2.

CLEANING AND MAINTENANCE PROBLEMS AND SOLUTIONS
FIGURE 4-1

Identification of Problem	Sources or Cause	Selection Method	Comments
Stoppages - Emergency			
Manhole Overflowing Flooding of residences or businesses	Grease Roots Debris stoppages such as rocks, lumber, caused by broken lines, open manholes, vandalism.	Flushing Truck	Rod from downstream manhole with a 4-inch auuger into stoppage. When clear, then run 5-inch or larger auger through restricted area. Write work request to high-velocity clean or ball line as soon as possible. Hand rods and power rodders will usually unplug most grease stoppages. If cannot open with hand rods, or they are not available, use a high-velocity cleaner.
		High-velocity cleaner	A high-velocity cleaning will open most grease stoppages.
		High-velocity cleaner	High-velocity cleaner will usually open stoppage and restore service. Schedule TV check and chemical treatment.
		High-velocity cleaner	Clean line with high-velocity cleaner
Grease			
Stoppage causes grease buildup. TV report on routine inspection Observe buildup on side walls of sewer Past records Grease Trap	Restaurant on blocked segment of sewer. Low velocity allowing grease buildup from home disposal unit. Problems often develop where high velocities are suddenly slowed down.	High-velocity cleaner	High-velocity cleaner is an effective tool in removing grease buildups in line sizes up to 15 inches. High-velocity cleaner becomes ineffective in larger diameter pipes.
		Balling (or tire)	Balling will remove grease deposits from pipe walls, but will not clean as effectively as properly used high-velocity cleaner
		Scooter (or kite)	More effective in lies above 18-inch diameter than high-velocity cleaner.
		Chemicals	Be sure to insist on a performance contract. Do not pay until the chemical or material performs as claimed.
		Bacteria cultures	Specific cultures are required for collection system maintenance.
		Clean trap regularly	A regular maintenance program must be established and continued.

FIGURE 4-1 CONTINUED

Identification of Problem	Sources or Cause	Selection Method	Comments
Roots			
Poor joints or damaged pipe allow root entry.	Trees and shrubs	Chemicals	For long-term control, chemical treatment provides the best solution with up to three years between applications.
	Repairs		Special root cutters are available.
		High-velocity cleaner	If TV report shows only one section of broken line or a few bad joints, dig up and repair. If a great number of defects are observed, consider pressure sealing, or relining the pipe by insertion of a liner.
Sand, Grit, Debris			
TV report	Eggshells, coffee grounds, bones from residential disposal units	High-velocity cleaner	For light concentration of grit in small lines; not effective cleaner in lines above 15 inch diameter.
Grit settles during low flows		Balling (or tire)	The workhorse for cleaning. Large volumes can be removed at a reasonable cost. Requires careful control in shallow lines.
Grit sticks to grease or slimes	Broken china, bones, and glass from restaurant disposal units	Scooters and kites	More effective in larger lines. Removes some dangers of flooding in shallow lines that balling may create if not property controlled.
Routine inspection			
Past records	Sand, silt from poor joints and broken lines	Bucket machines	Use where extreme concentration of grit and sand have loaded the line to extent that above methods are ineffective due to cost and handling of material to be removed.
H_2O and Odor Control			
Odor complaints	Lines with low flows or velocities permitting solids deposition	High-velocity cleaner	Fast cleaning of slimes in lines up to 15-inch diameter.
Manhole inspection reveals line deterioration		Balling	Best for sewers with bellies and offset joints, but expensive operation for odor control only.
	Force mains	Scooter	Fast for larger lines.
	Low flows and velocity	Flushing	Small line. Usually not effective for more than one week.
	Offset joints	Plug lifting and vent holes in manhole covers	Roofing cement makes a satisfactory hole sealer.
	Bellies in line		
	Drop manholes	Control programs	Develop program using combination of solutions.
	Manhole where trucks dump septic tank contents		

FIGURE 4-1 CONTINUED

Identification of Problem	Sources or Cause	Selection Method	Comments
Systems Inspections	Detects problem areas and permits realistic scheduling of preventive maintenance program	Closed circuit TV	Permits thorough inspection of system. Pinpoints damaged areas such as broken pipe segments, offset joints, lines not to grade, collapsed pipes, protruding service taps, root intrusion, deterioration of lines, and grease deposits. Informs you of required cleaning and the effectiveness of the cleaning method. If a stoppage reoccurs or you are curious regarding cause of problem, TV the line. The most useful tool in collection system maintenance.
		Air and water testing	Detection of sources of infiltration and exfiltration
		Smoke testing	Identification of illegal connections and location of overflowing or leaking manholes and sewers.
		Dye testing	Locates leaks when groundwater table is below sewer. Also used to determine if buildings and residences are properly connected to the collection system and to identify illegal connections.
		Pipeline lamping	Inspection of sewers for condition, including alignment and obstructions.
		Visual	Lift manhole covers and observe conditions.

EFFECTIVENESS OF SOLUTION
FIGURE 4-2

Solution to Problems	Type of Problems				
	Emergency Stoppage	Grease	Roots	Sand, Grits, Debris	Odors
Balling[a]		4		4	4
High Velocity Cleaning	1	5		4	3
Flushing					2
Sewer Scooters		3		3	
Bucket Machines, Scrapers				2	
Power Rodders	4	1	3		
Hand Rods	5[c]	1	2		
Chemicals[b]		2	5		1
Bacteria[d]		4			

EFFECTIVENESS SCALE: 1 = Low 5 = High

[a] Kites, tires, bags, parachutes, scooters, and cones are commonly used instead of balls in large sewers (greater than 24 inches in diameter) with similar results.
[b] Effectiveness depends on type of chemical and its intended use.
[c] Power rodders and high-velocity cleaners may be faster (if available) under certain conditions.
[d] Effectiveness depends on formulation of cultures.

4.4 MANHOLE INSPECTION

The Board will perform a surface inspection on all sanitary sewer manholes at a minimum of once every 3.3 years to determine if there is any defect with the sanitary system requiring any maintenance activity by the Board's forces. This inspection will not replace any current maintenance activity.

Reporting and Data Entry: Teams performing the manhole inspection will be required to fill out a checklist for each manhole inspection. This information will then be turned over to the Data Entry Department for inclusion in the Asset and Facility Maintenance System, currently CASSWORKS™ database. The inspection will entail examinations of:

- Manhole Location
- Cover
- Ring and Frame
- Cone
- Riser
- Shelf
- Channel Level of Flow
- Type and Amount of Debris in the Manhole

This information will be recorded in the Asset and Facility Maintenance System, currently CASSWORKS™ database system.

As a result of the inspection, any required maintenance will be performed on a priority basis. An analysis of the results of the inspection will be performed and that information will be utilized to prioritize preventive maintenance activities.

The Board will assign teams from each zone at the direction of zone management to the Preventive Maintenance Program. These teams will be responsible for performing the manhole inspections and for providing the preventive maintenance as required. In addition, as corrective maintenance equipment and teams are available, they will also assist with the existing preventive maintenance.

4.5 SEWER TELEVISION INSPECTION

Television inspection of sewer lines is currently performed extensively by contractors to the Board. References within this document to selection of a TV team may instead involve authorization to the contractor.

Routine TV inspection of sewer lines by the Networks Gravity Department within the Board's collection system may be performed for, but are not limited to, the following purposes:

- Inspect new pipe construction prior to acceptance.
- Assure sound pipes prior to paving.
- Find problems in troubled areas.

- Pinpoint the case, source and magnitude of infiltration.
- Ascertain the applicability of various rehabilitation methods.

TV inspections provide detailed information of manhole-to-manhole sections of pipe not available using other inspection methods. The technique is well suited for determining joint condition, root intrusion, sources of infiltration, and locating structural deficiencies. Inspection documentation is made on log forms which are input into a computerized tracking system and may be supplemented with videotape or photographs of the TV picture.

Since TV inspection is live, precarious conditions in the pipe should be approached with due caution. Control of the inspections is achieved by the ability to stop and position the camera as desired. Problems can be discussed, analyzed, photographed and the footage noted during the course of the inspection. TV inspection enables the identification of the infiltration/inflow sources and is the only practical method to monitor flow from building sewers.

4.5.1 - Equipment and TV Picture Quality: The TV camera must be specifically designed for sewer inspection – small, rugged, and waterproof. The camera must have its own light source suitable to provide a clear picture of the entire periphery of the pipe.

The camera, television monitor, and other components of the video system must be capable of producing a picture quality which is adequate for the purpose of the inspection.

4.5.2 - Television Inspection Procedures

1. Schedule routine sewer inspection for several gravity sewer line segments using closed circuit TV camera equipment.
2. Prepare a work order with necessary information for this activity.
3. The Supervisor assigns a TV team or contractor to complete the work order.
4. Check inventories of supplies and equipment to ensure availability as required.
5. Upon arrival at the work site, observe all traffic control and safety precautions as outlined in the Board's Safety Manual, as well as adherence to all City of New Orleans ordinances. Notify Fire and Police Departments if the street will be blocked or traffic lane is to be closed. Also, notify the communication center of the work being done.
6. Clean the line segment to be inspected using the high velocity jet machine as discussed in the cleaning procedures.
7. Thread the camera pull line through the line segment to be inspected using the high velocity jet machine.
8. Set up the winch at the downstream manhole and the TV truck at the upstream manhole.

9. Stop any flow coming into the stream manhole using inflatable plugs
10. After all the TV gear is set up and ready to use, lower the camera into the manhole and connect the winch pull line. The winch is operated remotely from the TV truck.

4.5.3 – Television Documentation Procedures

Two methods of documentation which are often used in combination:

1. Television Inspection Logs: Written records that show the location in relation to an identified manhole of each infiltration point observed during inspection. In addition, other points of significance such as locations of building sewers, unusual conditions, roots, storm drain connections, broken pipe, presence of scale and corrosion, and other discernible features are recorded and a copy of the records is supplied to data input personnel for computerized maintenance tracking.

   TV inspection logs should contain the following information at a minimum:

   Operator ID No.
   Date
   From MH No._____Located at_____
   To MH No._____Located at_____
   Director of Flow
   Type of Pipe
   Type of Joints, if apparent
   Joint Spacing
   Cleanliness
   Manhole Conditions
   Section Length
   Pipe Size
   Depth of pipe
   Direction of Inspection (camera movement)

2. Video Recordings: The purpose of tape recording is to obtain a visual and audio record of the pipe conditions that may be replayed at a later time.

The Board uses a series of code numbers to identify conditions inside the pipes, see Figure 4-3.

TV INSPECTION DEFECT CODE GUIDELINES
FIGURE 4-3

CODE	DESCRIPTION
01	UPSTREAM MANHOLE
02	DOWN STREAM MANHOLE
03	BEGIN OBSERVATION
04	END OBSERVATION
05	CROWN
06	INVERT
07	TO RIGHT
08	TO LEFT
09	CAMERA SUBMERGED
10	CAMERA BLOCKED
11	REVERSE SET-UP
12	BURIED MANHOLE
13	LIGHT ROOTS IN JOINT
14	MEDIUM ROOTS IN JOINT
15	HEAVY ROOTS IN JOINT
16	LIGHT OFFSET JOINT
17	MEDIUM OFFSET JOINT
18	HEAVY OFFSET JOINT
19	INFILTRATION
20	LIGHT CRACKED JOINT
21	MEDIUM CRACKED JOINT
22	HEAVY CRACKED JOINT
23	GASKET EXPOSED
24	TYPICAL JOINT PICTURE
25	CIRCULAR CRACK
26	LONGITUDINAL CRACK
27	OPEN CRACK
28	MULTIPLE CRACKS
29	BROKEN PIPE
30	COLLAPSED PIPE
31	HOLE IN PIPE
32	LONGITUDINAL CRACK ENDS
33	CRACKED PIPE ENDS
34	SAG BEGINS
35	SAG ENDS
36	GREASE BEGINS
37	GREASE ENDS
38	CHANGES TO TRUSS
39	CHANGES TO CLAY PIPE

CODE	DESCRIPTION
40	CHANGES TO CONCRETE
41	CAN'T PASS, CONCRETE
42	26-50% FLOW
43	51-75% FLOW
44	76-100% FLOW
45	SERVICE CONNECTION
46	SERVICE CONNECTION WITH BREAK-IN
47	SERVICE CONNECTION WITH DEFECT
48	ABANDONED CONNECITON
49	DOMESTIC FLOW
50	INTRUDING > 1 INCH
51	ROOTS
52	LATERAL INFILTRATION
53	CONNECTION INFILTRATION
54	CATCH BASIN LEAD
55	CAPPED OFF
56	BROKE AT THE MAIN
57	ERROR CODE
B	BROKEN PIPE
CC	CIRCUMFERENTIAL CRACK
CL	LONGITUDINAL CRACK
CM	MULTIPLE FRACTURES
CN	CONNECTION
CAN	ABANDONED CONNECTION
CNDI	CONNECTION WITH DYED WATER INFILTRATION
CNI	CONNECTION INTRUDING
CNII	CONNECTION INTRUDING WITH INFILTRATION
CNM	MATERIAL INSIDE CONNECTION
CNO	OFFSET CONNECTION
CNT	CONNECTION TAP
CNX	DEFECTIVE CONNECTION
COH	CORROSION HIGH
COL	CORROSION LIGHT
COM	CORROSION MEDIUM
CU	CAMERA UNDERWATER
D	DEFORMED PIPE
DB	DISPLACED BRICK
DC	DIMENSION CHANGE
DE	DEBRIS
DEG	DEBRIS GREASE
DES	DEBRIS SILT
FC	CIRCUMFERENTIAL FRACTURE
FL	LONGITUDINAL FRACTURE
FM	MULTIPLE FRACTURES

CODE	DESCRIPTION
H	HOLE IN PIPE
ID	INFILTRATION DRIPPER
IDJ	INFILTRATION DRIPPER AT JOINT
IE	EVIDENCE OF INFILTRATION
IEJ	EVIDENCE OF INFILTRATION AT JOINT
IG	INFILTRATION GUSHER
IGJ	INFILTRATION GUSHER AT JOINT
IR	INFILTRATION RUNNER
IRJ	INFILTRATION RUNNER AT JOINT
IS	INFILTRATION SEEPER
ISJ	INFILTRATION SEEPER AT JOINT
JDL	JOINT DISPLACED LARGE
JDM	JOINT DISPLACED MEDIUM
JN	JUNCTION
JX	DEFECTIVE JUNCTION
LC	LINING CHANGE
LD	LINE DEVIATES DOWN
LDI	LATERAL WITH DYED WATER INFILTRATION
LL	LINE DEVIATES LEFT
LN	LINING DEFECT
LR	LINE DEVIATES RIGHT
LU	LINE DEVIATES UP
MB	MISSING BRICK
MC	PIPE MATERIAL CHANGE
MH	MANHOLE
MM	MORTAR MISSING MEDIUM
MS	MORTAR MISSING SLIGHT
MT	MORTAR MISSING TOTAL
MU	UNPLOTTED MANHOLE
OB	OBSTRUCTION
OJL	OPEN JOINT LARGE
OJM	OPEN JOINT MEDIUM
RF	ROOTS FINE
RFJ	ROOTS FINE AT JOINT
RM	ROOT MASS
RMJ	ROOT MASS AT JOINT
RT	ROOTS TAP
RTJ	ROOTS TAP AT JOINT
SA	SURVEY ABANDONED
SC	SHAPE CHANGE
SG	LINE SAG
SIP	SIPHON
WL	WATER LEVEL
X	COLLAPSED PIPE

4.5.4 - Variables Which Affect TV Inspection: The inspection team is familiar with the many variables which impact the performance, production, and cost on any particular sewer TV inspection job. Some variables apply to each main line section to be inspected.

- Locating, exposing and removing manhole covers.
- Access to manholes and removing manhole covers
- Condition of the manholes…steps, cleanliness, structure.
- Depth of the sewer…difficulty and safety of entry.
- Availability of water for threading the sewer line.
- Plugging requirements…ability to plug, necessity to bypass.
- Presence of explosive gas or combustible liquid.
- Offset joints, intruding joint materials, intruding service connections, curved pipe, crushed pipe, and other obstructions which could prevent the passage of the camera.
- Cleanliness of the pipe and the presence of root curtains or grease, which could foul the camera lens.
- Sags in pipes causing the camera to become submerged.
- Size of the pipe: 6-inch to 8-inch is tight and may involve equipment clearance problems due to offset joints, crushed pipe, protruding house services, etc.; 10-inch to 21-inch pipe is easiest to inspect; 24-inch to 36-inch pipe may require special lights and skids.
- Production is sensitive to the number of setups required; it is possible to televise one thousand feet (1000') in one (1) direction from a single location when inspecting successive manhole sections. Random inspection of single manhole sections is more time consuming.
- Requirements for documentation by means of data logging and videotape recording.
- Weather

4.5.5 - Television Inspection Database: All data collected during TV inspections is entered into the Asset and Facility Maintenance System, currently CASSWORKS Physical Inspection Module Television Inspection Menu. This information will be used to log out or close the work order and scheduled future TV inspections of the line segments. The data will also be used to generate work orders for repairs to line segments. The data will also be used to generate work orders for repairs to line segments that have defects identified during TV inspections.

4.6 I/I – REDUCTION AND REHABILITATION PROGRAM

The Board has established a program to conduct sewer system evaluations and to rehabilitate the system by eliminating sources of groundwater, storm water, or any other water not requiring treatment. Many of the program activities will be perpetually required to maintain the Department's sewer system integrity and to keep I/I amounts within an acceptable level.

To understand how the I/I reduction program works, it is important to understand the conditions needing to be corrected. The first is infiltration. Because the water table is close to the surface virtually all of the sanitary gravity sewer pipelines are installed below the water table. As pipes deteriorate and cracks form, the groundwater drains into the sanitary sewer system. This is known as infiltration.

Exfiltration is the reverse of this situation. It occurs when the same deteriorated, sanitary sewer pipelines seep sewage into the groundwater, or deteriorated adjacent storm drains during sewer system surcharging. This surcharging can be due to a line chokage, or a sewage pumping station malfunction.

Inflow occurs when rainwater is introduced into the sanitary sewer through manhole covers, house lateral clean outs, house down spouts, and connections between storm drains and sanitary sewers.

The program is made up of the following elements:

- Flow Monitoring
- Manhole Inspection
- Sewer Cleaning
- Smoke Testing
- Dye Water Flooding
- TV Inspection
- Manhole Repair
- System Rehabilitation
- System Performance/Cost Effectiveness Evaluation, and other data collection as required.

4.7 BASIN PRIORITIZATION

Basins are prioritized for the purpose of scheduling detailed evaluations which include inspections, testing and possible rehabilitation. Flow monitoring will establish an estimated volume of flow entering the system from within a particular basin.

4.8 DETAILED BASIN EVALUATION

The purpose of a detailed basis evaluation is to identify and quantify inflow and infiltration sources.

The basin ranking will be used on:

- Final Characterization Report
- Flow Measurement plan and results of temporary flow monitoring.
- Supplemental cross-connection investigation and reports.
- Other relevant information known about the collection system, including data based upon the design and development of the Collection System Model.

Task protocol for detailed basin evaluations are as follows:

4.8.1 - TV Inspection:

1. Sections of the sewer in the basin are cleaned and televised to identify defects. All defects are logged and a copy of the video tape is prepared for follow-up evaluation.
2. Infiltration from open joints and pipe defects such as cracks, corrosion, and broken or collapsed pipe are prioritized rehabilitation by various techniques.

4.8.2 - Flow Monitoring:

1. A flow monitoring program is completed prior to sewer rehabilitation to document pre-rehabilitation flow I/I conditions.
2. Velocity/depth flow meters are installed for inspection activities.
3. Meters are installed upstream of the sewage pumping station wet well. The intent is to meter flow from the entire basin.
4. Once all inspections, testing, and rehabilitation are completed, the meters are installed at the same location and post-rehabilitation monitoring program is performed. Post rehabilitation flows are compared to pre-rehabilitation flows, and the actual reduction in I/I water flows is determined.

   Post rehabilitation flow monitoring is typically performed after all in-house and contracted rehabilitation work is completed. In some cases, if only a few sections of contracted work remain, the post rehabilitation monitoring could be done immediately for intermediate evaluation and reporting, and redone after all rehabilitation is complete.

4.8.3 - Manhole Inspections:

Manhole structures are inspected for infiltration and general overall condition. If manhole defects are identified, the infiltration is quantified and a work order issued for repair work.

4.8.4 - Smoke Testing:

1. Smoke testing is utilized as the primary inflow investigation technique. Smoke will migrate to and escape from major pipe defects and direct connections to storm water structures and roof drains. All sewer sections under the Board's jurisdiction will be smoke tested at least once (1) during the I/I Reduction Program.
2. All defects identified by smoke testing are prioritized for repair. Based on jurisdictional authorities, repairs may be completed or verified as follows:
    a. Smoke observed escaping along the line of the sewer will generate a work order for an internal inspection.
    b. Smoke observed from a storm water inlet or catch basin will generate a work order for repair of the sanitary sewer and storm drain system if it can be determined that a direct connection exists. In cases where a direct connection between the storm drain and sanitary sewer does not exist, dye water flooding will be conducted with the internal inspection to locate the system defects that resulted in smoke entering the storm drain.

c. Observations of smoke from private property defects and/or private property connections will be forwarded to the Plumbing Department.

4.8.5 - Dye Water Flooding Testing: In some cases smoke may be detected, but the source is not identifiable by the above described procedures. In this case, the storm water system will be flooded with dyed water and the sanitary system televised to locate the point or points where I/I is entering the sanitary sewer.

4.9 REHABILITATION PROGRAM ELEMENT DESCRIPTIONS

The Rehabilitation Program includes the analysis of rehabilitation methods and the implementation of the rehabilitation requirements.

The purpose of the Rehabilitation Program is to repair defects that allow groundwater and storm water to gain access to the sanitary sewer system. The repairs will reduce the quantity of wastewater transported and treated, and thereby reduce the possibility of system overflows and treatment plant malfunctions. The following rehabilitation methods are utilized:

- Main Line Replacement
- Point Repairs
- Cured-In-Place Sewer Lining
- Fold and Form Sewer Lining
- Manhole Rehabilitation/Reconstruction
- Manhole Inflow Covers
- Others

4.10 REHABILITATION PROTOCOL

Work orders generated by the detailed basin evaluation activities are forwarded to the Networks. Defects are scheduled for repair by the Board, or by an outside contractor.

Typical repair programs are as follows:

- **Point Repairs**: Point repairs consist of repairing small sections of cracked, corroded or broken gravity sewers or sewer force mains. This work typically includes excavating to the location of the break, removal of broken pipe section(s), and replacement with new pipe. All identified structural problems are scheduled for repair/replacement. Sewer sections that have more than one (1) structural repair (requiring excavations) per one hundred feet (100') or more than three (3) structural repairs per line section are generally completely replaced. Locations requiring complete line section replacement are generally contracted to outside contractors.

- **Manhole Repairs**: Manhole repairs consist of repairing structural defects of leakage in individual manholes or castings. This work may include replacement of castings (lid and frame), replacement of defective adjusting rings or top sections, complete manhole replacement, or relining the existing manhole to eliminate leakage. Manholes within areas where main line repairs are being contracted to outside contractors are generally included in the contracted work.

- **Sewer Television Inspections**: Videotapes are produced and evaluated in the office. The protocol for selecting the sewer line rehabilitation method is as follows:
    1) Point or spot repairs are recommended to be performed where a major structural program is observed, such as broken pipe, cracked pipe, corroded pipe, misaligned joints, and where trenchless repair technology is not practical.
    2) Complete replacement is generally performed when the sewer line section has lost its structural integrity and other methods are not appropriate. This type of repair requires open excavation.
    3) Sewer lining is performed when there are multiple cracks and/or multiple leaking joints and where lining would be more cost effective than replacement. Lining is usually more cost effective when the sewer is deeper than five feet (5'), the surface is paved, or where there are soil and groundwater concerns. The systems currently being utilized include fold and formed, or cure-in-place lining.
- **Private Section Repairs:** Private section repairs are referred to the property owner for correction of any defective service lateral or disconnection of any illegal storm water connection.

- **Contractor Repairs:** System repairs are performed by the Board or outside contractors depending upon the type of repair required and backlog of work. Any defect that the Networks Department is not equipped to repair or which would overload the Department's resources is referred to the appropriate outside contractor.

4.11 ANNUAL I/I EVALUATION

As infiltration and inflow sources are identified and eliminated, clear water flows will decrease. However, as the pipe repairs are completed, exfiltration will also be reduced, possibly causing an increase of flow to the plant. This combination of influences will complicate overall evaluation of the reduction in I/I to the system because the Board will not be able to simply monitor flows at the treatment plants and determine the reduction achieved.

Using the three (3) sets of data, the Board will be able to:

- Track I/I reduction.
- Evaluate I/I removal with beneficial impact on treatment plant capacity.
- Quantify total I/I in the system.

4.11.1 - Cost Effective Considerations. As more I/I is removed from the system, the cost to remove additional I/I will increase. This is because the larger defects have been repaired and the remaining defects will be smaller flow contributors. The Board will be able to perform a cost versus I/I reduction evaluation based on the reduction values derived in the analysis described previously.

Using this analysis, the cost of I/I removal achieved, and the cost to transport and treat the flow can be evaluated to determine cost-effective I/I programs.

4.11.2 - Sewer Line Inspection

The inspection of sewer lines will be accomplished using several methods and sources of accomplishment. Inspections come from the Board Preventive Maintenance Teams, Board Contractors, and the SSES Contractors. Inspection of all sewer lines is expected to be completed in eight years. Inspection of the lines will come from visual inspections, TV inspections, sonar inspections, and other non-destructive observation methods. The result of all inspections will be input into the CASSWORK^{TM} system. An annual progress report will be generated to summarize the progress toward complete inspection of the sewer system.

4.12 PRESSURE SYSTEMS

The Board's sewer collection system consists of approximately one hundred and two (102) miles of sewer force mains, maintained by the Networks Department. Some of these sewer force mains, particularly those made of steel, have experienced corrosion problems and pipe failures leading to wastewater discharges and sewage pumping station shutdowns.

Also, air and other gases accumulate at the high points within the sewer force mains, reducing sewage pumping station output capacity. This accumulated air also contributes to the pipe corrosion problems. Many of the sewer force main points are located at or near canal crossings. Both automatic and manually operated air release valves are installed at selected high points along the sewer force mains to eliminate accumulated air from the sewer force mains. Scheduled maintenance, including opening, closing and flushing of valves, must be performed. The automatic valves must be inspected on a regular basis to ensure that grease buildup does not interfere with the automatic float operation.

In addition to the air release valves, the system has valves installed on the sewer force mains to isolate the sewage pumping stations and sections of the lines in the event that repairs or preventive maintenance are necessary.

4.13 AUTOMATIC AIR RELEASE VALVES

The Board has installed automatic air release valves in selected locations in the system. Automatic valves in the system have been provided with backwash fittings to allow the valve to be flushed with high-pressure water to remove grease and solids from the float mechanism.

4.13.1 Operation and Cleaning Procedures

NOTE: Observe all traffic control and safety procedures as outlined in the Board's Safety Manual when performing valve maintenance in roadways or over canals.

1. Obtain Asset and Facility Maintenance System, currently CASSWORKS, work orders for scheduled maintenance on automatic valves.
2. Check inventory on truck to ensure that proper supplies are available.
3. Once the air release valve to be serviced is located, remove any manhole cover and set aside in a safe place.
4. Inspect valves per manufacturer's recommendations.
   a. Close corporation cock isolating the valve from the sewer force main.
   b. Open corporation cock to place unit back in service.
5. Annually remove the top valve cover and inspect the float and seat mechanism to ensure that it functions properly.
6. Record the valve number, location, work performed and any comments to be entered into Asset and Facility Maintenance System, currently CASSWORKS.
7. The maintenance frequency for the automatic valves is semi-annually.

4.14 MANUAL AIR RELEASE VALVE OPERATION AND CLEANING PROCEDURES

NOTE: Observe all traffic control and safety procedures as outlined in the Board's Safety Manual when performing valve maintenance in roadways or over canals.

1. Obtain Asset and Facility Maintenance System, currently CASSWORKS, work orders for scheduled maintenance on manual valves.
2. Check the inventory on the truck to ensure that proper supplies are available.
3. Open the corporation cock slowly, listen for air being released and continue opening the valve until it is approximately half-open to allow for fast closing.
4. When all of the air has been expelled from the sewer force main, water will appear at the valve. At this point, quickly close the valve.
5. Record the valve number, location and any comments to be entered into Asset and Facility Maintenance System, currently CASSWORKS.
6. The maintenance frequency for the manual air release is semi-annually.

4.15 SEWER FORCE MAIN ALIGNMENT INSPECTION

While not strictly a preventive maintenance procedure, one method which can spot possible sewer force main failures before they occur is traveling along the sewer force main routes not

under or adjacent to streets and looking for possible changes in the sewer force mains' vertical alignment. Field personnel are assigned in geographical zones and are provided with information on the locations of force main routes within their zones. Maintaining an awareness of the conditions of these routes is instilled in these employees through regular training sessions. New depressions in the ground along the sewer force main route may indicate differential settlement of the ground and imminent pipe failure. Additionally, field personnel are trained to look for other indicators along their daily routes containing force mains, such as odors and surface water.

If an indicator is noticed, it is investigated at once. The Board has established and maintains a 24-hour, 7-days per week emergency phone number and field personnel for citizens to contact the Board in any sewer emergency, or any other emergency that the public perceives as a Board emergency. Each reported problem is investigated.

Inspection of sewer force alignment not on or near street right of ways will be performed annually and integrated into CASSWORKS. If unusual conditions are spotted, notify the Supervisor immediately for follow-up investigation.

SECTION 5
OPERATIONS DEPARTMENT

5.1 SEWAGE PUMPING STATION INSPECTIONS

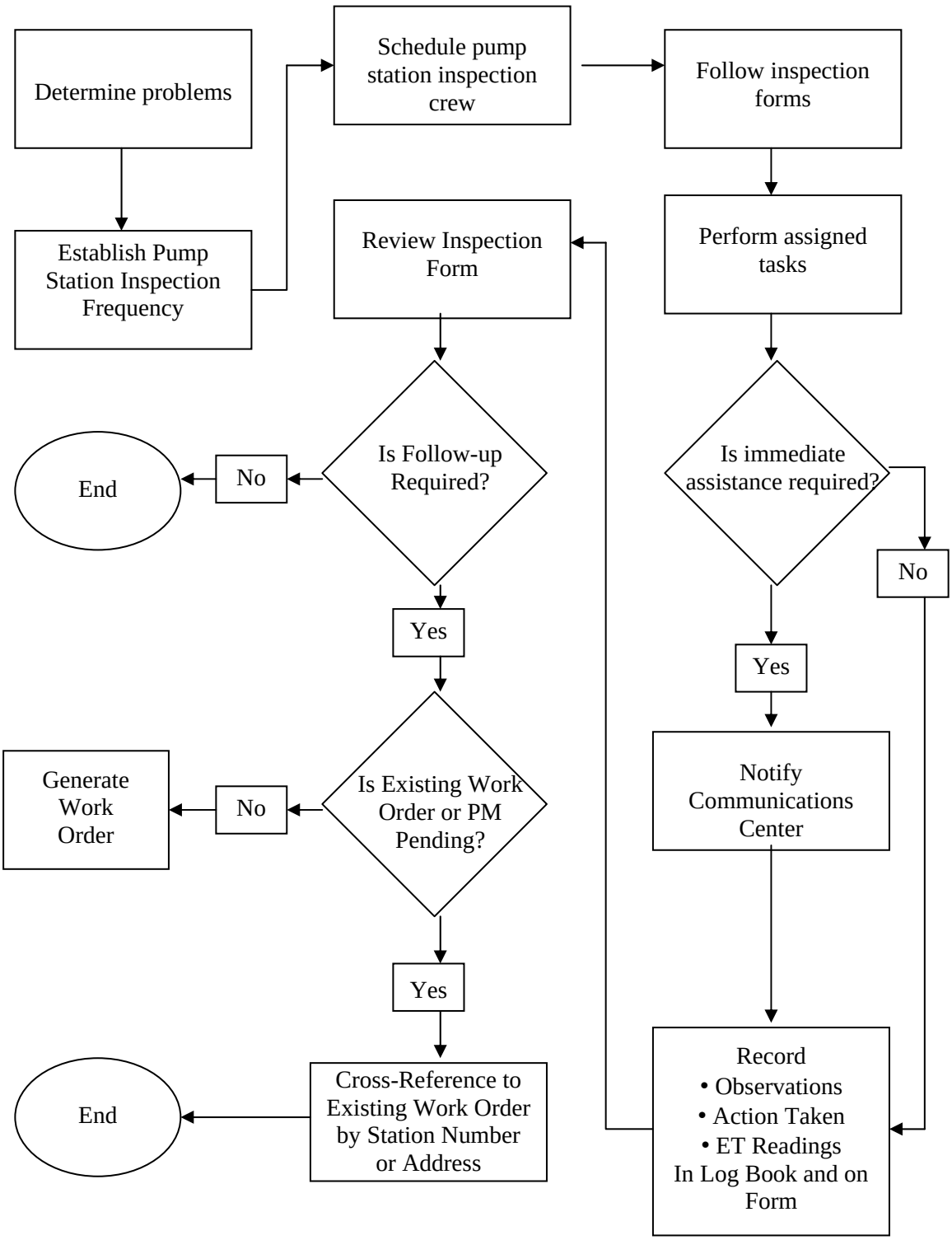
The Operations Department of the Board operates and maintains sewage pumping stations throughout the city of New Orleans. Currently Sewage Pumping Stations "A", "C", and "D" are manned continuously, while all other stations are visited on either a daily or an alternate day basis during the normal five (5) day work week. Operation Department personnel perform the majority of the preventive and some of the minor corrective maintenance tasks. All major electrical, mechanical and instrumental maintenance is performed by the Facility Maintenance Department.

5.1.1 - Pump Station Inspection System Flow Chart - Routine pumping station inspections are conducted by Operations Department personnel to check station operation. Inspection functions include looking and listening for malfunctioning equipment, observing wear and checking operation. Care functions performed during inspections include cleaning, lubricating, exercising, and adjusting equipment.

The following is a narrative description of the Sewage Pumping Station Inspection System as outlined in the flow chart presented as Figure 5-1:

1. The Operations Department Supervisor schedules sewage pumping station inspection teams and determines assignments.
2. The inspection team follows the Sewage Pumping Station Inspection Checklist.
3. Each team performs the tasks and inspections which are applicable to their specific sewage pumping stations. The inspectors are responsible for completing the checklist.
4. If immediate action is required, the inspector notifies the proper Operations Department Supervisor.
5. Before leaving the sewage pumping station, the inspectors record station information on the inspection form and in the station log book including: observations, action taken and station elapsed time meter readings.
6. The inspection form is routed to the supervisor for review.
7. If additional maintenance is required as a result of the findings during the inspection, the Supervisor will generate the appropriate work orders.
8. If the maintenance items can wait until the next scheduled preventive maintenance date, or if a work order to address the item is already open, the Supervisor cross references the maintenance item noted in the inspection with the existing work order.

OPERATIONS DIVISION
SEWER PUMP STATION INSPECTION FLOWCHART
FIGURE 5-1



5.1.2 - Sewage Pumping Station Inspection Form: Sewage Pumping Station Maintenance Inspectors follow a comprehensive checklist.

5.2 SEWAGE PUMP STATION PREVENTIVE MAINTENANCE

Preventive maintenance (referred to as "PM") is the scheduled work performed to prevent equipment breakdown, reduce wear, improve efficiency, and extend the life of the equipment. The key to preventive maintenance is scheduling; preventive maintenance is scheduled maintenance.

Recurring preventive maintenance activities include inspection and care. Checking, cleaning and adjusting are performed both during routine sewage pumping station inspections and during scheduled preventive maintenance. The inspection and care functions are necessitated by the specific service requirements and are recurring in nature and frequency.

Cyclical preventive maintenance is a defined period within which a piece of equipment is evaluated by testing or by measuring wear, performance, or service life. The evaluation may result in overhaul or replacement of the component in accordance with Board experience or industry standards.

All sewage pumping stations preventive maintenance tasks are scheduled using the Asset and Facility Maintenance System, currently CASSWORKS, Plant Maintenance Module Software. The maintenance tasks and frequencies utilized in the work orders are taken directly from manufacturers' equipment manuals, from industry practice and from Board experience.

5.2.1 - Sewage Pumping Station Maintenance Procedures and Schedules. A master schedule of maintenance activities (tasks) have been developed for major sewage pumping station equipment.

Figure 5-2 Mechanical Maintenance Schedule
Figure 5-3 Electrical Maintenance Schedule
Figure 5-4 Instrumentation Maintenance Schedule
Figure 5-5 Structural Maintenance Schedule

5.2.2 - Instructions for Using Figures 5-2 through 5-5. The following information provides instructions for using and understanding the Table Schedules:

EQUIPMENT - Equipment is listed in alphabetical order by major equipment type as found in Board sewage pumping stations. The schedules are master lists.

ACTIVITY TASK DESCRIPTION - The work activity (or task) is described in a brief phrase for simplifying generation of checklists and work orders.

ACTIVITY CODE - A code system is used for recording activities in the database management system.

ACTIVITY TYPE - Identifies the type of maintenance to be performed and defines the maintenance section which will be assigned to the task.

SI = Station Inspection
PM = Cyclical Preventive Maintenance

MINIMUM FREQUENCY - The minimum frequency for scheduling each task is based upon one (1) of the following: manufacturer recommendations, code and association guidelines, industry standards, and Board experience. Some activities are performed more frequently than as listed in the schedule.

W	= Weekly	S/A	= Semi-Annually
M	= Monthly	A	= Annually
Q	= Quarterly	B	= Bi-Annually

MECHANICAL MAINTENANCE SCHEDULE – OPERATIONS
FIGURE 5-2

Equipment	Activity (Task Description)	Activity Type	Minimum Frequency	Man-hrs/Year Operations	Man-hrs/Year Fac. Mtc. Electrician	Man-hrs/Year Fac. Mct. Mechanic	Total Man-hrs
Air Compressor-Bubbler System	Check Operation	SI	W	6.5	0.0	0.0	6.5
	Clean Air Inlet Filter	SI	W	6.5			6.5
	Drain Condensate	SI	W	6.5			6.5
	Check Oil Level	SI	W	6.5			6.5
	Clean Exterior	SI	W	6.5			6.5
	Check Belt Tension	SI	M	3.0			3.0
	Operate Safety Valve	SI	M	3.0			3.0
	Tighten Bolts	SI	M	3.0			3.0
	Change Oil	PM	Q	4.0			4.0
	Inspect Compressor Valves	PM	Q	2.0			2.0
	Lubricate Motor Bearings	PM	A	1.0			1.0
Blowers – Ventilation	Check Operation	SI	W	5.2			5.2
	Check Belt Tension	SI	M	3.0			3.0
	Inspect/Clean Wheel	PM	S/A	1.0			1.0
	Lubricate Motor Bearings	PM	A	1.0			1.0
Couplings	Check Coupling	SI	W	5.2			5.2
	Lubricate Coupling	SI	W				0.0
Crane – Bridge (Pumping Stations “A” & “D”)	Inspect Bearings	PM	M	6.0			6.0
	Lubricate Wheels & Gears	PM	M	6.0			6.0
	Check Controls	PM	M	6.0			6.0
	Check Wiring/Contacts	PM	M	6.0			6.0
	Check Load Break	PM	M	6.0			6.0
	Inspect Hook	PM	M	6.0			6.0
	Inspect Wire Rope	PM	M	6.0			6.0
	Inspect Bearings	PM	M	6.0			6.0
	Inspect Hardware	PM	M	6.0			6.0

MECHANICAL MAINTENANCE SCHEDULE – OPERATIONS
FIGURE 5-2 (CONTINUED)

Equipment	Activity (Task Description)	Activity Type	Minimum Frequency	Man-hrs/Year Operations	Man-hrs/Year Fac. Mtc. Electrician	Man-hrs/Year Fac. Mct. Mechanic	Total Man-hrs
Pumps – Main Centrifugal	Check Operation	SI	W	26.0			26.0
	Check Packing/Seals	SI	W	26.0			26.0
	Lubricate Bearings	SI	Q	26.0			26.0
	Inspect Driveshafts	SI	M	6.0			6.0
	Inspect Belt/Sheaves	SI	M	3.0			3.0
	Check for Vibration	PM	W	4.0			4.0
Pumps – Sump	Check Operation	SI	W	13.0			13.0
	Inspect/Clean	SI	W	13.0			13.0
	Inspect Impeller	PM	A	4.0			4.0
	Inspect Bearings	PM	A	1.0			1.0
Vacuum – Pump	Check Packing/Seals	PM	W	8.7			8.7
	Check Switches/Screen	PM	W	8.7			8.7
	Check Gauges	PM	W	8.7			8.7
Valve – Check	Inspect/Clean	SI	W	13.0			13.0
Valve – Discharge	Inspect Packing/Seals	SI	W	13.0			13.0
	Lubricate	SI	M	3.0			3.0
	Exercise	M	M	2.0			2.0
Valve – Suction	Inspect Packing/Seals	SI	W	13.0			13.0
	Lubricate	SI	W	3.0			3.0
	Exercise	M	M	2.0			2.0
TOTAL – MECHANICAL				***315.0***	***0.0***	***0.0***	***315.0***

ELECRICAL MAINTENANCE SCHEDULE – OPERATIONS
FIGURE 5-3

Equipment	Activity (Task Description)	Activity Type	Minimum Frequency	Man-hrs/Year Operations	Man-hrs/Year Fac. Mtc. Electrician	Man-hrs/Year Fac. Mtc. Mechanic	Total Man-hrs
Lighting	Check	SI	W	3.0			3.0
	Operation	PM	S/A	1.0			1.0
	Clean	PM	S/A	0.5			0.5
	Relamp	PM	W	0.5			0.5
Variable – Speed Drive	Clean Exterior/Interior	PM	Q	2.0			2.0
	Inspect Ring/Magnet	PM	Q	4.0			4.0
	Inspect Brushes	PM	Q	2.0			2.0
	Check Rotor Bearings	PM	Q	4.0			4.0
	Tighten Connections	PM	Q	1.0			1.0
	Inspect for Overheating	PM	Q	1.0			1.0
	Lubricate Bearings	PM	Q	2.0			2.0
Transformer – Power (Dry Type)	Record Load Current	S1	W	7.8			7.8
	Record Voltage	S1	W	7.8			7.8
	Record Temperature	SI	W	7.8			7.8
	Record Pressure/Vacuum	S1	W	7.8			7.8
TOTAL – ELECTRICAL				*52.2*	*0.0*	*0.0*	*52.2*

INSTRUMENTATION MAINTENANCE SCHEDULE – OPERATIONS
FIGURE 5-4

Equipment	Activity (Task Description)	Activity Type	Minimum Frequency	Man-hrs/Year Operations	Man-hrs/Year Fac. Mtc. Electrician	Man-hrs/Year Fac. Mts. Mechanic	Total Man-hrs
Gauges	Check Operation	SI	W	8.7			8.7
Level Control – Bubbler	Check Operation	SI	W	8.7			8.7
	Inspect Tubing	SI	W	8.7			8.7
	Replaced Tubing	PM	A	2.0			2.0
Level Control – Float	Check Operation	SI	W	8.7			8.7
	Inspect Float Balls	SI	W	8.7			8.7
	Test Level Alarm	SI	W	8.7			8.7
Lights – Indicating	Check Operation	SI	W	8.7			8.7
Switch – Pump Control	Check Operation	SI	W	1.0			1.0
Transmitter – Pressure	Check Operation	SI	W	1.0			1.0
SCADA Remote Monitoring	Test Probes	PM	W	2.0			2.0
TOTAL – INSTRUMENTATION				*66.9*			*66.9*

STRUCTURAL MAINTENANCE SCHEDULE – OPERATIONS
FIGURE 5-5

Equipment	Activity (Task Description)	Activity Type	Minimum Frequency	Man-hrs/Year Operations	Man-hrs/Year Fac. Mtc. Electrician	Man-hrs/Year Fac. Mtc. Mechanic	Total Man-hrs
Station Building	Check Locks	SI	W	4.0			4.0
	Check Lights	SI	W	4.0			4.0
	Check Man-Doors	SI	W	4.0			4.0
	Check Paint Condition	SI	W	4.0			4.0
	Check Landscaping	SI	W	4.0			4.0
	Check Housekeeping	SI	W	4.0			4.0
	Inspect Structural Steel	SI	M	2.0			2.0
	Inspect Ladders	SI	M	2.0			2.0
	Inspect Flooring/Grating	SI	M	2.0			2.0
	Inspect Roof	SI	M	2.0			2.0
	Inspect Fencing	SI	M	2.0			2.0
	Inspect Masonry Walls	SI	M	2.0			2.0
	Inspect Windows	SI	M	2.0			2.0
Wet Well	Inspect Access Hatch	SI	W	4.0			4.0
	Inspect Cracks/Leaks	PM	A	2.0			2.0
TOTAL – STRUCTURAL				*44.0*			*44.0*

5.3 SEWER PUMP STATION MECHANICAL PREVENTIVE MAINTENANCE

Cyclical preventive maintenance for mechanical equipment is performed during station preventive maintenance visits (PM).

Mechanical preventive maintenance includes:

- Pump Maintenance
- Pump Drive Maintenance and Coupling Alignment
- Pump Testing
- Bearing Maintenance
- Valve Exercising and Maintenance
- Hydro Pneumatic System Maintenance
- Air Compressor Maintenance
- Blower Maintenance

5.4 SEWAGE PUMP STATION ELECTRICAL PREVENTIVE MAINTENANCE

Limited preventive maintenance for electrical equipment is also performed during station PM visits by the Operations Department.

Electrical preventive maintenance by the Operations Department includes:

- Electrical service Equipment Inspection
- Control Panel Inspection, Cleaning and Testing
- Motor Inspection to Check Connections, Vibration, Temperature and Lubrication
- General Electrical System Inspection at each station

5.5 SEWAGE PUMP STATION STRUCTURAL PREVENTIVE MAINTENANCE

Structural preventive maintenance includes repair to or replacement of:

- Concrete Structures
- Building Roofs
- Walls and Structural Supports
- Windows
- Doors, Hatches and Locks
- Metal Grating and Flooring
- Ladders and Access Platforms
- Site Fencing
- Paint

The condition of structural items listed above is checked during routine sewage pumping station inspections. Cyclical preventive maintenance may be required for structural items like roofing at specific locations.

5.6 ISOLATION VALVE MAINTENANCE

The sewer force main valves are intended to isolate portions of the sewer force main in the event that repair or preventive maintenance is required. These valves will be needed infrequently, but they must be capable of being operated at all times. Therefore, they must be exercised and maintained on a regular basis.

Note: Before closing or adjusting valves for maintenance, check with the appropriate sewage pumping station supervisor to coordinate sewage pumping station shut downs. Also, manual air release valves must be bled after this maintenance procedure.

- Coordinate with Operations Department to shut down sewage pumping station.
- Move valve through the range of movement to the full-closed position.
- Reopen to the full-open position.
- Restore sewage pumping station operations.

SECTION 6
FACILITY MAINTENANCE

The Facility Maintenance Department of the Board performs all major mechanical, electrical and instrumentation maintenance of eighty-four (84) sewage pumping stations.

6.1 SEWAGE PUMPING STATION PREVENTIVE MAINTENANCE

Preventive maintenance (referred to as "PM") is the scheduled work performed to prevent equipment breakdown, reduce wear, improve efficiency, and extend the life of equipment. The key to preventive maintenance is scheduling; preventive maintenance is scheduled maintenance.

Recurring preventive maintenance activities include inspection and care. Checking, cleaning and adjusting are performed both during routine sewer pumping station inspections and during annual scheduled preventive maintenance. The inspection and care functions are necessitated by the specific service requirements and are recurring in nature and frequency.

Cyclical preventive maintenance is a defined period within which a piece of equipment is evaluated by testing or by measuring wear, performance, or service life. The evaluation may result in overhaul or replacement of the component in accordance with Board experience or industry standards.

All sewage pumping station preventive maintenance tasks are scheduled using the Asset and Facility Maintenance System, currently CASSWORKS, Plant Maintenance Module Software. The maintenance tasks and frequencies shown in the work orders are taken directly from manufacturers' equipment manuals, from industry practice and from Departmental experience.

6.2 SEWAGE PUMPING STATION PROCEDURES AND SCHEDULES

A master schedule of maintenance activities (tasks) has been developed for major sewage pumping station equipment as follows:

Figure 6-1 Mechanical Maintenance Schedule
Figure 6-2 Electrical Maintenance Schedule
Figure 6-3 Instrumentation Maintenance Schedule

Instructions for Using Figures 6-1 through 6-3. The following information provides instructions for using and understanding the Figures:

EQUIPMENT - Equipment is listed in alphabetical order by major equipment type as found in Board sewage pumping stations. The schedules are master lists. Refer to the Sewage Pump Station Inventory Database for specific equipment in each station.

ACTIVITY TASK DESCRIPTION - The work activity (or task) is described in a brief phrase for simplifying the generation of checklists and work orders.

ACTIVITY CODE - A code system is used for recording activities in the database management system.

ACTIVITY TYPE - Identifies the type of maintenance to be performed and defines the maintenance section which will be assigned to the task.

SI = Station Inspection
PM = Cyclical Preventive Maintenance
OH = overhaul (Replacement or "Corrective Maintenance")

MINIMUM FREQUENCY - The minimum frequency for scheduling each task is based upon one of the following: manufacturer recommendations, code and association guidelines, industry standards, and Board experience. Some activities are performed more frequently than as listed in the schedule.

W	= Weekly	S/A	= Semi-Annually
M	= Monthly	A	= Annually
Q	= Quarterly	B	= Bi-Annually
MFR	=As per Manufacturer		

MECHANCIAL PREVENTIVE MAINTENANCE - Major preventive maintenance work for mechanical equipment is performed during station preventive maintenance (PM) visits by Facility Maintenance machinists and electricians. These PM work orders are generated for the CASSWORKS.

MECHANICAL MAINTENANCE SCHEDULE – FACILITY MAINTENANCE
FIGURE 6-1

Equipment	Activity (Task Description)	Activity Type	Minimum Frequency	Man-hrs/Year Operations	Man-hrs/Year Fac. Mtc. Electrician	Man-hrs/Year Fac. Mtc. Mechanic	Total Man-hrs
Couplings	Align Coupling	PM	A			1.0	1.0
Crane – Bridge (Pumping Stations "A" & "D")	Inspect Gearing	PM	A			4.0	4.0
	Inspect Brake Discs	PM	A			4.0	4.0
	Inspect Lifting Devices	PM	A			4.0	4.0
	Inspect Sheaves/Drums	PM	A			4.0	4.0
	Perform Load Test	PM	A			4.0	4.0
Pumps – Main Centrifugal	Inspect bearings	PM	A			8.0	8.0
	Inspect Rotating Elements	PM	A			8.0	8.0
	Inspect Wear Rings	PM	A			8.0	8.0
	Inspect Packing/Seals	PM	A			8.0	8.0
	Test Pump Operation	PM	A			4.0	4.0
TOTAL – MECHANICAL						***57.0***	***57.0***

ELECTRICAL MAINTENANCE SCHEDULE – FACILITY MAINTENANCE
FIGURE 6-2

Equipment	Activity (Task Description)	Activity Type	Minimum Frequency	Man-hr/Year Operations	Man-hr/Year Fac. Mtc. Electrician	Man-hr/Year Fac. Mtc. Mechanic	Total Man-hrs
Cables – Low Voltage Power (600 v Maximum)	Check Condition	PM	A		0.5		0.5
	Inspect Connections	PM	A		1.0		1.0
	Inspect Raceway	PM	A		0.5		0.5
	Test Insulation Resistance	PM	A		1.0		1.0
Cables – Medium Voltage Power (6.6 kv Maximum)	Check Condition	PM	A		0.5		0.5
	Inspect Connections	PM	A		1.0		1.0
	Inspect Raceway	PM	A		0.5		0.5
	Test DC High – Potential	PM	A		1.0		1.0
Circuit Breakers	Inspect/Clean	PM	A		0.5		0.5
	Tighten Connections	PM	A		1.0		1.0
	Exercise Mechanism	PM	A		0.3		0.3
	Test Overcurrent Trip	PM	A		0.5		0.5
Contractors/Starters	Inspect for Overheating	PM	A		0.3		0.3
	Tighten Connections	PM	A		0.5		0.5
	Inspect/Clean Contacts	PM	A		0.5		0.5
Fuses	Inspect/Clean	PM	A		0.3		0.3
	Tighten Connections	PM	A		0.3		0.3
	Clean Contacts	PM	A		0.3		0.3
Pumps – Submersible Centrifugal <+25 HP	Inspect Cables	PM	A		0.3		0.3
	Check Sensors	PM	A		1.0		1.0
	Test Insulation Resistance	PM	A		1.0		1.0
Relay – Control	Inspect for Overheating	PM	A		0.5		0.5
	Tighten Connections	PM	A		1.0		1.0
Relay – Protective	Inspect/Clean	PM	A		0.5		0.5
	Perform Pickup Test	PM	A		2.0		2.0
	Perform Timing Test	PM	A		2.0		2.0
	Test Target and Seal-in Unit	PM	A		2.0		2.0
	Test Circuit Trip	PM	A		2.0		2.0

ELECTRICAL MAINTENANCE SCHEDULE – FACILITY MAINTENANCE
FIGURE 6-2 (CONTINUED)

Equipment	Activity (Task Description)	Activity Type	Minimum Frequency	Man-hr/Year Operations	Man-hr/Year Fac. Mtc. Electrician	Man-hr/Year Fac. Mtc. Mechanic	Total Man-hrs
Transformer – Power (Dry Types)	Inspect Case Exterior	PM	A		0.3		0.3
	Inspect Equipment Ground	PM	A		0.3		0.3
	Inspect Bushings	PM	A		0.3		0.3
	Inspect Cooling System	PM	A		0.5		0.5
	Test Grounding Electrode Resist	PM	A		0.5		0.5
Transfer Switch (20 Stations)	Check Connections	PM	A		0.3		0.3
	Check Relays/Timers	PM	A		0.3		0.3
	Test Switch	PM	A		0.3		0.3
TOTAL – ELECTRICAL				***0.0***	***26.5***	***0.0***	***26.5***

INSTRUMENTATION MAINTENANCE SCHEDULE – FACILITY MAINTENANCE
FIGURE 6-3

Equipment	Activity (Task Description)	Activity Type	Minimum Frequency	Man-hr/Year Operations	Man-hr/Year Fac. Mtc. Electrician	Man-hr/Year Fac. Mtc. Mechanic	Total Man-hrs
Switch – Pressure	Inspect/Clean	PM	A		1.0		1.0
Transmitter – Pressure	Check Calibration	PM	S/A		2.0		2.0
SCADA Remote Monitoring	Test Alarm Functions	PM	SA		1.0		1.0
	Test Control Functions	PM	S/A		3.0		3.0
	Clean Probes	PM	As Needed		3.0		3.0
TOTAL – INSTRUMENTATION					***8.0***		***8.0***

6.3 FACILITY MAINTENANCE – MECHANICAL PREVENTIVE MAINTENANCE

Mechanical preventive maintenance includes:

- Pump Drive Maintenance
- Pump Testing
- Bearing/Wear Ring Inspection
- Bridge Crane Inspection/Load Testing

6.4 FACILITY MAINTENANCE - ELECTRICAL PREVENTIVE MAINTENANCE

Preventive maintenance for electrical equipment is also performed by the Facility Maintenance Department.

Electrical preventive maintenance performed by the Facility Maintenance Department includes:

- Power Cable Inspection
- Circuit Breaker and Starter Inspection
- Testing of Electrical Relays
- Testing the Electrical Transfer Switch
- Transformer Inspection at each station