



# **SEWER OVERFLOW RESPONSE PLAN#**

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**CITY OF OAK RIDGE#  
PUBLIC WORKS DEPARTMENT**

**APPROVED BY EPA APRIL 2011**

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# THE CITY OF OAK RIDGE TENNESSEE SANITARY SEWER OVERFLOW RESPONSE PLAN

## INTRODUCTION

A Sewer Overflow Response Plan (SORP) is an outline of procedures necessary to minimize the adverse effects of a sanitary sewer overflow (SSO). Having a plan in place that a response team can follow is an absolute necessity to minimize damage to the environment and to protect the safety, health, and property of those affected.

This SORP is an emergency plan to ensure that:

- The City of Oak Ridge operating management is aware of SSO's
- There is a plan for appropriate, rapid response
- There is timely notification to appropriate regulatory authorities (Anderson Co. Health Dept. doesn't require notification at this time, per Gabe Davis on 4-1-11)
- That personnel are trained, know and follow the plan
- Emergency operations are provided

The goal of the SORP is to document the City of Oak Ridge procedures for responding to all SSO's and ensure a consistent response. These protocols are intended to address all types of events and ensure that every effort is made to reduce the adverse impact to the environment and protect the public from any potential health hazard associated with an overflow or backup. The City of Oak Ridge will use its discretion and best professional judgment to evaluate each event and choose the appropriate remediation tools.

### Reasons for SSO's

Reasons for sewer overflows can be from any number of conditions including collapsed or broken sewer lines, obstruction in the sewer pipe and overloading the hydraulic capacity from inflow or infiltration, particularly during heavy rains or prolonged rainy seasons.



## 1.0 Definitions

**Basin:** Basins are small portions of the sanitary sewer system separated by boundaries of natural topography or system configurations. Separating the system into basins allows the City of Oak Ridge to better identify and monitor system performance in these small basins.

**Building Back up:** A building backup means wastewater backs up into buildings that are caused by blockages or flow conditions in the City of Oak Ridge waste water collection system other than a private service lateral. A wastewater backup into a building that is caused by a blockage or other malfunctions in a private service lateral is not a Building Backup.

**Bypass:** Shall have the meaning set forth at 40 C.F.R.-122.41 (m).

**CCTV:** Closed circuit television used to visually inspect the internal conditions of pipes and sub-surface structures.

**Cleanout:** A cleanout is a vertical pipe with a removable cap extending from a private service lateral to the surface of the ground. It is used for access to the private service lateral for inspection and maintenance.

**Combination Cleaners:** Combination Cleaners are mechanical equipment with flushing and suction capabilities. This equipment is used to clean or collect wastewater and related debris from the sanitary sewer system.

**Discharges:** A discharge is any release of untreated wastewater (including that combined with rainfall induced by infiltration and inflow, or I&I) from a sanitary sewer system.

**Dry Weather SSO:** A discharge of untreated sewage from a sanitary sewage system due to flow restrictions or system disruptions.

**EPA:** Environmental Protection Agency

**First Responder:** Typically a designated sewer maintenance employee or qualified City of Oak Ridge employee who assumes initial responsibility for response to a SSO event.

**Force Main:** A pressurized line that conveys wastewater from a pump station.

**Gravity Line:** Gravity or main sewer collection lines represent the largest portion of the City of Oak Ridge wastewater collection system. Elevation differences are used to transport wastewater between points, normally manholes.

**I&I:** Inflow and Infiltration, or extraneous surface or ground water that enters the sanitary sewer collection system.



**Impacted Areas:** Impacted areas are sites where sanitary sewage has collected or areas that have been affected as a result of a discharge from the sewage system.

**Infiltration:** Infiltration is the introduction of groundwater into a sanitary sewer system through cracks, pipe joints, manholes or other system leaks.

**Inflow:** Inflow is the introduction of extraneous water into a sanitary sewer system by direct or inadvertent connections with storm water infrastructure such as gutters and roof drains, uncapped cleanouts and cross-connections with storm drains.

**Lift or Pump Station:** A lift or pump station is a mechanical method of conveying wastewater to higher elevations.

**Manhole or Junction Box:** A manhole or junction box provides a connection point for gravity sewer collection lines, private service laterals or force mains, as well as an access point for maintenance and repair activities.

**Public System:** Public system refers to the City of Oak Ridge sanitary sewer system, excluding private service laterals and connections with private systems.

**Private Service Laterals:** That portion of a sanitary sewer conveyance pipe, including that portion in the public right-of-way, that extends from the wastewater main to the single-family, multi-family, apartments, or other dwelling unit or commercial or industrial structures to which wastewater service is or has been provided.

**Sanitary Sewer System:** A sanitary sewer system collects, conveys and treats residential, commercial and industrial wastewater through a complex network of infrastructure that includes these components:

- Private service laterals
- Gravity or main lines
- Manholes or junction boxes
- Sewer lift or pump stations
- Force mains
- Treatment plants

**Supervisory Control and Data Acquisition System (SCADA):** SCADA is automated sensory control equipment that monitors the operation of the pump station. The SCADA system will convey alarms when predetermined conditions occur. Monitoring parameters include but are not limited to power failures, high wet well levels and pump failures that could potentially cause overflows.



SORP: The City of Oak Ridge Sewer Overflow Response Plan provides structured guidance, including a range of field activities to choose from for a uniform response to overflows.

Sanitary Sewer Overflows (SSO): SSO shall mean an overflow, spill or release of wastewater from the City of Oak Ridge wastewater collection system, including:

- (a) All unpermitted discharges or (b) overflows, spills, or releases of wastewater that may not have reached waters of the United States or the State and (c) all building backups.

TDEC: Tennessee Department of Environment and Conservation.

Unpermitted Discharges: A discharge of pollutants that reach waters of the United States or the State from the sewer system (including constructed overflows) from WWTP's through a point source not specified in an NPDES Permit or from WWTP's which constitute a prohibited bypass.

Wastewater Collection and Transmission System: The municipal wastewater collection and transmission system, including all pipes, force mains, gravity sewer lines, lift stations, pump stations, manholes, and appurtenances there to, which are owned or operated by the City of Oak Ridge.

Water of the State: Waters of the State shall have the same meaning as "Waters" defined at TCA 69-3-103 (33).

Wastewater Treatment Plant: Devices or systems used in the storage, treatment, recycling, and reclamation of municipal wastewater. This includes all facilities owned, managed, operated, and maintained by the City of Oak Ridge.

Wet Weather SSO: A discharge of untreated sewage from a sanitary sewer system due to excessive flows during rain events or elevated ground and surface water conditions.



## 2.0 Process Overview

The City of Oak Ridge continues to work to provide an efficiently designed, maintained and operated sanitary sewer system to safely collect and convey sewage to the wastewater treatment plant for appropriate treatment and discharge.

A SSO occurs when sewage escapes from a sanitary sewer system anywhere other than at an approved discharge point. A SSO can result from flow restrictions or system disruptions or it may also result from excessive flows caused by elevated ground water and surface water during rain events.

The City of Oak Ridge developed this SORP to reduce the impact of SSO's relating to customers or the environment and to comply with regulatory requirements. It provides structured guidance for response to overflows and includes a range of appropriate and effective field activities to choose from to meet the needs of each individual situation. The operating staff must use its discretion and best professional judgment to evaluate each event and choose the appropriate method for remediation.

The response to a SSO begins when a customer, City of Oak Ridge employee, telemetry system or outside party reports a possible overflow.

### 2.1 Scope and Summary

The SORP consists of procedures to help mitigate the adverse impact of an SSO to the environment. The process begins with a report of a possible SSO into the City of Oak Ridge management system. The notification initiates a series of protocols to confirm the report, reduce the impact on the environment, report the occurrence to the appropriate individuals and agencies, and track the occurrence to help prevent future events.

#### Key Components of the City of Oak Ridge SORP

- Determine if the cause of the SSO falls under the City of Oak Ridge area of responsibility or is a private issue
- Contain the overflow to reduce any further negative impact
- Resolve system disruption
- Advise the customer if the overflow is due to a problem on their property or is the City of Oak Ridge's responsibility
- Implement appropriate notification procedures
- Track SSO occurrences



- Develop and implement system improvements

## **2.2 Assumptions and Limitations**

The City of Oak Ridge initiates the SORP promptly after notification of a possible SSO from a customer, passerby, emergency agency or other individual or entity.

The process to be implemented depends on these factors:

- City of Oak Ridge responsibility
- Private customer issue
- Location of SSO
- Environmental impact

A building backup or overflow caused by a failure in the customer's private system is referred to internally as "Customer Responsibility". If the City of Oak Ridge identifies the problem to be on the private portion of the system, the customer is notified. The customer is responsible for any required repair or clean-up of their own facilities.

A building back up that is caused by a failure in the City's wastewater collection system is referred to as "City Responsibility". When this occurs, the first responder contacts his appropriate supervisor and a coordinated effort is placed into action with the property owner for cleaning and repairs to occur.

## **3.0 System and Organizational Structures**

Implementing the SORP requires the following:

1. Effective and timely communication
2. Well-trained and experienced responders
3. Structured and concise response procedures
4. Accurate and comprehensive monitoring procedures
5. Continuous and annually scheduled re-evaluations of the plan



### **3.1 City of Oak Ridge Wastewater System**

The City of Oak Ridge wastewater system is composed of:

1. 265 miles of gravity line
2. 50,000 feet of force main
3. 6,200 manholes
4. 35 pump stations
5. 1 wastewater treatment plant
6. 30 MGD treatment capacity
7. 10,991 connections
8. 27,387 population served

As the utility provider, the City of Oak Ridge owns and maintains the network of pipes, manholes and associated equipment that transport wastewater from homes and businesses to the treatment plant. This network is referred to as the collection system. Customers own the private service laterals from the served structure to the public main line.

### **3.2 City of Oak Ridge Operational and Functional Structure**

An organizational chart for the City of Oak Ridge, Public Works Department is included in Appendix A.

### **3.3 Equipment and Tools**

A detailed list of equipment and tools that are available for employees to utilize during a SSO is included in Appendix B.

### **3.4 SORP Procedures**

The SORP will detail events from the time the City of Oak Ridge receives notification of a possible SSO until the confirmed SSO is contained and the site remediated. Response procedures provide guidelines for the evaluation, mitigation and correction of the conditions that are causing or contributing to an unpermitted discharge of untreated wastewater. The primary objectives of these procedures are to provide standard protocols, minimize risk and protect public health and the environment.



Emergency response procedures appropriate to the vulnerabilities, sensitive areas and critical facilities identified for the Public Works Department (PW) have been developed. These procedures reflect best management practices.

During regular working hours the PW Administrative Assistant will dispatch sewer maintenance personnel with appropriate equipment to confirm and contain the SSO and determine the cause. Crews and equipment are available for response during regular work hours Monday through Friday from 7:30 a.m. to 4:00 p.m. A three-member crew is available after hours in the on-call status. The phone calls are transferred to automatically ring at the Oak Ridge Police Department Dispatch who will contact the on-call crew leader if needed. PW relies on radios and cell phones for communication.

### **Preliminary Assessment**

Upon arrival at the reported SSO site the response crew may request additional personnel, material, supplies and equipment from the Operations and Maintenance Manager (O&M Manager), if needed.

Response crews may report their findings, including possible damage to private and public property, to the O&M Manager upon making their investigation. Crew leaders have the authority to contact the City of Oak Ridge's insurance investigator to handle property damage.

In all cases, pictures will be taken of the overflow site before and after work to show the extent of the overflow, how much area is affected, and the route the flow traveled.

If needed, the O&M Manager will visit the site of the overflow to ensure the SORP is being followed. PW is responsible for informing TDEC of all SSO's within 24 hours of becoming aware of the event.



### 3.4.1 SORP-Sewer Blockage or Backup into Basement

#### EMERGENCY PROCEDURES

- Dispatch the crew immediately to the complainants address with details. Crew notifies complainant/property owner when they are on site.
- Check upstream and downstream manholes to visually compare flows.
- If the flow from both manholes is reasonable for the area, run the jet nozzle up the line to make sure the problem is not at the tap. If the City sewer is clear, notify the property owner that the problem is in their service lateral and to contact a plumber or sewer service contractor to relieve the blockage.
- If the downstream manhole is full and there is a potential for overflow, immediately begin the set up for pumping around the blockage.
- Request additional manpower and equipment as needed.
- Set up pump out equipment and hoses from the upstream manhole to nearest flowing manhole below the blockage.
- Continue to check downstream manholes until a dry manhole is found, indicating a blockage upstream.
- See “Overflowing Sewer Manhole” procedure for pumping around the blockage while the line is repaired.
- If no blockage is found and the problem is attributed to a pump station problem, refer to Pump Station Response.
- Using the jet truck or vac-truck, rod the line after installing the proper size debris basket or pole hoe in the downstream invert of the manhole to capture the debris.
- Remove the debris from the manhole and observe it to try to determine the cause of the blockage.
- Notify supervisor and describe the blockage. The supervisor will notify the proper authorities and agencies as needed.
- Cordon off the area if ponding occurs on the street or easement.
- Collect as much of the sewage as possible, disinfect, spread lime on the area and notify surrounding homes.



- Notify crews to schedule a CCTV inspection. Give approximate footage to problem from manhole.
- Prepare a report indicating the time of the call, a description of the problem, repair work performed, personnel present and equipment used.
- If sewage overflowed the collection system, complete the Sanitary Sewer Overflow report form as required.
- Notify TDEC within the required 24 hours, followed by the Final Report within five days.
- If sewer backed up into a basement, notify City's insurance company and give owner a claim form.

### **3.4.2 SORP-Overflowing Manhole Due to Surcharged Sewer Main**

#### **EMERGENCY PROCEDURES**

- Dispatch the crew immediately to the problem.
- Before responding to the call, refer to sewer maps for location of sewers and manholes. Determine if a pump station serves the area.
- Go to the location of the overflowing manhole to assess the immediate danger to public health or the environment. Take pictures as needed.
- Determine the location of the blockage by inspecting the downstream manholes until a dry manhole is found.
- Install the proper size debris basket or pole hoe in the downstream invert of the manhole before cleaning the blockage to capture the debris. Use the jet rodder to relieve the blockage. Remove the debris from the manhole and assess it to try to determine the cause of the blockage.
- If it is imminent that the wastewater will be released into wetlands, receiving waters or a drinking water supply watershed, use the vac-truck and try to capture as much wastewater as possible and notify the supervisor. The supervisor may call in extra crews and equipment to set up flotation booms across streams, brooks, etc., if needed. The supervisor may notify the proper authorities and agencies.
- Gather and remove sewage related debris and organic matter from the affected area.



- If the wastewater is in the streets/roads use sand bags to contain the wastewater to minimize any impact to the public or environment.
- Sandbag nearby catch basin inlets or paved spillways to prevent the wastewater from entering the drainage system and causing potential contamination to the receiving waters.
- Cordon off areas if ponding occurs.
- Collect as much of the sewage as possible, disinfect and lime the area and notify surrounding homeowners.
- If the wastewater jeopardizes a playground or park, cordon off the area. Close the park to the public until the issue has been remediated to the satisfaction of the local and state regulatory authorities and the park management.
- Complete a report indicating the time of the call, description of the problem, repairs made and personnel and equipment used.
- If sewage overflowed the collection system, complete the Sanitary Sewer Overflow report form as required.
- Notify TDEC within the required 24 hours, followed by the Final Report within five days.

### **3.4.3 SORP-Cavities and Depressions in Streets and Lawns**

#### **EMERGENCY PROCEDURES**

- When a call is received from the public, confirm that; (1) the problem area is a cavity or depression and not a missing or low manhole cover or catch basin grate; (2) the location of the reported cavity and the name and address of the person making the call.
- If the problem is severe, extensive or associated with sewer system, investigate and barricade the area. Lights and barricades should be used if the situation is dangerous.
- When checking a depression over a main line it is important to check the main sewer at both upstream and downstream manholes adjacent to the depression to determine if there is a restriction of flow. If there is a blockage, it may indicate a possible main sewer break.
- If the cavity is a result of sewer failure, refer to the procedures for “Sewer Main Breaks/Collapse”.



- If it has been determined that it is a cavity or depression caused by another utility (storm drain, water main, etc.), the crew should notify the supervisor.
- The crew leader should thoroughly document the nature and extent of the impact including the use of photographs and/or video footage.
- Complete a report indicating the time of the call, a description of the problem, the repair work done, personnel and equipment used.
- If sewage overflowed the collection system, complete the Sanitary Sewer Overflow report form as required.
- Notify TDEC within the required 24 hours, followed by the Final Report within five days.

#### **3.4.4 SORP-Sewage Force Main Break**

##### **EMERGENCY PROCEDURES**

- Dispatch a crew to the site to assess the situation, determine who or what might be affected and the immediate danger to the environment.
- Refer to sewer maps for location of sewer lines, manholes and what pump station is associated with the force main.
- Set up traffic cones and barricades as needed.
- Initiate measures to contain the overflow, protect the street, public areas, catch basins, etc. that might be subject to flooding and collect wastewater that has been discharged. These measures will help minimize impact to the public health and the environment.
- Determine if it will be possible to pump around the break from the pump station wet well to the force main discharge manhole or other accessible manhole. If it is possible, then prepare to pump around the break as follows: (1) request additional manpower and equipment as needed (excavating crews, bypass pumping equipment, etc.), (2) set up pump equipment and hoses from the wet well to the nearest sewer discharge point, (3) draw down the wet well as much as possible to maintain a low level, (4) lock out and tag out the pumps at the station.



- If pumping around the break is not possible, utilize the vac-truck or tanker truck to draw down the wet well as much as possible and maintain a low level.
- Call in additional crews as necessary to help contain the sewer overflow. Set up flotation booms across streams and sandbag storm drains, etc.
- Check the tributary area to determine if the discharge will affect any receiving waters and notify the proper authorities and agencies as necessary.
- If the wastewater is in the road, contain the wastewater to the extent possible with sandbags. Sandbag nearby catch basins inlets or paved spillways to prevent wastewater from entering the drainage system and causing potential contamination of receiving waters.
- Cordon off the area if ponding occurs. Collect as much of the wastewater as possible, disinfect and lime area and notify surrounding homeowners and the appropriate officials and agencies.
- If the wastewater jeopardizes a playground or park, cordon off the entire area. Close the park to the public until the issue has been remediated to the satisfaction of the local and state regulatory authorities and the park superintendent.
- Gather and remove sewage related debris and organic matter from the affected area.
- Drain the force main as follows: (1) close the gate valve on the upstream side of the discharge check valve on the pumping station, (2) Open the check valve by hand and secure it in place, (3) Bleed the force main back into the wet well by slowly opening the gate valve on the discharge side of the pump, but only to the point where the force main stops leaking and there is enough room to make the repair. Constant communication must take place between the crew at the leak and the crew at the pump station, (4) Close the gate valve and return the check valve to its normal operating position and then fully open the gate valve.
- Repair force main break.
- After the repair is complete, remove the lock out-tag out and return the pumps to normal operating position.
- Run the pumps in the hand position to fill the force main. Care must be taken while filling the force main (use only one pump



during filling). Once complete, observe several pump cycles before completely backfilling the excavation.

- Upon confirmation of no leaks at the repair, backfill the excavation and restore surface area.
- While the crew is restoring the excavation, the crew leader should conduct a preliminary assessment of damage to private and public property. The crew leader should thoroughly document the nature and extent of the impact using photographs and videos.
- Complete a report indicating the time of the call, a description of the problem, the repair work performed and persons and equipment used.
- If sewage overflowed the collection system, complete the Sanitary Sewer Overflow report form as required.
- Notify TDEC within the required 24 hours, followed by the Final Report within five days.

### **3.4.5 SORP-Sewer Main Breaks/Collapse**

#### **EMERGENCY PROCEDURES**

- Dispatch a crew to the location of the break/collapse immediately while referring to the sewer maps for the location of sewer, manholes, etc., to determine if critical facilities are in the area.
- Crew sets up signs, barricades or barrels for traffic control and public safety, rerouting traffic as necessary and deploying traffic control measures such as police and flag persons as needed.
- If it is a main line break, notify the appropriate authorities.
- Request additional manpower and equipment as needed based on initial damage assessment (excavating crew, equipment to pump around break, etc.).
- Pumping around the break from the upstream manhole to the downstream manhole may be required. If necessary, set up bypass pumping equipment. If not necessary, prepare for repairs while the pipe is flowing.
- Call in additional crews to set up flotation booms across streams, install sandbags, etc., as needed. Unless special conditions exist, pumping around the failed sewer main is a priority before containing the overflow.



- Gather and remove sewage related debris and organic matter from the affected area.
- If the wastewater is in the street/roads use sandbags to contain the wastewater to minimize any impact to the public health or the environment.
- Sandbag nearby catch basin inlets or paved spillways to prevent the wastewater from entering the drainage system and causing potential contamination to the receiving waters.
- Cordon off the area if ponding occurs.
- Collect as much of the sewage as possible, disinfect and lime area; notify surrounding homeowners and the appropriate officials.
- If the wastewater jeopardizes a playground or park, cordon off the entire area. Close the park to the public until the issue has been remediated to the satisfaction of the local and state regulatory authorities and the local park superintendent.
- Determine the location of the break/collapse and make any necessary repairs. Use repair procedures consistent with policy. If the break is on the pipe length, then a repair can be made with a repair clamp. If the break is at the bell, cut out the bell and replace with a piece of pipe for a point repair.
- Upon confirmation of adequacy of the repair, backfill the excavation and restore surface conditions.
- To restore the sewer line to full capacity, the crew should remove any debris that may have entered and accumulated in the sewer line downstream and upstream from the break/collapse. The crew should clean the sewer line. Install the proper size debris basket in the downstream invert to trap any debris that may have accumulated in the sewer line.
- The crew leader should thoroughly document the nature and extent of the impact including the use of photographs and videos.
- Complete a report indicating the time of the call, a description of the problem, the repair work done personnel present and equipment used.
- If sewage overflowed the collection system, complete the Sanitary Sewer Overflow report form as required.
- Notify TDEC within the required 24 hours, followed by the Final Report within five days.



### **3.4.6 SORP-Air Release and Vacuum Valve Failure**

#### **EMERGENCY PROCEDURES**

- These valves require frequent inspection and maintenance. Their failure is often found during routine inspections. Both valves may fail to operate if grease is allowed to accumulate in the valve or on the opening mechanism.
- The maintenance crew should inspect valves in accordance with the specific manufacturer's recommendations.
- Attach fittings at the top and bottom to permit flushing of all valves upon initial installation or retrofit upon failure.
- Isolate the valve from the force main by closing the shutoff valve attached to the force main.
- Clean the internal components of the valves. Attach a back-flushing hose to a pressurized water source using a quick disconnect coupling.
- Place a blow-off discharge hose in a container to collect the back-flush water from the blow-off valve. This is wastewater that should not be discharged onto the street or into the valve pit.
- Open the shutoff valve and back-flush the valve through the blow-off valve at the bottom.
- If a potable water source is being used, provide the system with an anti-siphon device or backflow device to prevent contamination of the potable water.
- Prepare a report indicating the time of the visit, description of the problem, repair work done and personnel and equipment used.
- If sewage overflowed the collection system, complete the Sanitary Sewer Overflow report form as required.
- Notify TDEC within the required 24 hours, followed by the Final Report within five days.

### **3.4.7 SORP-Wastewater Pump Station Alarms General Response Plan**

#### **EMERGENCY PROCEDURES**

- Send an individual to the station indicating an alarm as soon as possible. Responders should bring a detailed station-specific



trouble-shooting guide with them for the pump station. If serious trouble is found, call for additional assistance and keep an individual at the station until further instructions are received.

- Always check with the Electric Department when an alarm activates. The pole number nearest the station should be reported to the Electric Department.
- Personnel called in to investigate pump station alarms shall respond to the station even if the alarm has cleared prior to their arrival. All alarm conditions are to be checked and logged. Use the following guidelines and follow confined space entry procedures.

### **Wet well/Dry well Stations**

- Observe all safety precautions per training.
- Check the atmosphere within the dry well with a gas meter prior to entering.
- Upon entering, identify the storage capacity in the wet well. This will give some indication of the time available for response. If flooded, skip to pump-out steps under “Pumping Station Failure inside valve pits, Pump or Valve Failure”.
- Take your time entering the dry well. Never enter a flooded dry well.
- Note any unusual odors (burning electrical equipment or paint).
- Listen and note any unusual noises.
- Check for heat around pump motors and pump bearing housings. Note anything that seems unusually hot.
- Observe every piece of equipment in the station. Note anything that looks out of place.
- Record all gauge readings including wet well hour meters, flow charts, on/off levels, pressure gauges on pumps, rpm and anything else deemed significant.
- Using available information and the trouble-shooting guide, systematically run through the system. Use a process of elimination to identify the cause of the failure. Check the level controls, pump operation using manual position, and check the pump outlet by pressing on the check valve counterweight as defined in the trouble-shooting guide. Once the cause is isolated, engage mechanical or electrical disciplines for repairs.



- Emergency personnel should be absolutely certain that the cause of the pump station alarm or failure has been properly identified and corrected prior to leaving the station.
- Reset any / all alarm feature indicator lights.

### **Submersible Type Stations**

- Take all safety precautions per training.
- Check the atmosphere within the wet well with a gas meter prior to working over the station.
- Note any unusual odors (burning electrical wires, hot or smoking oil or paint).
- Listen for any unusual noises and note if pumps are operating.
- Observe every piece of equipment in the station. Specific attention should be given to level controls. Note anything that looks out of place.
- Record all gauge readings from the control panel wet well level, hour meters, flow charts, on-off levels, pressure gauges on pumps rpm and anything else deemed significant.
- Using available information and the trouble-shooting guide, systematically run through the system. Use a process of elimination to isolate the cause of the failure. Check level controls, pump operation using the manual position and pump output by observing the check valve counterweight as defined in the guide. Once the cause is isolated, engage mechanical and electrical disciplines for repairs.
- Emergency personnel should be absolutely certain that the cause of the pump station alarm or failure has been properly identified and corrected prior to leaving the station.
- Reset any/all alarm feature indicator lights.
- The Operation and Maintenance (O&M) manual should be used to check the level sensors and pump controls. Pumps may be checked for operation by checking the arm of the check valve in the discharge line of an operating pump. If it feels “spongy” or soft when pressed downward, the pumps are pumping. If a breaker is off and the pump motor is hot to the touch, do not attempt to reset and start. If a pump motor is simply warm, one attempt to restart can be made. If the pump has lost prime or is plugged the check valve will not open.



- If there has been an overflow at any pump station, prepare a report of the time and duration of the spill, cause and corrective actions, personnel and equipment on site.
- If sewage overflowed the collection system, complete the Sanitary Sewer Overflow report form as required.
- Notify TDEC within the required 24 hours, followed by the Final Report within five days.



### 3.4.8 SORP-Pump Station Failure due to Secondary Power Failure

#### EMERGENCY PROCEDURES

- Dispatch crews to the pump station immediately. The crew needs to bring the auxiliary generator for that specific station as a backup. If the dedicated generator can't be repaired in a timely manner the auxiliary generator will be installed.
- Upon entry, identify the storage capacity in the well. This will give some indication of the time available for response. If flooded, skip to pump out steps under "Pumping Station Failure Inside Valve Pit, Pump or Valve Failure" procedures.
- Crew may request the assistance of the Electric Department in restoring power to the station.
- As they approach the station, the crew should check the overhead power lines for fuses that might be blown or downed power lines. If the crew notices a blown fuse or downed power lines, identify the location and pole number and notify the Electric Department.
- Lock out and tag out (LOTO) the main line.
- Check all components of the dedicated generator to determine failure. Use the manufacturer's prepared troubleshooting guide to aid in the diagnosis. If it cannot be repaired immediately, connect the portable generator to the auxiliary power connection located outside the building. Examine plug type and insure consistency. Use adapters as necessary.
- Follow manufacturer's recommendation for starting the generator.
- Obtain the service of a qualified generator repair company to address the repairs to the dedicated generator.
- Once the dedicated generator is repaired, place back into service and return auxiliary generator to storage. Operate the dedicated generator through several cycles to insure reliability.
- If sewage overflowed the collection system, complete the Sanitary Sewer Overflow report form as required.
- Notify TDEC within the required 24 hours, followed by the Final Report within five days.



### 3.4.9 SORP- Pump Station Failure inside Valve Pit, Pump or Valve Failure

#### EMERGENCY PROCEDURES

- Dispatch crew to the pump station immediately.
- Prior to viewing the wet well, measure the atmospheric conditions for sufficient oxygen and the presence of explosive or toxic gases.
- Upon arrival, the crew should determine the storage capacity of the wet well. This will give some indication of the time for response. If flooded, skip to pump-out steps.
- Inspect the main controls looking for failure indicators. Check processors to determine failure. If pump failure is determined, skip to wet well inspection steps.
- Inspect the valve pit. Observe all valves and force mains. If flooded, skip to pump out steps.
- Constantly monitor the atmospheric conditions while working in or above the wet well. Inspect the wet well, checking the floats or level system, bar rack and pump volute area for clogging or other problems.

#### Pump-Out Steps

- If pump failure, determine if pump out is necessary. If so, skip to repair procedures.
- Pump the flow with portable pumps. If necessary, call additional crews to bring appropriate portable pumps, suction and discharge hose to the station. Connect the portable pump placing the suction hose in the wet well and the discharge hose to a downstream manhole or pre-determined connection point. Start the portable pump and begin pumping.

#### Repair Steps

- Lock out and tag out (LOTO) the main line.
- Monitor the atmospheric conditions for sufficient oxygen and the presence of explosive or toxic gases. If safe, enter valve pit or wet well and inspect the piping and valves for cause of failure.



- Complete repairs to the pipe, pump or valve. If permanent materials are not available, install temporary repairs until the permanent repairs are complete.
- Restore facilities to normal and inspect other components of the force main and pumping system for signs of similar failure.
- Shut down portable pumping operations. Do not disconnect hoses until repair is checked for leaks. Operate pump to check repair under pressure and normal operating conditions.
- If no leak is observed, return pumps to normal operations by removing LOTO. Monitor pumps for leaks.
- Prepare a report indicating the time of the call, description of the problem, the repair work done, personnel present and equipment used.
- If sewage overflowed the collection system, complete the Sanitary Sewer Overflow report form as required.
- Notify TDEC within the required 24 hours, followed by the Final Report within five days.

#### **4.0 Sanitary Sewer Overflow (SSO) Discovery, Recording and Reporting Process**

- All SSO's should be recorded and reported for future reference.
- Recorded data should include:
  1. Date
  2. Time SSO started
  3. Time SSO stopped
  4. Location (address, manhole number)
  5. Cause (grease, roots, blockage, etc.)
  6. Estimated volume
  7. Ultimate destination (river, storm drain, ditch, etc.)
  8. Corrective action taken to stop SSO
  9. How SSO was initially reported
  10. Names of responders



11. Sewer system component from which the SSO was released (manhole, crack in pipe, pump station wet well, constructed over flow pipe).
12. Date of last SSO at same location if there was one.
13. Report of all notifications to the public and other agencies or departments.

#### **4.1 SSO Evaluation and Review**

- A responding crewmember shall sign all sanitary sewer overflow report forms.
- All reports of SSO's shall be reviewed by a supervisor and signed.
- The City shall keep all SSO reports for a period of not less than 5 years from the date of the overflow.
- The City shall keep customer complaints concerning SSO's for a period of not less than 5 years.
- Being consistent with the NPDES permit, if five SSO's occur at the same location over a 12 month period, a detailed plan shall be submitted to TDEC on the City's plans to resolve this issue.
- A monthly meeting shall be scheduled for administrative, supervisors and crew leaders to review all SSO's that have occurred. A plan of action shall be established on how to prevent a repeat of SSO's. This could include point repairs, grease control, root eradication, cleaning of lines, replacement of lines, pump station repairs or replacement, etc. Minutes of all meetings shall be kept and reviewed.

#### **4.2 Reporting Process**

Two forms for reporting each SSO to TDEC are included in Appendix C. One is an initial form to email (addresses already on form) within 24 hours and one is a form for a final report.

- A Sewer Overflow Report shall be completed on all overflows.
- All SSO's shall be reported to TDEC within 24 hours of the time the City first became aware of the SSO. This initial report shall be sent by email.
- A copy of the Final Overflow Report shall be faxed to TDEC within five days of the overflow.
- The City shall identify and establish a list of SSO locations within the collection system that have been recorded as overflowing more than once and are likely to occur first in the event of a pump station failure or rain event. The City shall establish routine inspection routes to be performed during and after each rain event. This would specifically include all pump



stations that are not monitored via telemetry, SCADA or other remote monitoring devices.

- Any SSO that occurs, which management determines might impose a health risk to the public, shall be properly posted with signs, taped off, etc. Local news media may be notified as needed to inform the public.

#### **4.3 Other Public Notifications**

Should the posting of surface water or ground surfaces to an overflow be deemed necessary by TDEC, the City shall comply as directed.

Signs shall be posted to notify the public of bypass/overflow points that have discharged five or more times in the last year and shall be clearly visible to the public. The minimum size shall be two feet by two feet with one-inch letters. The sign shall be made of durable material and have a white background with black letters.

City of Oak Ridge Administration shall determine further public notification through the use of printed or electronic news media.

##### **4.3.1 Contact Information**

**John West – TDEC, Knoxville Basin Office; (865) 594-5522;**  
[John.West@tn.gov](mailto:John.West@tn.gov)

**Farokh Kamel – TDEC, Knoxville Basin Office; (865) 594-5586;**  
[Farokh.Kamel@tn.gov](mailto:Farokh.Kamel@tn.gov)

**Lanny Bonds – TDEC, Knoxville Basin Office; (865) 594-5594;**  
[Lanny.Bonds@tn.gov](mailto:Lanny.Bonds@tn.gov)

**Gabe Davis – Anderson County Health Dept.; (865) 425-8777;**  
[Gabe.Davis@tn.gov](mailto:Gabe.Davis@tn.gov) Gabe said ACHD doesn't require notification.



#### 4.4 Likely Overflow Sites

When a rain event occurs, City crews will inspect each sewer pump station that is not monitored at a central location by a remote monitoring device. Crews will also inspect a list of all manholes known to have overflowed more than once. Inspections will begin at the eastern most part of the collection system and work west.

A manhole that overflows which is not on the duplicate overflow list will have the lines cleaned and tv'd as marked on the SSO report, to determine if repairs are needed. City crews will make needed repairs if feasible. If not, the report is given to the City's Engineer to be contracted for repair. The location goes to the Sewer Maintenance Crew to watch and keep the lines flowing. The Sewer Maintenance Crew Chief maintains a list of locations to clean on a routine basis until repairs are made. A manhole that overflows more than once within a 12 month period will be added to the duplicate overflow list. The Operations & Maintenance Manager will maintain the overflow list along with the Crew Chief.

SSO locations will be removed from the duplicate overflow list after the areas mini-system has been rehabbed and there are no more SSO's after significant rainfalls that would have previously caused the SSO.

In accordance with the NPDES permit, a **rainfall event** is defined as any occurrence of rain, preceded by 10 hours without precipitation that results in an accumulation of 0.01 inches or more. Instances of rainfall occurring within 10 hours of each other will be considered a single rainfall event.

Listed below are overflow points in the collection system that have overflowed at least twice in the past two years. Dates, location and manhole number are included. Also listed are likely overflow points if a wastewater lift station fails.



**Locations of Duplicate SSO's from 9/1/08-9/30/10**

12/9/2009	119 Athens Road	Manhole D1018
12/18/2009	119 Athens Road	Manhole D1018
11/4/2009	151 Cairo Lane	Manhole G22-14
12/9/2009	151 Cairo Lane	Manhole G22-14
12/25/2009	151 Cairo Lane	Manhole G22-14
12/10/2008	117 N. Purdue Avenue	Manhole D-40
12/11/2008	117 N. Purdue Avenue	Manhole D-40
1/7/2009	117 N. Purdue Avenue	Manhole D-40
5/6/2010	115 Athens Road	Manhole D1010
1/25/2010	115 Athens Road	Manhole D1010
1/22/2010	151 Cairo Lane	Manhole G2213, G2214
1/26/2010	151 Cairo Lane	Manhole G2213, G2214
2/8/2010	151 Cairo Lane	Manhole G2213
5/6/2010	151 Cairo Lane	Manhole G2214
5/7/2010	151 Cairo Lane	Manhole G2214
1/25/2010	103 Dallas Lane	Manhole D809
2/5/2010	103 Dallas Lane	Manhole D809
1/22/2010	216 South Illinois Avenue	Manhole J1116
1/25/2010	216 South Illinois Avenue	Manhole J1116
2/5/2010	216 South Illinois Avenue	Manhole J1116
2/5/2010	216 South Illinois Avenue	Manhole J1116
5/3/2010	216 South Illinois Avenue	Manhole J1116
1/25/2010	103 Mohawk Road	Manhole C325
2/5/2010	103 Mohawk Road	Manhole C325
1/25/2010	1403 Oak Ridge Turnpike	Manhole G118
2/5/2010	1403 Oak Ridge Turnpike	Manhole G118
2/5/2010	1403 Oak Ridge Turnpike	Manhole G118
5/3/2010	1403 Oak Ridge Turnpike	Manhole G118
5/3/2010	1403 Oak Ridge Turnpike	Manhole G118
1/25/2010	535 Oak Ridge Turnpike	Manhole F702
5/3/2010	535 Oak Ridge Turnpike	Manhole F702
2/5/2010	117 North Purdue Avenue	Manhole G1513
5/3/2010	117 North Purdue Avenue	Manhole G1513



## SSO Locations Likely if Wastewater Lift Stations Fail

<b>Station</b>	<b>SSO Location</b>
1. Westview Ln. (129 Westview Ln.)	MH A3W22 at station
2. William Ln.	MH AN4W-9 at station
3. Whippoorwill Ln. (104 Whippoorwill Ln.)	MH A3W-22 at station
4. West Outer Dr. (1129 W. Outer Dr.)	MH A8W-1 at station
5. Southwood Ln. (E. Southwood at Shagbark Ln.)	MH F5W-2 at station
6. Oak Hills (Oak Ridge Tnpke. east of Westover)	MH 2W-9 at station
7. Gum Hollow (197 Gum Hollow)	MH H2W-2 at station
8. Graceland (113 Graceland Rd.)	MH H4W-6 at station
9. Turtle Park (Monterey Rd.)	MH D22 at 2491 ORT
10. Peach Orchard (105 Wedgewood Rd)	MH G13-22 at station
11. Home Depot	MH G1723 at 175 Laboratory
12. Fairbanks (545 Oak Ridge Tnpke)	At the station
13. Emory Heights (Coe Rd.)	MH G20-4A at 103 Clark Ln.
14. Warehouse Rd. (East of Dresden)	MH F804A at 503 Warehouse
15. East Plant (151 Cairo Rd.)	MH G22-13 at station
16. Castlewood (Arcadia Ln.)	MH D1103B on Arcadia Ln.
17. WATO (113 Eastburn Ln.)	MH C1203 at 112 Eastburn Ln.
18. Riversway (120 Marywater Ln)	MH F24-13 at station
19. Gregory's (Melton Lk. Peninsula)	MH G24-7 at 59 Riversway Dr.
20. Palisades #1 (10 Palisades)	MH G23-2 at station
21. Palisades #2 (18 Palisades)	MH G23-3 at station
22. Palisades #3 (28 Palisades)	MH G23-10 at station
23. Palisades #4 (40 Palisades)	MH G22-22 at 42 Palisades
24. Marina (695 Melton Lk.)	MH L24-1 at station
25. Summit Ridge (720 S. Ill. Ave.)	MH N14-9 at station
26. Emory Valley (301 Emory Valley)	MH L22-20 at station
27. Rivers Run (100 Rivers Run Blvd.)	MH P25-2 at 3 Rivers Run Blvd
28. Radisson Cove	MH P26-2 at station
29. Rolling Links (51 Rolling Links)	MH Q26-11 at station
30. Rock Bridge Greens (117 Rock Bridge)	MH R24-8 at station
31. Park Meade (1402 Edgemoor Rd.)	MH U21-1 at station
32. Centennial Bluff (300A Centennial Bluff)	At station
33. Pump House Rd.	MH U14-13 at station
34. Scarboro Rd.	At station
35. Wolf Creek (108 Pavilion Dr.)	At station



## Estimating Volumes from SSO

To determine the amount of gallons in a sewage discharge, the volume of the discharge must be determined. A reference sheet with pictures for estimating overflows showing water at various gpm discharging from manholes is included in Appendix D. The following are some examples of other ways to determine the total volume:

### Example 1:

A discharge of 100 ft. x 100 ft. x 0.5 ft.

If it is a rectangular ponded area:

Volume= Length (ft.) x Width (ft.) x Depth (ft.)  
X 7.48 gal/ cu ft. = Gallons

100ft x 100ft x .5 ft. x 7.48= 37,400 gallons

### Example 2:

A discharge 100 ft. diameter x 0.5 ft.

If it is a circular ponded area:

Volume= Diameter (ft. squared) x .785 x Depth (ft.) x 7.48 gal/ cu ft. = Gallons

100 ft. diameter circular pond

100ft x 100ft x .785 x 0.5 x 7.48= 29,359 gallons

If an overflow has been discharged into a storm drain, the gallons must be estimated by the elapsed time of the overflow multiplied by the number of services connected by 200 gallons per household per 24 hours.

### Example 3:

If there are 6 houses on a line and it has been overflowing for 24 hours:

Volume= 6 houses x 200 gal per house = 1,200 gallons

### Example 4:

If there are 60 houses on a line and it has been overflowing for 1 hour:

60 houses x 200 gal per house/24 hrs. divided by 24 hours a day = 500 gallons



## 5.0 Training

The commitment of management to training is key to a successful program. A collection system with untrained or poorly trained collection system personnel runs a greater risk of experiencing noncompliance.

The following elements are essential for an effective training program:

- Fundamental mission, goals, and policies of the collection and treatment facility are addressed.
- Mandatory training requirements are identified for key employees.
- On-the-job training progress and performance are measured.
- Effectiveness of the training is assessed including periodic testing, drills or demonstrations.
- New employees receive training.

**The City will continue to provide training in the following areas:**

- Routine line maintenance (on the job training)
- Safety during confined space entry
- Traffic control
- Record keeping
- Pump station O&M
- Electrical and instrumentation (formal or OJT)
- Public relations and customer service
- SSO/Emergency response
- Pipe repair (trenching/shoring)

### **Sources of Training**

- Manufacturer
- In-house
- On-the-job (OJT)
- Industry wide (consultants, regulatory authorities, professional associations, or educational institutions)



The Operations and Maintenance Manager shall be responsible for routinely assess the effectiveness of training through periodic testing, drills, demonstrations, or informal reviews and improve training based on this assessment.

### **5.1 Review and Update SORP**

The City of Oak Ridge will review the SORP annually during the month of July and amend it as appropriate. Review shall include, as a minimum, the following:

- Conduct workshops with supervisors and key personnel to review response activities and gather suggestions for new or revised procedures.
- Review all contact lists and update as necessary.
- Update the SORP when TDEC issues a new or revised NPDES permit.



## APPENDIX A--ORGANIZATIONAL CHARTS

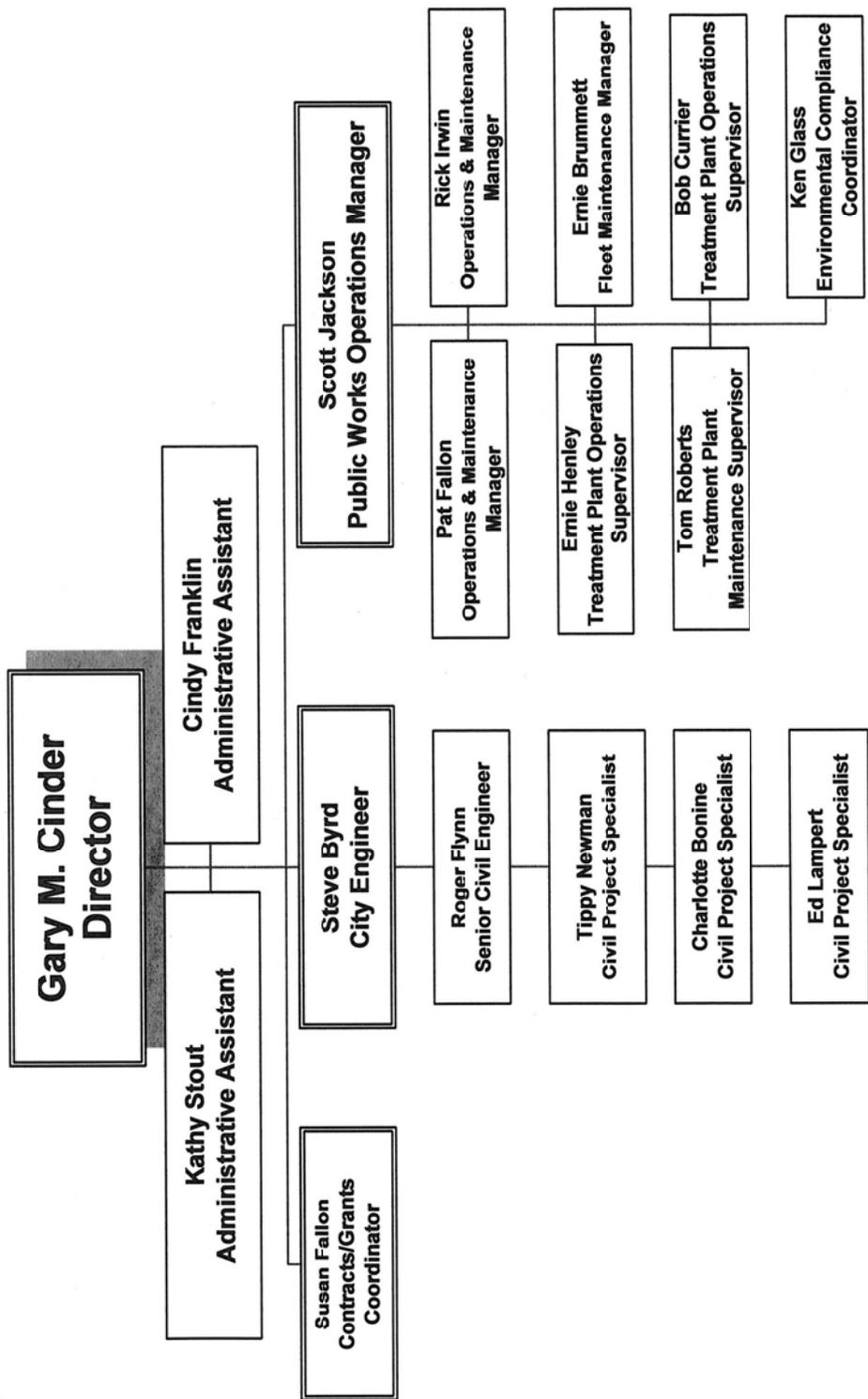
**PW Supervision**

**PW Treatment Plants**

**PW Work Pool**



**PW Supervision**



Updated by:  
Kathy Stout  
April 8, 2011

Page 1



# PW Treatment Plants

Scott Jackson  
Public Works  
Operations Manager

## Water Plant

Ernie Henley  
Treatment Plant  
Operations  
Supervisor

Allen Aull  
Senior Treatment Plant  
Operator

Nathan Dison  
Treatment Plant Operator

Mark Terry  
Treatment Plant Operator

Terry Howard  
Treatment Plant Operator

Dustin Loflin  
Treatment Plant Operator  
(Trainee)

Jeremy Justice  
Treatment Plant Operator  
(Trainee)

Mike Smith ETP  
Senior Treatment Plant  
Operator

## Wastewater Plant

Bob Currier  
Treatment Plant  
Operations  
Supervisor

Pete McGhee  
Senior Treatment Plant  
Operator

Mitchell Price  
Senior Treatment Plant  
Operator

William Sharp  
Senior Treatment Plant  
Operator

Randy Covey  
Senior Treatment Plant  
Operator

Frank Matthews  
Senior Treatment Plant  
Operator

Don Rose  
Treatment Plant  
Operator

Willie Strickland  
Treatment Plant  
Operator

Marty McFalls  
Equipment Operations  
Specialist

Tom Roberts  
Treatment Plant Maintenance  
Supervisor

James Roberts  
Treatment Plant  
Maintenance  
Specialist

Ronnie Hill  
Treatment Plant  
Maintenance Crew  
Chief

Terry Tedder  
Senior Treatment  
Plant Maintenance  
Specialist

Mike Christopher  
Senior Treatment  
Plant Maintenance  
Specialist

Tim Ward  
Maintenance  
Mechanic

Maintenance Worker

Harry Harris  
Treatment Plant  
Maintenance Crew  
Chief

Calvin Hunt  
Senior Treatment  
Plant Maintenance  
Specialist

Ronnie Sharp  
Senior Treatment  
Plant Maintenance  
Specialist

Mark McBee  
Maintenance  
Mechanic

Ken Glass  
Environmental  
Compliance  
Coordinator

Janice Duncan  
Administrative  
Assistant

Tom Thompson  
Laboratory  
Technician

Updated by:  
Kathy Stout  
April 8, 2011





## APPENDIX B--EQUIPMENT AND TOOLS



- Jet Rodder and assorted cleaning/cutting attachments
- Air blower with hose
- Power Vacuum
- Portable pumps
- Portable generators
- Safety cones/barricades
- Gas meter
- Confined space entry tripod and assorted equipment
- Map book
- Closed circuit television camera unit
- Truck with hoist
- Power saw
- Debris basket
- Pole hoe
- Sand bags
- Vac-truck
- Pipe cutters
- Floatation booms
- Safety harness and lifeline
- Caution tape
- Hoses
- Backhoe or track hoe
- Standard disinfectants
- Lime
- Emergency lights
- Flash lights



- Assorted types of hand tools
- Assorted types of electrical repair and testing equipment
- First aid kit



## **APPENDIX C--TWO SSO FORMS**

**Initial 24 hr. Notice**

**Final Report**



**Stout, Kathy**

---

**Sent:** Friday, October 08, 2010 1:16 PM  
**To:** 'John West'  
**Cc:** Jackson, Scott; Irwin, Rick; Cinder, Gary; 'Farokh.Kamel@tn.gov'; Lanny.Bond@tn.gov; Currier, Robert  
**Subject:** 24 Hour Notification of a Sanitary Sewer Overflow

## City of Oak Ridge 24 Hour Notification of a Sanitary Sewer Overflow

NPDES Permit # [REDACTED] TN0024155  
Or  
NPDES Permit # [REDACTED] TN0078051

Form filled out by (Name): [REDACTED]

Overflow Date: [REDACTED]

Manhole #: [REDACTED]

Address (Or Nearest Address To Overflow): [REDACTED]

As mandated by our NPDES Permit, a written report with the required information of the sanitary sewer overflow will be submitted within the next five days. If you have any further questions regarding this matter, please call (865) 425-1875. Thank you.

***Rick Irwin***  
***City Of Oak Ridge***  
***Operations and Maintenance Manager***



CITY OF OAK RIDGE  
REPORT DATE: [ ] SANITARY SEWER OVERFLOW FINAL REPORT NPDES PERMIT # TN0024155

LOCATION DATA  
LOCATION: [ ] 1<sup>st</sup> Occurrence at this location? Y  N

If No, Date of Last Occurrence: [ ]

POINT OF OCCURANCE

Manhole  Clean Out  In-House Backup  Lift Station Name: None or None or None

If Manhole; Give Mini-system # [ ] Map Page # [ ] Manhole # [ ] Force Main:

FLOW DATA

Start Date: [ ] Time: [ ] AM  PM  End Date: [ ] Time: [ ] AM  PM

Duration [ ] hours/minutes Est. Flow Rate: [ ] gpm Estimated Total Flow: [ ] gallons

CAUSES

(Check all that apply)

Rainfall  [Estimated amount [ ] in] Power Outage  Equipment Failure

Broken Sewer  Blocked line from Roots  Grease  Collapse  Other

Explain causes of overflow: [ ]

REMEDIAL MEASURES TO CORRECT, PREVENT OR MINIMIZE FUTURE OCCURANCES

Line was: Jet Rodded  Nozzle  Root Saw  Lid Removed  Lined  Equipment Repair

Line will be: cleaned and TV'd for needed repair:  Other: [ ]

WHERE DID DISCHARGE GO (Check all that apply)

Did flow run to surface water: Yes  No  Name of surface water: [ ]

Ran on/in: Ground & absorbed into soil  Ditch  Storm Sewer

Basement Back-up  No. of basements [ ] Use (i.e., commercial, residential) [ ]

Other (describe) [ ]

Notified Public: Yes  No  How: City Web Site  The Oak Ridger  Signs Posted  Date: [ ]

Names of Responders: [ ]

Report completed by \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_

Reviewed by \_\_\_\_\_ Title: \_\_\_\_\_ Date: \_\_\_\_\_

Initial TDEC Notification By: [ ] Date: [ ]

After Review & \_\_\_\_\_ Title: Operations Manager Date: \_\_\_\_\_  
Notification to TDEC

Final Review \_\_\_\_\_ Title: Public Works Director Date: \_\_\_\_\_

Final Report Transmitted to TDEC By: \_\_\_\_\_ Date: \_\_\_\_\_

Revision 9

Kathy Stout

December 8, 2010



**APPENDIX D--PHOTOS-ESTIMATING SSO's FROM MANHOLES**

