Maintenance Management System Program

DeKalb County
Department of Watershed Management

July 2015

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Acronyms

ARV	Air/Vacuum Release Valve
AWWTF	Advanced Wastewater Treatment Facility
CCTV	Closed Circuit Television
CERP	Contingency and Emergency Response Plan
C&M	DeKalb County, Department of Watershed Management, Construction and Maintenance
CIP	Capital Improvement Program
CIPP	Cured in Place Pipe
CMMS	Computerized Maintenance Management System
County	DeKalb County
DWM	DeKalb County, Department of Watershed Management
EPA	U.S. Environmental Protection Agency
EPD	Georgia Environmental Protection Division
FOG	Fats, Oil, and Grease
GIS	Geographical Information System
gpm	Gallons per Minute
GPS	Geographic Positioning System
HMI	Human Machine Interface
I/I	Infiltration/Inflow
KPI	Key Performance Indicator
MACP	Manhole Assessment Certification Program
MGD	Million Gallons per Day
MMS	Maintenance Management System
O&M	Operation and Maintenance
OSARP	Ongoing Sewer Assessment and Rehabilitation Program
PACP	Pipeline Assessment Certification Program
PASARP	Priority Areas Sewer Assessment and Rehabilitation Program

PTT	Push-to-Talk
SCADA	Supervisory Control and Data Acquisition
SOP	Standard Operating Procedure
SSO	Sanitary Sewer Overflow
WAM	Work and Asset Management
WCTS	Wastewater Collection and Transmission System
WQC	Water Quality Control

1 Introduction

1.1 Overview

DeKalb County, Georgia (the County), Department of Watershed Management (DWM) has developed and has been implementing a Maintenance Management System (MMS) Program with the goal of facilitating effective operation and maintenance (O&M) activities associated with the Wastewater Collection and Transmission System (WCTS). This MMS Program document has been prepared in accordance with the requirements of the Consent Decree, DeKalb County, Civil Action File No. 1:10-CV-4039-WSD requirements at VI.B (iv) 21, 22, and 23 (the Consent Decree). The County is required to submit the MMS Program to the U.S. Environmental Protection Agency (EPA) and the Georgia Environmental Protection Division (EPD) on December 20, 2013, for review and comment. Each section of the MMS Program provides specific tools and procedures that are used to advance the goal of the program.

The County's MMS Program involves a combination of preventive, corrective, and predictive inspection and maintenance activities to maintain the WCTS. The Program is divided into two key areas: (1) tools that support the maintenance activities and (2) specific maintenance activities performed for the County's gravity system, lift stations, and force mains. Section 2 *Communication Systems*, Section 3 *Physical Inspection and Testing*, Section 4 *Information Management*, and Section 5 *Inventory Management* describe the tools used to support maintenance activities. Sections 6 *Gravity System Maintenance* and Section 7 *Lift Stations, Force Mains, and Appurtenances* describe the County's maintenance activities established under the MMS Program. Section 8 provides *Key Performance Indicators* that will enable the County to measure its performance.

Table 1-1 provides a summary of the MMS Program sections for each applicable Consent Decree element.

TABLE 1-1
Summary of MMS Program Sections and Applicable Consent Decree Element

MMS Sections	Consent Decree Elements
Section 1 – Introduction	**21:** The County has in place a MMS Program. No later than 24 months from the Date of Entry, the County shall re-evaluate and submit to EPA/EPD, for review and comment, its MMS Program. The goal of the MMS Program is to facilitate effective O&M activities associated with the WCTS. The MMS Program shall be submitted to EPA/EPD to ensure consistency with the following criteria:
Section 2 – Inspection and Testing	**21 (a):** Written physical inspection and testing procedures (i.e., television, visual, smoke, dyed water, and others).

TABLE 1-1
Summary of MMS Program Sections and Applicable Consent Decree Element

MMS Sections	Consent Decree Elements
Section 3 – Communication Systems	**21 (b), (i):** 21(b): Identification of the means and modes of communication between lift stations, field crews, and supervising staff. 21 (i): A description of resource commitments such as staffing, contractual support and equipment.
Section 4 – Information Management	**21 (j), (k), (m), (n):** 21 (i): A description of resource commitments such as staffing, contractual support and equipment. 21 (k): A common information system that the County uses to track implementation of the MMS Program, track maintenance activities (including lift station equipment histories), and track management, and O&M performance indicators. 21 (m): Written procedures for generation of maintenance work orders. 21 (n): Reports which list equipment problems and the status of work orders generated during the prior month.
Section 5 – Inventory Management	**21 (i), (j):** 21 (i): A description of resource commitments such as staffing, contractual support and equipment. 21(j): An inventory management system that includes: (1) lists of critical equipment and critical spare parts; (2) an inventory of the critical spare parts and critical equipment stored at the County's facilities, and a list of where the remaining critical spare parts and critical equipment may be secured to allow repairs in a reasonable amount of time; and, (3) written procedures for updating the critical spare parts and equipment inventories in the inventory management system.
Section 6 – Gravity Line and Appurtenances	**21 (f), (g), (h), (i)** **22 (c), (d)** 21 (f): Written preventive maintenance schedules, practices, and procedures as more particularly described in Paragraph 22 below. 21 (g): Written corrective maintenance practices and procedures. 21 (h): Schedules for the maintenance of easements. 21 (i): A description of resource commitments such as staffing, contractual support and equipment. 22 (c): Inspection and cleaning of Gravity Sewer Lines and manholes. 22 (d): Inspection of sewer and Force Main easements, including inspection of: creek crossings, stream bank encroachment toward Gravity Sewer Lines and Force Mains, and easement accessibility (including the need to control vegetative growth or encroachment of man-made structures or activities that could threaten the integrity of the affected Gravity Sewer Lines or Force Mains). Inspections shall include written reports, and where appropriate, representative photographs or videos of appurtenances being inspected (e.g., manholes, creek crossings, etc.). Inspectors shall promptly report any observed SSOs to their area supervisors and shall record any evidence of SSOs which may have occurred since the last inspection. Any observed SSO shall be promptly reported in accordance with the Contingency and Emergency Response Plan.

TABLE 1-1
Summary of MMS Program Sections and Applicable Consent Decree Element

MMS Sections	Consent Decree Elements
Section 7 – Lift Station, Force Mains and Appurtenances	**21 (c), (d), (e) ,(f), (g), (i)** **22 (a), (b)** 21 (c): Written WCTS operations, practices, and procedures. 21 (d): Technical specifications of each lift station in the WCTS, including critical response time (defined as the time interval between activation of the high wet well level alarm and the commencement of a SSO) under peak flow conditions. 21 (e): A description of a lift station monitoring system which shall continuously monitor, report, and transmit information for each pump station. 21 (f): Written preventive maintenance schedules, practices, and procedures as more particularly described in Paragraph 22 below. 21 (g): Written corrective maintenance practices and procedures. 21 (i): A description of resource commitments such as staffing, contractual support and equipment. 22: Preventive maintenance activities as required in subparagraph 21 (f) above shall be scheduled appropriately and shall include, but not be limited to, written procedures for: 22 (a): Periodic service and calibration of instrumentation such as flow meters, liquid level sensors, alarm systems, elapsed time meters, and remote monitoring equipment. 22 (b): Predictive (including non-physical inspections) and/or physical inspection and service for all lift stations; and inspection and service for air release valves.
Section 8 – KPI Summary and List	**21 (l):** The key performance indicators ("KPIs") the County will track to measure performance of the WCTS using the information system referenced in the above Paragraph. These KPIs shall: (1) include, but not be limited to, materials costs, the linear footage of Gravity Sewer Line inspections, the linear footage of Gravity Sewer lines cleaned, the number of manholes inspected, and the number of SSOs per mile of Gravity Sewer Line; and (2) be tracked by the type of maintenance activity: corrective, preventive, and emergency.
Appendices	Procedures and Supporting Information

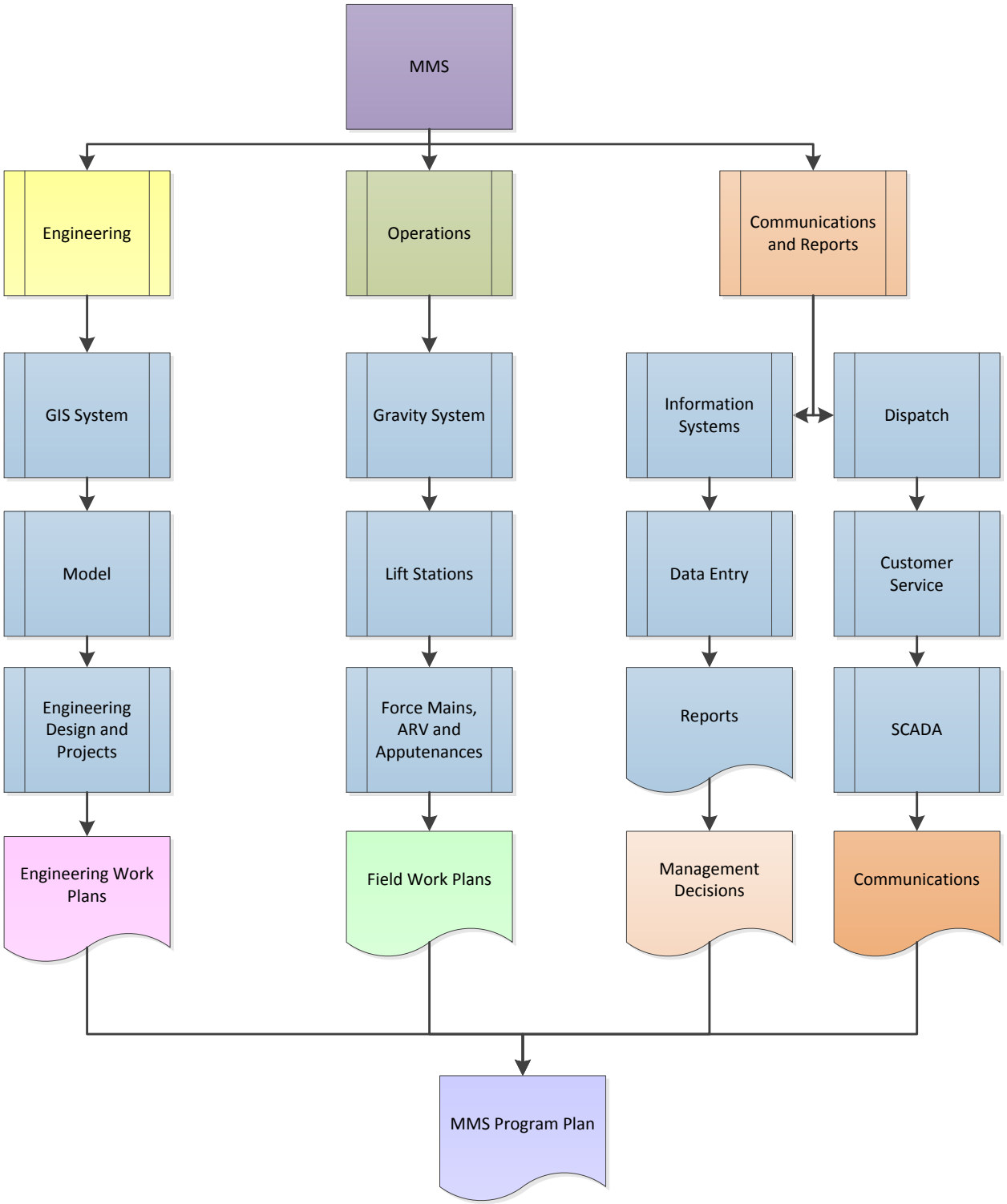
In implementing the MMS Program, the County is tracking maintenance activities and determining the effectiveness of those measures, using selected key performance indicators (KPIs) also referred to as performance measures. Figure 1-1 provides an overview of the MMS Program planning process and highlights areas that integrate into the MMS Program through three major groups and functions:

- The Engineering Group manages the GIS and Hydraulic Modeling functions to provide technical assessment data. They, in turn, use this data as part of their project development for large-scale improvement projects.
- The Operations Group manages the day-to-day O&M of the gravity system, lift stations, force mains, and appurtenances. During their course of work, data and information are gathered and reported through appropriate systems that are utilized for system evaluations and improvements.

- The Communications Group 1) manages the various data and enters it in the appropriate information system for historical and planning purposes and controls the routing of all requests for service to the appropriate entity for action; and 2) processes the data and information for program management decisions under the Consent Decree.

Each of the program areas is discussed in detail in the MMS Program. As data is gathered through system O&M, this data is also used to continually improve various systems and plans in place. The MMS Program is updated as each program area makes individual improvements or changes through the work and evaluation processes.

FIGURE 1-1
MMS Overview



1.2 Background

The County continues to implement an effective O&M program. For instance, in the last several years, the County has been assessing the condition of its manholes and based on the results to date, more than 90 percent had no structural defects. Similarly, in 2010, the County evaluated a representative portion of its WCTS for excessive infiltration and inflow (I/I) and found that the County's WCTS has insignificant amounts of I/I during periods of wet weather. The MMS Program, which formalizes and improves on current programs, will ensure the long-term viability of the WCTS and is designed to significantly reduce sanitary sewer overflows (SSOs).

1.2.1 WCTS Description

The County's WCTS consists of an estimated 2,600 miles of sewers, 66 lift stations, and an estimated 61,500 manholes. The system conveys wastewater primarily to the County's two plants, Pole Bridge Advance Wastewater Treatment Facility (AWWTF) and Snapfinger AWWTF. In addition, wastewater is conveyed to the City of Atlanta's Wastewater treatment facility R.M. Clayton Plant. Detailed information on gravity lines, force mains, and lift stations are provided in Section 6, *Gravity Line, Force Mains, and Appurtenances*; and Section 7, *Lift Stations* and Table 7-2, Lift Station List. Figure 1-2, titled *Overview of Major Sewer Basins and Wastewater Treatment Facilities* and Figure 1-3, titled *Overview of Lift Stations, Gravity Mains, and Force Mains* are provided in the following pages.

The County utilizes a computerized maintenance management system (CMMS), other software, and advanced data management systems to track its maintenance data. Section 3, *Communications Systems*; Section 4, *Information Management*; and Section 5, *Inventory Management* provide detailed information on data management systems used in DWM's MMS Program.

1.2.2 Sewersheds

The County is divided into three sewer basins (Intergovernmental, Snapfinger, and Pole Bridge) containing 35 sewersheds (two of which do not contain sewer lines). Refer to Figure 1-3, *Overview of Lift Stations, Gravity Mains, and Force Mains.* The following are summary descriptions of the three sewer basins:

- *Inter-Governmental Basin*: The Intergovernmental Basin is divided into the following nine sewersheds: Ball Mill Creek, Camp Creek, Lucky Shoals Creek, Marsh Creek, Northeast Creek, Nancy Creek, North Fork Creek, South Fork Creek, and Peavine Creek. This basin contains an estimated 1,136 miles of sanitary sewers and an estimated 25,800 manholes.

  Approximately 36 million gallons per day (MGD) of wastewater generated within the Intergovernmental Basin is collected, transmitted, and treated at the City of Atlanta R. M. Clayton Water Reclamation Facility under an intergovernmental agreement with the City of Atlanta. Sewers located within the City of Atlanta, through which wastewater from the Intergovernmental Basin flows, are owned and maintained by the City of Atlanta under the above-mentioned intergovernmental agreement.

- *Snapfinger Basin*: This basin is divided into the following 15 sewersheds: Barbashela Creek, Blue Creek, Cobb Fowler Creek, Conley Creek, Constitution Area, Corn Creek, Doolittle Creek, Indian Creek, Intrenchment Creek, Lower Snapfinger Creek, Shoal Creek, South River, Sugar Creek, Upper Snapfinger Creek, and Upper Stone Mountain. This basin contains an estimated 1,098 miles of sanitary sewers and an estimated 25,100 manholes.

  There are two areas served by septic tanks in the Snapfinger Basin. These areas include approximately one-third of the Cobb Fowler Creek Sewershed and the entire Upper Stone Mountain Sewershed.

- *Pole Bridge Basin*: The Pole Bridge Basin is divided into the following 11 sewersheds: Crooked Creek, Honey Creek, Johnson Creek, Lower Crooked Creek, Lower Stone Mountain, Pine Mountain Creek, Plunket Creek, Polebridge Creek, Swift Creek, Upper Crooked Creek, and Yellow River. This basin includes an estimated 398 miles of sanitary sewer and an estimated 10,600 manholes.

FIGURE 1-2
Overview of Major Sewer Basins and Wastewater Treatment Facilities

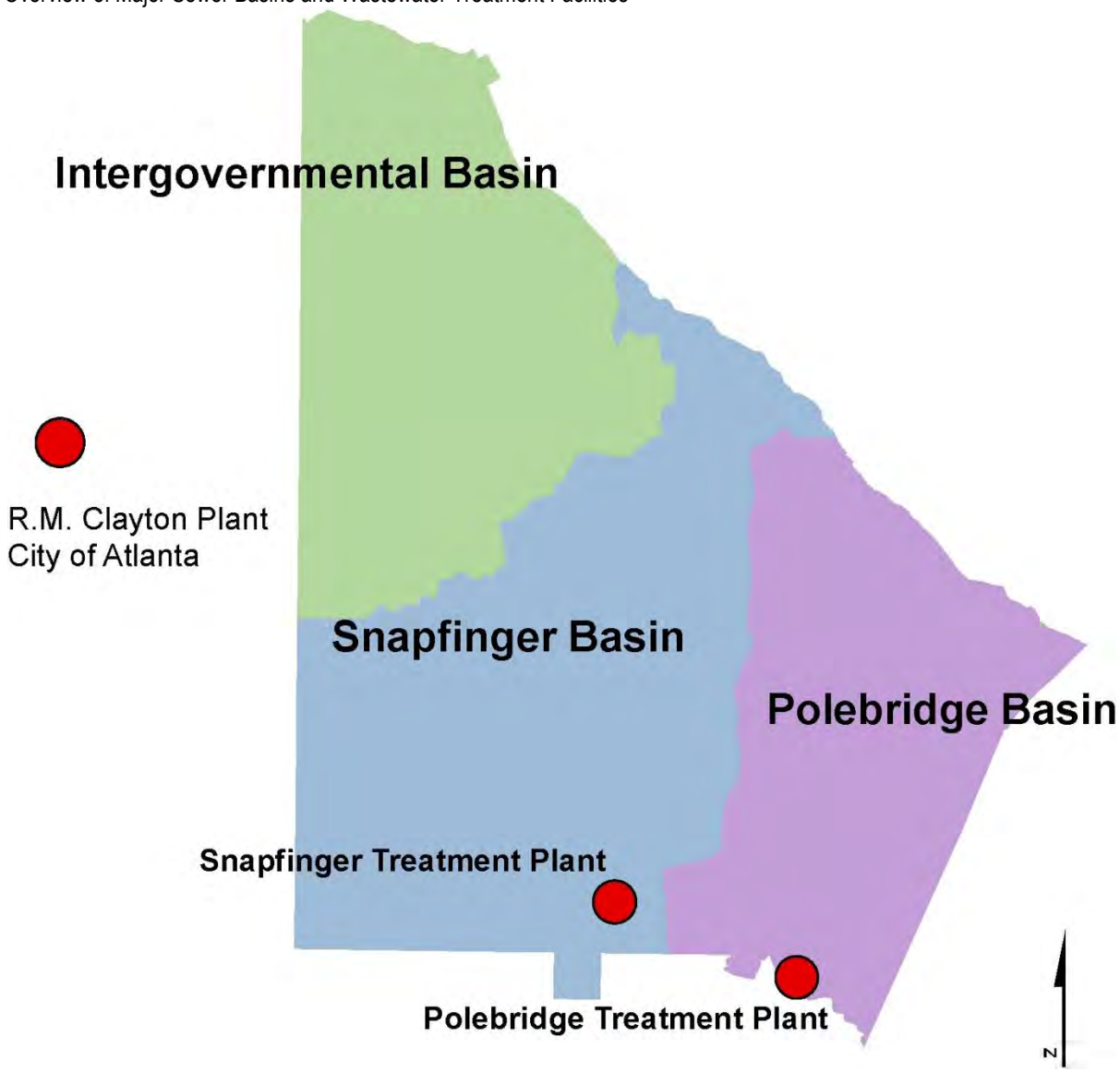
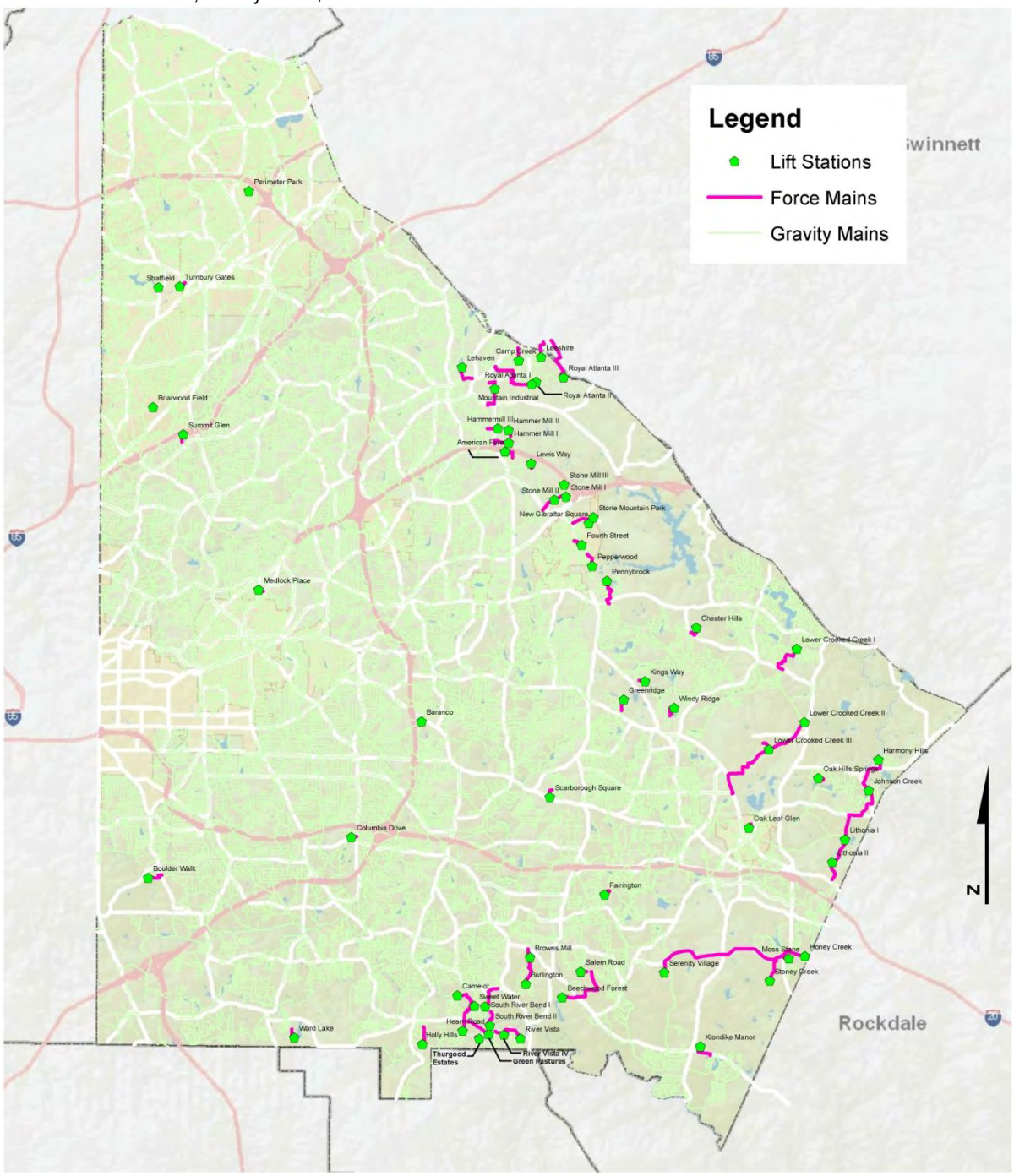


FIGURE 1-3
Overview of Lift Stations, Gravity Mains, and Force Mains



1.2.3 MMS Program Resources

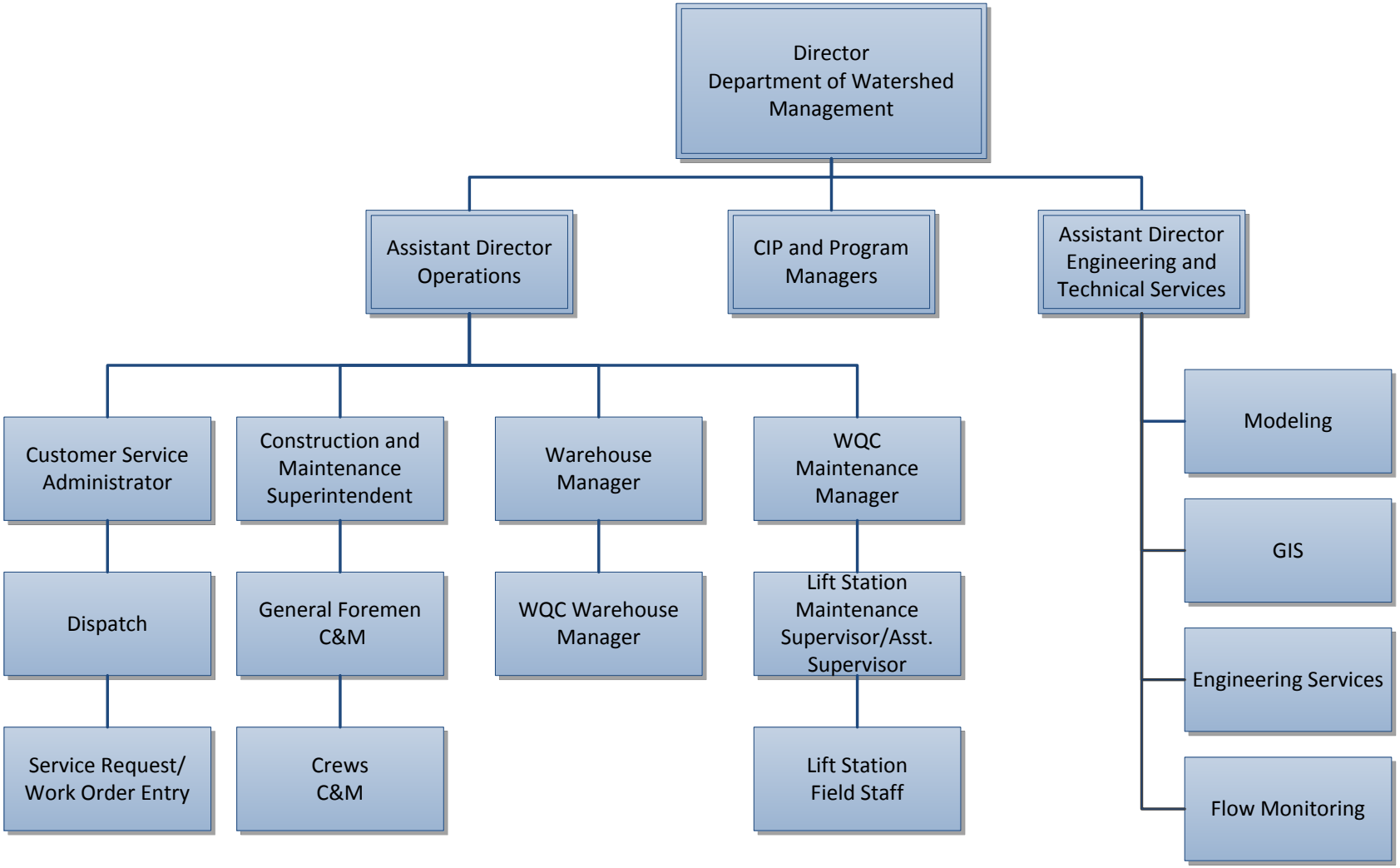
In order to promote effective O&M of its WCTS, the County maintains equipment and support personnel to perform preventive, corrective, and predictive maintenance activities. Each section of the MMS contains a detailed listing of resources related to the topics of communications, information management, inventory management, gravity line maintenance, and lift station maintenance. Figure 1-4 depicts the current organizational chart for DWM.

In addition, the County has hired a contractor to serve in the capacity of Program Manager to assist the County with the implementation of Consent Decree sewer system improvement programs, including the MMS Program. The County developed and continues to improve and implement Capacity, Management, Operations, and Maintenance programs as part of its Consent Decree requirements. The County is currently implementing the EPA approved programs. The approved programs are listed below and referenced in this MMS Program, where applicable:

- Sanitary Sewer Overflow Contingency and Emergency Response Plan (CERP)
- Sewer Mapping Program
- Priority Areas Sewer Assessment and Rehabilitation Program (PASARP)
- Ongoing Sewer Assessment and Rehabilitation Program
- Collection and Transmission Systems Training Program
- Financial Analysis Program
- Infrastructure Acquisitions Program
- System-Wide Hydraulic Model
- System-Wide Flow and Rainfall Monitoring Program
- Fats, Oils, and Grease (FOG) Management Program

Refer to http://dekalbwatershed.com/ConsentDecree.html for complete program submittals.

FIGURE 1-4
DWM Organizational Chart



1.3 Re-evaluation of Current Program

The County re-evaluated its current MMS Program to determine its effectiveness and identify improvements. In order to meet the goal of improving its MMS Program, the County hired and worked with a third-party consulting firm to provide a comprehensive and objective expert assessment of the MMS Program. The consulting firm has extensive expertise in collection system O&M. Through a series of interviews, site visits, document reviews, and meetings held by the consultants with individual program managers and staff associated with the specific program areas, the team assessed opportunities for improvement in the following elements of the program:

- Resource commitments for all management systems within the MMS including communications, information, inventory, gravity system, and lift stations, force mains, and appurtenances.
- Workflow process, service request process, reporting structure, and enhancements that could be realized.
- Inventory management system process, physical storage locations, the purchasing process, critical assets, and enhancements that could improve the program.
- Gravity system and lift station maintenance work flow process, preventive maintenance schedules, practices and procedures for preventive, corrective, and predictive inspection and maintenance, and enhancements that could improve the program.
- Key Performance Indicators (KPIs) for each program area.

As a result of the County's re-evaluation, DWM has identified program enhancements to be implemented over the next 4 years. These enhancements are provided in each section of this document, including the following highlights:

- Improving communication system through enhanced technology and equipment available to staff.
- Improving information management through integration of the work order system into all aspects of preventive, corrective, and predictive maintenance activities.
- Implementing the bar code system to receive and issue parts and improve efficiency in the inventory process.
- Improving condition assessment and prioritization process through the integration of data and information into one common framework.
- Evaluating existing procedures and development of new procedures, as needed, to cover all aspects of maintenance activities as part of a continuous improvement process.

2 Physical Inspection and Testing Procedures

The County's WCTS Physical Inspection and Testing Procedures are described below as summaries of various methods/techniques the County uses to physically inspect and test the WCTS. The information these methodologies produce varies depending on the infrastructure's environmental surroundings and pre-inspection weather conditions. Depending on the inspection or testing purpose, various combinations of inspection methodologies may be applied to the same asset.

MMS Program inspection and testing procedures are used to facilitate effective O&M activities. DWM assesses results of inspections and testing procedures to refine maintenance management of the County's WCTS. In addition, inspections and testing are established to identify defects and potential problems in a timely manner, allowing for immediate corrective maintenance, as appropriate. Data collected through inspections and testing of WCTS assets are managed through the MMS Program information management system described in Section 4, *Information Management*.

DWM's inspection and testing methods include:

- *Smoke Testing:* Smoke testing is used to identify and locate defects that are allowing the entry of I/I into the sewer and subsequently to prioritize closed circuit television (CCTV) inspection as well as other assessment activities. Smoke testing is effective on both public and private property (laterals) and can locate cross connections or other illicit connections. DWM procedures and master specifications for smoke testing are contained in the Priority Areas Sewer Assessment and Rehabilitation Program (PASARP), Appendix K.

- *CCTV*: CCTV is used to provide a direct visual physical assessment of the interior of a pipe asset. The visual assessment is converted to a condition score for establishing priority. The asset is often pressure-washed in advance of the CCTV inspection to provide a clearer structural image. DWM procedures for CCTV inspections are contained in the PASARP, Appendix I.

- *Dyed Water Flooding:* Dyed water flooding is used in conjunction with smoke testing and CCTV to determine whether a smoke exit point is directly or indirectly connected to the sewer system. Dyed water flooding is also used to investigate building sewer system connectivity. Procedures for dyed water flooding are contained in the PASARP, Appendix E.

- *Corrosion Defect Identification:* Corrosion identification methods used for gravity sewers include direct visual observation or CCTV inspection. For force mains, direct and indirect technology is dependent on the force main's accessibility. Combinations of technologies may be employed. Procedures for corrosion defect identification are contained in the PASARP, Appendix F.

- *Manhole Condition Assessment:* Manhole condition assessment technologies areimplemented primarily by visual inspection or camera imaging and can be performed from the surface or by physical entry depending on the desired level of precision of the collected data. Procedures for manhole condition assessment are contained in the PASARP, Appendix G.

- *Lift Station Inspections and Testing*: Lift station inspections and testing procedures arediscussed in Section 7, *Lift Station, Force Mains, and Appurtenances*. Inspections and testing include visual inspections, predictive inspections such as vibration analysis, infrared spectroscopy testing, pump capacity performance through drawdown tests, and mechanical equipment testing. Procedures for lift station inspections and testing are contained in this MMS Program, Appendix D.

- *Force Main and Air Release Valve Inspections*: Force main and air release /vacuum valve (ARV) inspections are discussed in Section 7, *Lift Station, Force Mains, and Appurtenances*. Inspections to identify and locate defects on force mains and ARVs include inspection, cleaning, and tear down of ARV components, and inspection of force mains and receiving manholes. Procedures for force main and ARV inspections are contained in this MMS Program, Appendix D.

3 Communication Systems

3.1 Overview

This section presents the communication systems used by DWM to maintain and operate the WCTS. Descriptions of available resources, planned enhancements and schedule associated with the communication systems are also included. This section describes DWM's ability to communicate between lift stations, field crews, and supervising staff. Specifically, descriptions of the following program elements and communication systems are included in this section:

- Website and electronic mail
- Landline telephone
- Mobile communication devices (push-to-talk and mobile telephones)
- Telemetry (lift stations)
- Fleet tracking
- Verbal communication

Tracking of performance measures for communication systems are presented in Section 8, *Key Performance Indicators*

Good communication is essential to effective operation of the County's WCTS. Currently, through the systems in place, County customers, state and federal agencies, and the general public are able to communicate problems to DWM. DWM dispatchers communicate to field personnel who can then respond and solve problems. Field personnel are able to communicate with each other and their supervisors in real time to adapt to the situations they encounter and execute an appropriate solution. The County's lift stations transmit operational data to operators who can alert field supervisors when potential problems arise. Effective and reliable communication systems remain critical to DWM's ability to maintain the WCTS and respond to potential problems quickly. DWM continuously seeks to enhance effective communication, improve maintenance activities, and reduce the likelihood for SSOs.

3.2 Resource Commitments

3.2.1 Website, Intranet, and Electronic Mail

The County's customers and the public can communicate with DWM by website, e-mail, and telephone. There is a prominent link on DWM's website where customers and the public can find information and measures taken by the County to address the Consent Decree, improve O&M of the WCTS, and reduce the likelihood of SSOs. The County's customers can contact the DWM regarding sewer issues by e-mail using a form on the DWM website at http://www.dekalbwatershed.com.

Office staff and field supervisors who are assigned a computer have the ability to use e-mail for communication. E-mail provides a convenient method for customers to initiate contact

with DWM staff to address issues of importance to the customer, such as billing questions. E-mails are answered by the Customer Service Group. Customer Service monitors the DWM e-mail account during normal weekday business hours. E-mails received outside of normal business hours are not read until the next business day. For this reason, e-mail is not a suitable method for customers to use to report emergency issues regarding the WCTS. The County's website instructs the reader to report emergency issues by telephone, which is monitored 24 hours a day/ 7 days a week.

3.2.2 Landline Telephone

The County's customers and the general public primarily use a landline telephone system to report sewer emergencies, repair needs, and maintenance needs. The County publishes its emergency phone number (770-270-6243)on the County's website, DWM's website, and in water and sewer bills. The emergency phone number is monitored 24 hours a day, 7 days a week.

The County has also posted an emergency telephone number at every lift station for the public to call if they observe unusual events occurring at a lift station, such as smoke, fire, overflow, etc. In some cases, DWM is notified of issues through calls to the 911 system. DWM dispatchers receive these calls, begin the service request recording process, and transmit the service request to the appropriate supervisor and field crew.

The County plans to track statistics regarding the number of calls received, number of calls dropped, call duration, or number of callers that could not connect when all lines are busy. Reliable landline communication is essential to ensure that the customer and the public can report SSOs or other emergency needs in a timely manner.

3.2.3 Push-To-Talk Devices

Push-to-talk (PTT) devices are the primary method used to communicate with field crews, lift station staff, and supervisors. PTT is used by:

- Dispatch staff to reach field supervisors and field crews
- Field supervisors to reach field crews
- Field crews to reach their supervisors and other field crews
- Managers and administrative staff
- DWM staff to contact contractors

PTT enables rapid communication to field crews, which is important in effective response to SSOs and other WCTS emergencies.

PTT offers several advantages such as instantaneous connections, the ability to connect to one person, a group, and/or DWM's entire group of users simultaneously. DWM uses group mode for dispatch so that the closest field crew can accept the assignment and thus provide the best possible response time. This system provides effective communication among supervisors and field staff during routine and emergency situations.

PTT device vendors offer the option to enable mobile telephone service to these devices. DWM enables mobile telephone service on PTT devices for management staff as a means to conduct business and communicate while away from the office.

3.2.4 Telemetry

Lift stations are monitored using equipment at each lift station that measures and logs information such as pump run status, generator run status, and wet well level alarms. Data are recorded, stored, and transmitted to a central data collection server a minimum of every 24 hours, or more frequently if programmed, except when alarm conditions exist. When data trip an alarm, the data are transmitted to the central data collection server immediately. Communication from lift stations to the central server is accomplished using cellular carriers.

The central data collection server relays data to the human machine interface (HMI) servers at Polebridge and Snapfinger AWWTFs. Computers connected to the HMI server are monitored by plant operators. Lift station alarms appear prominently on the monitoring station computer screens along with an audible alarm to ensure the operators notice the alarms. Operators at the Snapfinger AWWTF monitor lift station alarms and alert the on-call mechanic and supervisor of lift stations issues.

Additional information about DWM's telemetry system is presented in Section 4, *Information Management*, and Section 7, *Lift Stations, Force Mains, and Appurtenances*.

3.2.5 Fleet Tracking

DWM is deploying a fleet tracking system for field vehicles. This is not a direct communication system; however, it will provide location services for field vehicles that dispatchers and supervisors can use to route the nearest crews to reported SSOs efficiently and further reduce response times.

3.2.6 Verbal Communication

In addition to the communication systems described in this section, DWM practices effective verbal communication through daily meetings between supervisors and field staff. This ensures staff members understand their assignments for the day. Likewise, field personnel have the opportunity to update their supervisors and share issues and concerns during the meetings.

3.3 Reports

The County will generate reports regarding communication systems relevant to the WCTS in the future as capability allows. For example, these reports will include landline telephone reports and will track the number of dropped calls or missed calls, as feasible.

3.4 Planned Enhancements

DWM ensures communication systems are reliable and are maintained to meet their business needs effectively. Table 3-1 describes the County's planned improvements and enhancements to communication systems.

TABLE 3-1
Communication System Program Planned Enhancements

Activity	2014	2015	2016	2017
Upgrade Landline Telephone System Upgrade landline telephone system to better manage incoming calls and provide a means to track dropped calls, missed calls, and duration of call. Additionally, DWM will review assignment of codes to different call types so reports can be generated.	X	X		
Implement New PTT System DWM will implement a new PTT system in 2014.	X			
Deploy Mobile Work Order Management Devices for Field Staff The County plans to deploy a mobile work order solution for collection system crews. The County plans to use mobile devices (laptops, tablets, and/or smart phones) to assign work orders to field staff and receive work order updates from field staff in real-time. (Refer to Section 4, *Information Management*)			X	X
Use GPS Location Services for Field Vehicles This service will provide location tracking to enable dispatchers and managers to know the location of all field crews in real time. This information will be used to reduce response times by routing crews to respond to sewer system emergencies more efficiently based on their location and workload.	X	X		

4 Information Management

4.1 Overview

This section provides an overview of the County's information management systems that DWM uses in the O&M of its WCTS. Descriptions of available resources, planned enhancements, and implementation schedule are also included. Specifically, descriptions of the following program elements are included in this section:

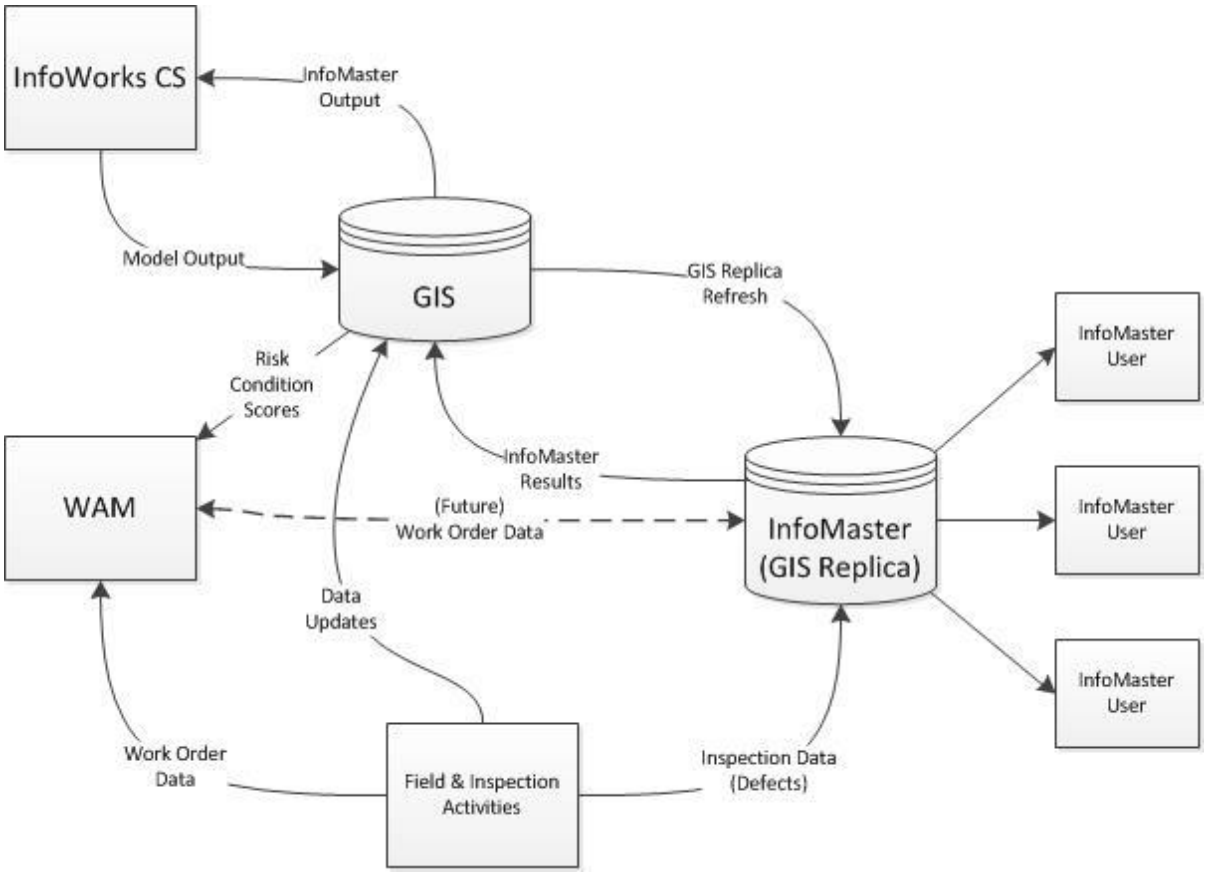
- Resource commitments such as staffing, contractual support, and equipment
- Primary information systems that DWM uses to track maintenance activities (including lift station equipment histories) and management, and O&M performance indicators
- Other information systems used by DWM to manage and maintain the WCTS
- Written procedures for generation of maintenance service requests and work orders
- Reports that list equipment problems and the status of work orders generated during the prior month
- Tracking of performance measures for information management (Refer to Section 8, *Key Performance Indicators)*

Information management systems allow DWM personnel to manage its WCTS efficiently and assess performance. DWM personnel have implemented several advanced software systems and hard copy processes to track data. Expansions of software systems are ongoing; strategic upgrades will allow integration between the platforms and user interfaces to generate and receive reports.

Information management of DWM's Construction and Maintenance (C&M) Division and Lift Station Group is completed through the systems listed below and depicted in Figure 4-1:

- Oracle Work and Asset Management (WAM) Maintenance Management System
- Geographic Information System (GIS)
- InfoMaster software to calculate condition scores, calculate risk, and assist in assessment and rehabilitation planning and budgeting
- Supervisory Control and Data Acquisition (SCADA) (lift station operational data)
- Info Works CS Hydraulic Modeling Software (Refer to *System-Wide Hydraulic Model*)
- IRTH Solutions SAGE 811 software for "One Call" centers to manage and track excavation and line locate requests
- Other Software Programs

FIGURE 4-1
Overview of Major Information System Components and Data Flow



DWM uses Oracle WAM as the central system to manage information related to maintenance activities. DWM's GIS enhances the ability to track and analyze maintenance activities within a geospatial or geographic context. The information presented in this section is integrally related to the CERP. The CERP presents information such as summary organizational charts and work flow charts that relate specifically to SSO maintenance activities.

DWM's major information systems are in place and undergoing continuous improvement to integrate and create dynamic links between the systems to make them readily available to all users. These systems are depicted in Figure 4-1. Through this dynamic link, DWM will have the ability to generate reports as described in this section.

The GIS database will also be used to store asset data for sanitary manholes and mains in the WCTS. Data such as location, nearest address, size, depth, material, elevation, grade, and approximate age will be maintained in GIS. As manholes and mains are surveyed through *the Sewer Mapping Program,* or are added through the infrastructure acquisition process, DWM personnel will add data to the GIS database. GIS will also maintain

rehabilitation data such as type and date. The asset identification (ID) will be unique to each individual asset. This ID will be used to link all of the systems together.

InfoMaster will store the assessment and inspection data for the sanitary manholes and mains. CCTV videos and inspection photographs will be linked to InfoMaster as well. As contractors and DWM personnel perform assessments and rehabilitation, DWM staff will receive reports and input the information into GIS and InfoMaster™ and Oracle WAM as appropriate The hydraulic model will be linked to the GIS (and this indirectly to Oracle WAM) using the asset ID for each manhole or main.

Oracle WAM will be used to manage and create a work order history database. As service is requested for sanitary sewer assets, a work order will be created. Field personnel will capture the work performed and DWM personnel will enter it in the Oracle WAM. The work will be linked to an asset with a unique asset ID. This is the same ID in GIS and the hydraulic model, thereby linking the systems together. Labor and materials will be assigned to the asset as well. The model can access this information to track any DWM internal maintenance or rehabilitation. Photos or videos will be linked to the model as well.

SCADA data (such as pump run times or alarm data) from the lift stations is integrated into WAM to generate Benchmark Maintenance Work Orders. The data is also integrated into the GIS database. As mentioned above, GIS asset IDs (such as manhole IDs) and WAM asset secondary data (such as street addresses) are the connection points between the major information systems.

Infrastructure reports include those generated from data collected in GIS, Oracle WAM, and the Hydraulic Model. In addition, three other functional elements are envisioned:

- A dashboard to show a daily view of the base level component data (such as individual lift station data)
- Queries and reports to extract and collate data for presentation to data consumers.
- Business intelligence features to track and analyze vital metrics (such as maintenance performance indicators) at a higher overview level with the ability to drill down to the underlying data

4.2 Resource Commitments

DWM employs the following resources to meet the needs of the County by managing and maintaining data for both C&M Division and the Lift Stations maintenance staff. DWM primarily supports its information management system with County staff and some contractual support. Table 4-1 summarizes these resources.

TABLE 4-1
Information Management Resources

Resource	Description
Staffing	
Customer Support Administrator	Administers and maintains the Oracle WAM database
Customer Service Assistant	Provides assistance to DWM Customer Service
Service Request Technicians	Performs data entry to update and close service requests with data from field crews
Dispatch Supervisor	Supervises dispatchers
Dispatchers	Receives calls, creates service requests
Accounting Technician	Provides billing assistance
Administrative Assistant	Performs data entry for work order management for Lift Stations
GIS Staff	Appends and maintains GIS layers, perform spatial analyses, produces maps
County Information Systems Staff	Supports DWM information technology needs from County Information Systems Department
Software	
Oracle WAM	Enterprise asset management system used to track service requests, work requests, work orders, and inventory management
GIS via ArcServer and ArcGIS desktop products	Desktop and server geographic information system software used for mapping and spatial analysis; integrated with Oracle WAM
Oracle Financials	Used for purchasing functions, partially-integrated with Oracle WAM
InfoWorks CS	Hydraulic model for collections systems
InfoMaster	Software to manage condition scores, calculate risk, and assist in assessment and rehabilitation planning and budgeting
Telog Supervisory Control and Data Acquisition (SCADA) System	Measures and records lift station operational parameters such as pump run status, generator run status, and wet well level alarms. Data is transmitted to a control center via cellular communication. Alarms can be set and communicated to the control center in real time.
Hydraulic Modeling System	Provides the ability to simulate performance of the WCTS under selected flow scenarios. Also provides a data management platform for WCTS assets.
Microsoft Office	Used for common office needs such as word processing, reporting, flowcharting, presentations, and tracking of data. DWM will track MMS implementation using tools such as Microsoft Excel and/or Microsoft Project (future).
Contracted Resources	

TABLE 4-1
Information Management Resources

Resource	Description
GIS Mapping Contractor	Contractors have substantially completed surveying and mapping the WCTS. Pipe and manholes are being located with survey-grade accuracy for spatial location as well as invert elevations. This mapping effort also includes force mains, and air release valves.

4.3 Service Requests

The majority of work performed by C&M crews is initiated through the service request process. Service requests are used to document and respond to requests for service (i.e. corrective or emergency maintenance). At the time a service request is generated, the nature and extent of the problem may not be known. DWM C&M crews respond and address the problem (if one is found) which is documented by a repair code recorded on the service request. Service requests for emergency or corrective maintenance of the WCTS can originate from multiple sources: phone calls from agencies like EPA/EPD and the public in general, emails from the public through DWM's website, or DWM staff. DWM Dispatch (housed at the DWM Roadhaven Complex) receives calls requesting service and initiates service requests in the Oracle WAM system. In addition, selected managers have the ability to create service requests in Oracle WAM.

After DWM generates a service request, it is first dispatched to field staff through a PTT device and then printed and distributed to the General Foreman during normal business hours or on-call field sewer crews after hours. Numerous users of Oracle WAM can create maps that can be attached to service requests using ArcGIS software and information from the service request. C&M crews may request those maps to locate an asset.

Appendix A provides service request procedures and supporting documentation, including an example *Service Request Report* detailing data described below, a service request generation procedure, and a service request closeout procedure.

A service request identifies the following information:

- Service request number
- Address and cross street
- Caller name and contact information
- County section, land lot, and district
- Description of problem
- Who the service request is assigned to
- Service request type and status
- Problem code and remarks
- Repair code and comments
- List of follow up work orders
- Start date and time
- Completion date and time
- Signature and date

When a C&M crew responds to a service request and determines the cause of the problem is associated with a lift station, the C&M crew notifies the Lift Station Group through a PTT device. The Lift Station Group will track their activity with a Work Order. The C&M service request is closed after notification is given to the Lift Station Group.

Each C&M foreman completes a *Daily Foreman's Report* in hard copy format, which summarizes labor hours, direct costs (equipment and materials), and activities completed for service requests completed each day. DWM personnel enter time from the *Daily Foreman's Report* for each service request into Oracle WAM in the timesheet subsystem to track hours worked to fulfill the service request. After review by the General Foreman, this report is returned to a Service Request Technician for entry into Oracle WAM. Appendix A provides a written procedure for time entry and an example *Daily Foreman's Report*. Figure 4-2 depicts the workflow process for a service request generated for gravity system maintenance (C&M crews) covering normal business hours, nights, and weekends.

Each service request has a problem code and a repair code. The dispatcher assigns the problem code when the service request is generated. The field crew determines the correct repair code associated with the activity. DWM uses repair codes when reporting on work accomplished. Repair codes are assigned by DWM staff based on the actual repair work performed. A list of repair codes is provided in Appendix A. DWM uses prefixes for repair codes to indicate the general category of each code, as listed in Table 4-2. These codes are evaluated and used in planning preventive maintenance activities as described in Section 6, *Gravity System Maintenance*.

In summary, a service request represents corrective maintenance or emergency maintenance and the Oracle WAM Service Request subsystem has the ability to track costs. As DWM implements work orders for linear assets (such as gravity lines or force mains), costs can be tracked by type of maintenance activity, such as corrective, preventive, and emergency maintenance, as presented in the *Financial Analysis Program*.

Water and Sewer Work Flow Dispatch

FIGURE 4-2
Overview of DWM Service Request Workflow

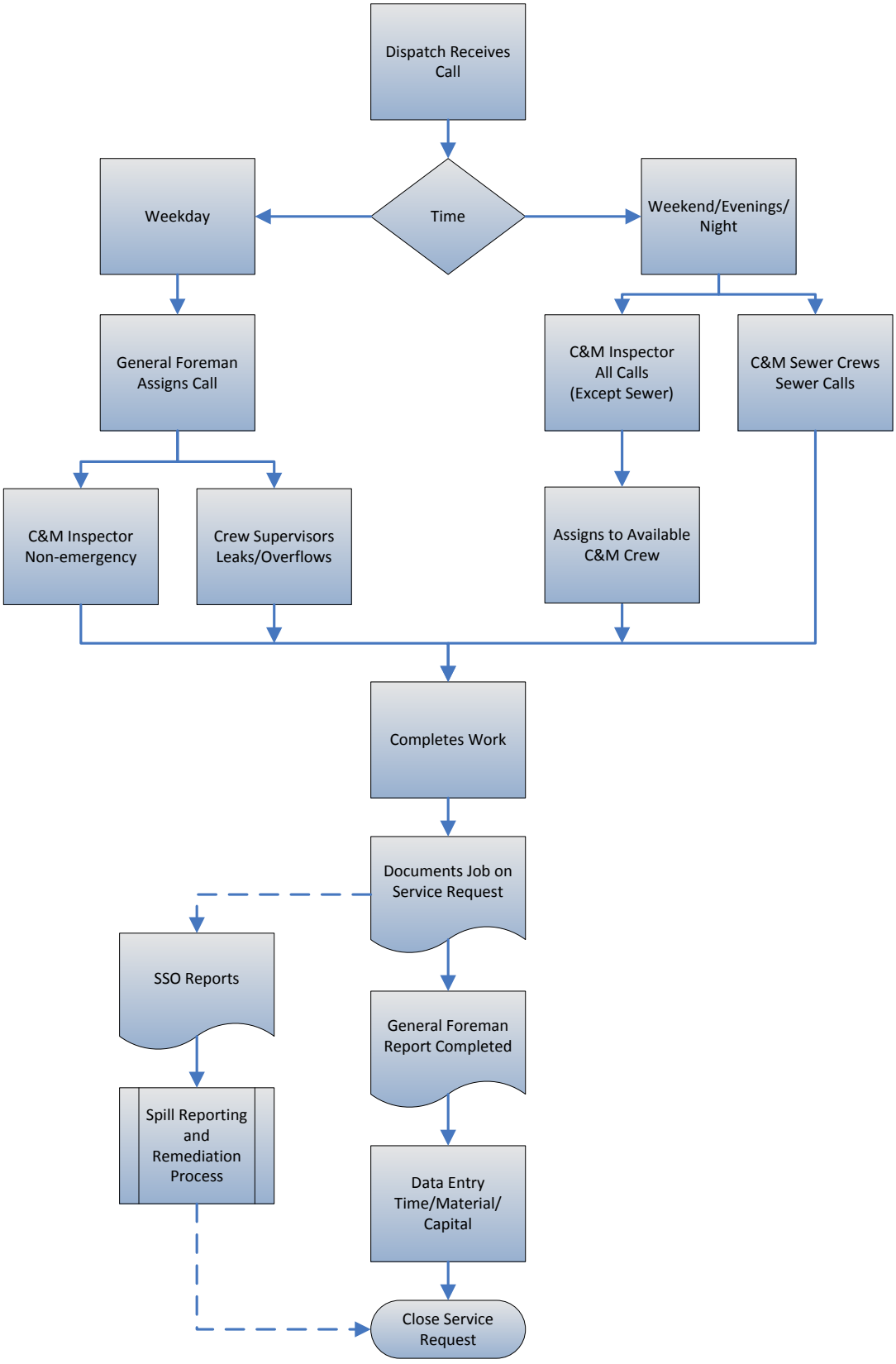


TABLE 4-2
DWM Repair Codes Prefixes

Prefix	Description
A	Support codes
M	Routine sewer work
W	Water repairs
D	Dispatch
C	Consent decree work
K	Contracted work

4.4 C&M Work Order Process

C&M personnel will use work orders for gravity line preventive and corrective maintenance in the future. C&M personnel will be enhancing the work order system in a greater capacity when a mobile work order solution is deployed. If a service request leads to work conducted on an asset, that work will be tracked by a work order. Service requests will continue to be used for investigating reported problems and will be linked to work orders for documenting the work completed to address those problems. In addition, C&M personnel will have the ability to create work orders. A work order can be generated from a service request if a problem is confirmed that requires additional work by DWM. Labor, parts, and materials will be tracked using the work order. The cost for contracted work can also be tracked on a work order.

Crew personnel record information regarding the repair such as: location, problem description, repair description, labor, parts, materials, and notes for additional follow-up work that may be required. As work orders for C&M crews are implemented, a work order will be generated and assigned to a crew. The completed field data is added to the work order and then it is closed. DWM plans to deploy the Oracle WAM Mobile application that will provide the functionality to send/receive work orders digitally while in the field using laptops, tablets, or smart phones. This means crews can receive instructions for their next work assignment while they are in the field. Once a work order is completed, the status of that work order will be updated and available for dispatchers and managers. This will reduce the potential for transcription errors on paper forms. In addition, dispatchers will be able to provide timely updates to customers and managers will be able to route and manage their crews more effectively.

4.5 Lift Station Group Work Order Process

Lift Station Group personnel under Plant Operations use the work order subsystem of Oracle WAM to plan and execute corrective, preventive, and predictive inspection and maintenance. Lift station assets have been identified and entered into Oracle WAM. This enables maintenance work performed at lift stations to be tracked by asset within the work order system. Labor and materials used in the repair and maintenance of these systems are recorded and charged against assets.

Preventive maintenance work orders for lift stations (benchmark work orders) are generated in Oracle WAM based on a pre-set schedule as described in Section 7, *Lift Stations, Force Mains, and Appurtenances*. The Senior Mechanic prints out preventive work orders to be completed daily on a Daily Work Order Report. The Senior Mechanic then assigns work orders to mechanics. Should additional materials be required to complete the work order, the Maintenance Coordinator assigns parts and materials to the mechanic for that work order. The work order is scanned or entered manually into the inventory tracking system (Section 5, *Inventory Management*). Mechanics complete, sign, and submit work orders to the maintenance supervisor for review and subsequent closeout.

Issues identified while completing benchmark work orders are noted and reviewed by the Senior Mechanic, who then generates either an emergency repair work order or a repair work order. A Work Order Planner/Scheduler schedules the non-emergency follow-up work based on the severity of the issue. Non-emergency repairs are typically scheduled for repair within a week of discovery. A procedure for *Lift Station Group Work Order Generation* is provided in Appendix A.

The work order process tracks predictive inspections and maintenance, which include, but are not limited to, the following:

- Infrared testing
- Collection of vibration monitoring equipment data
- Measurement and recording of amperage and voltage readings for major electrical equipment (quarterly)

Vibration monitoring readings and amperage readings are stored in a spreadsheet to provide information that can be used to identify trending which, when applicable, is used to initiate follow-on inspections or preventive work to address potential problems prior to full failure of the asset.

4.6 Geographic Information System

DWM's GIS is populated with WCTS data acquired through an ongoing field survey project, (refer to the *Sewer Mapping Program* [2013] for further details regarding asset parameters tracked in the GIS database). GIS data is populated using as-built drawings, field verification through global positioning system (GPS), survey-grade (horizontal and vertical) data, and input of collection system asset attribute data including size, material, estimated age or age range, and condition.

The approximate completion status of this work is as follows:

- Pole Bridge Basin: 95 percent complete
- Snapfinger Basin: 98 percent complete
- Intergovernmental Basin: 95 percent complete

DWM GIS personnel will continue to input collection system asset data into the GIS system as the field survey project is completed. This data will also allow gravity system work order activities to be tracked based on assets rather than addresses.

Manhole Naming Convention Used: In GIS, DWM uses a legacy naming convention for manholes, which is as follows:

AA-BBB-CDDD

Where:

AA = two-digit numeric land district
BBB = three-digit numeric land lot
C = one-character alphabetic code (S = Sewer owned by DeKalb County, P = Private, A = Sewer owned by City of Atlanta, W = Wet well)
DDD = three-digit numeric manhole number (unique within land lot)

4.6.1 GIS Software Environment

DWM uses ArcGIS version 10.1 for both server and desktop application. DWM uses Flexviewer to access GIS data in ArcServer. Upon completion of the *Sewer Mapping Program*, WCTS linear assets will be added to Oracle WAM and linked to ArcServer data through integration managed by Oracle WAM.

4.6.2 GIS Support for Oracle WAM

For contracted work, DWM's GIS group maintains GIS data for rehabilitation type by year and asset/line segment. An aggregation layer showing system wide rehabilitation work is maintained.

SSOs are input in GIS and the GIS group produces a monthly map of SSOs. The GIS group also provides support to C&M for mapping of aerial creek crossing inspections and areas scheduled for inspections. As needed, the GIS group creates requested maps of system data to support contractors and field crews. Field crews have access to GIS maps in multiple formats. GIS maps are separated and color-coded for "verified" and "unverified" feature levels. The "verified" level includes field located system data. In the future, web-based field laptop map updates will be completed using wireless technology. Field personnel without laptops have access to hard copy GIS maps of the system.

4.7 Supervisory Control and Data Acquisition System

Lift stations are monitored using a telemetry system (Supervisory Control and Data Acquisition [SCADA]) that measures and logs information such as pump run status, generator run status, and wet well level alarms. Data are recorded, stored, and transmitted to a central Telog lift station server a minimum of every 24 hours or more frequently if set to do so, except when alarm conditions exist. When data trips an alarm, the data is transmitted to the central data collection server immediately. Communication from lift station to the central server is accomplished using cellular carriers.

The Telog lift station server provides data to the HMI servers at Polebridge AWWTF. Computers connected to the HMI servers are monitored by plant operators at Snapfinger AWWTF through Windows Remote Desktop Protocol. The HMI software is Citect by

Schneider Electric. The SCADA system also includes a data historian that allows the retrieval of historical data for charting and analysis.

Operators at Snapfinger AWWTF monitor lift station alarms. When an alarm is received, the operator alerts the on-call mechanic and supervisor for lift stations. The on-call mechanic and his field crew respond to the alarm to investigate and resolve the issue. This procedure is documented in Appendix A. Lift station alarms appear prominently on the monitoring station computer screens. There also is an audible tone to ensure alarms notify operators.

4.8 Hydraulic Model

DWM has an ongoing program using InfoWorks Collection Systems (CS) for modeling the WCTS as described in the *System-Wide Hydraulic Model*. The software incorporates full solution modeling of backwater effects and reverse flow, open channels, trunk sewers, complex pipe connections, and complex ancillary structures. The model also incorporates data from flow monitoring as described in the *System-Wide Flow and Rainfall Monitoring Program*.

The WCTS hydraulic model is also used to check system capacity to determine if proposed additional flows can be accommodated. Use of the WCTS hydraulic model for this purpose is described in the *Infrastructure Acquisitions Program*.

DWM uses InfoMaster™ as a companion product to InfoWorks CS that is used for infrastructure management (i.e. managing data about the WCTS). InfoMaster™ provides a means to use information from a variety of sources including GIS, various databases, CMMS, field data systems, SCADA, hydraulic modeling software, and other applications. The modeling program that was initiated in 2012 is scheduled for completion in 2017

4.9 Line Locating Tracking System

Line location requests are submitted through Georgia 811 and/or the online Excavator Digging Event Notification (EDEN) system to the County IRTH Solutions SAGE 811 software system (http://www.irthsolutions.com/). For the purposes of line location, the County is divided into nine grid areas, each having an assigned line location crew supervisor. The IRTH system generates an email "ticket" to the appropriate grid area line location crew supervisor. Ticket record management (tracking and documentation) is conducted using the IRTH software and archived through the County Information Systems Department.

4.10 Reports

DWM personnel use a variety of reports to obtain select data from Oracle WAM. Table 4-3 provides a summary of these reports. Information collected to track maintenance activities is viewed and assessed by DWM staff through these reports. These reports provide decisions makers with the tools to enhance and refine O&M of the WCTS.

The MMS Program is in the process of being tracked by DWM Managers. The County is in the process of hiring a Program Manager who will track and collect reports from Engineering, CIP, C&M, and the Lift Station Group. The Assistant Director will collect reports and forward information to the Administrative Assistant who will input tracking

data into Microsoft Project and/or Microsoft Excel. This data will formalize the County's tracking of its implementation of the MMS Program. The Director and Assistant Directors will meet monthly to discuss data collected and information tracked for the MMS Program.

TABLE 4-3
Summary of Reports

Area	Report Name	Report Description	Comments
Gravity System	Ad-hoc service request reports	A list of service requests by selected criteria such as repair code, status (active, finished, etc.), and costs Purpose: Quickly review the number and general location of service requests along with cost accrued.	Viewed monthly or more often
	Spill Map	A map of spills based on address Purpose: Spatially display spills by cause to help DWM staff discern trends that could lead to follow-up actions to reduce the likelihood of future spills.	Viewed monthly or more often
	Work Order Status	A list of work orders started in the prior month. The report includes work order numbers, status, status date, asset(s), problem code, repair code(s), type (preventive, corrective, emergency), and total cost accrued to date. Purpose: provide managers with a quick overview showing work completed, work in progress, and work backlog. The Active Work Order Report and the Work Order Status Report contain a listing of equipment problems.	Viewed monthly
Lift Stations	Work Order Aging Report	A list of work order numbers grouped by age (0-2 days, 3-6 days, 7-13 days, 14-29 days, or 30-59 days) Purpose: Provide an overview to show if work orders are being completed in a timely manner.	Generally viewed daily
	Lift Stations Active Preventive Maintenance Work Orders	List of active PM work orders showing work type (preventive or reactive), work order number, status, description, work class, asset type, asset ID, priority, due date, and crew Purpose: Provide an indication of the volume and timely completion of preventive maintenance work orders.	Viewed weekly or more often
	Active Work Orders	List of active work orders showing work type (preventive or reactive), work order number, status, description, work class, asset type, asset ID, priority, due date, and crew Purpose: Provide a breakdown of preventive vs. corrective maintenance.	Viewed weekly or more often as desired
	Work Order Status	A list of work orders started in the prior month. The report includes work order numbers, status, status date, asset(s), problem code, repair code(s), type (preventive, corrective, emergency), and total cost accrued to date. Purpose: To show an accounting of all work orders initiated within the prior month and presentation of costs for those work orders that are finished.	Viewed monthly

4.11 Planned Enhancements

DWM's goal is to maintain information management systems that are reliable and meet their business needs effectively. Table 4-4 describes DWM improvements and enhancements to their information management systems.

TABLE 4-4
Information Management Program Planned Enhancements

Activity	2014	2015	2016	2017
Begin Integrating Work Orders for Gravity System Maintenance DWM can integrate work orders for gravity line system maintenance activities. This will have the following benefits: • Ability to generate work orders for gravity line system preventive maintenance • Ability to assign parts from storerooms to work orders and have the inventory updated automatically in Oracle WAM • Ability to track costs for labor, parts, and materials for budgeting and financial management • Integration with GIS will allow DWM to more efficiently depict work conducted and planned in a spatial context • Improve the work flow process • Improve the tracking of assessment and rehabilitation activities • Assign condition score to asset in Oracle WAM		X	X	
Implement Mobile Work Order Solution A mobile work order solution allows for service requests and work orders to be dispatched to field crews electronically instead of using printed forms. Upon completion of a work order, the mobile work order solution can allow field staff to update the work order with proper repair codes, labor, parts, and materials. This information may be posted in real time. Dispatchers could route critical work orders to crews on electronic devices (tablet, PC, smart phone, or similar). When coupled with DWM's vehicular GPS tracking system (Network Fleet), dispatchers and supervisors could route crews more efficiently and reduce overall travel time for maintenance crews.			X	X
Improve the Quality of Addresses Used for Service Requests and Work Orders DWM will improve the quality of addresses used in their work by such measures as selecting the source of record for addresses, performing QA/QC for addresses in Oracle WAM, improving the synchronization between the source of record and Oracle WAM, and training employees as needed.		X	X	
Modify Benchmark Work Orders to Include Generators Benchmark work orders will be modified to include preventive maintenance for generators that have been recently acquired.		X		
Evaluate and Select Business Intelligence Reporting Software System Evaluate Oracle *Business Intelligence for Utilities* software as a business intelligence solution to track and analyze vital metrics, build a dashboard to centralize MMS information, and provide KPI measurement of MMS Implementation. The ultimate goal of this enhancement is to build business intelligence and institutional knowledge by transforming data into information, information into knowledge, and knowledge into more informed decisions.	X	X		

5 Inventory Management

5.1 Overview

This section presents DWM's practices and procedures for inventory management. Specifically, descriptions of the following program elements are included in this section:

- A description of resource commitments such as staffing, contractual support, and equipment
- An overview of DWM's inventory management system that includes critical equipment and critical spare parts
- Written procedures for updating the critical spare parts and equipment inventories in the inventory management system
- Planned enhancements and proposed schedules
- Tracking of performance measures for Inventory Management (Refer to Section 8, *Key Performance Indicators)*

DWM has an inventory system that uses a combination of manual (paper copy) and automated Oracle WAM management processes. Current resources and inventory management system processes provide for equipment and parts accountability and control of inventory levels.

Effective management of spare parts and equipment allows DWM to respond to problems in an efficient and timely manner. Similarly, this also permits DWM to correct issues identified through predictive maintenance activities before an actual failure occurs.

The County's engineering specifications are used to assist in determining items that need to be stocked in order to maintain the WCTS. In addition, historical data is used to determine items (i.e., parts, materials, and equipment) critical to system operation and emergency response. These items are managed with the goal of ensuring availability when needed.

5.2 Resource Commitments

DWM inventory management resources include dedicated staff, purchasing resources, critical parts and ancillary equipment, and inventory storage locations.

5.2.1 Staffing

DWM employs full-time personnel for managing equipment and parts inventory, as identified in Table 5-1.

TABLE 5-1
Inventory Management Staff

Resource	Description
Staffing	
Warehouse Manager	Responsible for parts management for DWM warehouses
Warehouse Coordinator (future)	Assists the Warehouse Manager
Supply Specialists	Responsible for recordkeeping and use of Oracle WAM
Stock Workers	Receives parts, stock parts, retrieves parts to be issued, and maintains clean and orderly warehouse and stock yard
Maintenance Coordinator	Manages store rooms for lift station supplies and responsible for recordkeeping and use of Oracle WAM
Other Resources	
Oracle WAM	Enterprise asset management system - Oracle WAM Warehouse Module used to track inventory management
Warehouse, Storerooms, and Crew Trucks	Central Warehouse at Roadhaven Facility, and Lift Station Storerooms at Snapfinger and Polebridge AWWTFs. Crew trucks stocked with essential parts

5.2.2 Purchasing Sources

Purchasing sources for equipment and parts include standard procurement and emergency procurement resources. Under normal circumstances, parts are purchased through DWM's standard purchasing processes using vendors from an approved vendor list. DWM has provisions for staff to acquire parts in an emergency that expedites the procurement process.

5.2.2.1 Standard Procurement

DWM maintains a list of contracted vendors for ordering equipment and parts. A current contracted vendor list is provided in Appendix B. DWM also maintains annual service contracts with several vendors for maintenance and repair of specific equipment. Annual service contracts include provisions for 24 hours a day/7 days a week service request response. A contract management procedure is provided in Appendix B.

5.2.2.2 Emergency Procurement

DWM considers an emergency to be any situation that could affect public health, the environment, or cause a violation of Federal and/or State regulations. Emergency procurement is also required when a part must be purchased to support an emergency repair. DWM has three avenues available to procure equipment and parts in an emergency:

1. On call vendors
2. Loans from other utilities
3. Purchasing Card Use

Multiple vendors on the contracted vendor list are on-call 24 hours a day/7 days a week to provide rapid response for purchasing (or renting) and delivery of equipment and parts. This provides several back-up suppliers for purchasing equipment and parts.

DWM personnel maintain working relationships with other utilities in local, state, and regional areas. These relationships include temporary loaning of specific equipment and parts from other utilities, as available for use by DWM.

In addition, the maintenance manager or the maintenance coordinator have access to a purchasing card (P-card) to purchase equipment or parts needed to respond to emergencies. P-card purchases have a limit on purchase amount and personnel track and reconcile P-card purchases.

In the case of emergencies where the cost of required materials exceeds P-Card limits, personnel can submit a request for an emergency purchase order, which is processed within a 24-hour period in most cases. If an emergency occurs after hours, an emergency purchase order can be requested at the earliest possible time following the handling of an emergency.

If service is needed in an emergency, there are provisions in many service contracts that provide emergency contact numbers for personnel to call at pre-negotiated emergency rates.

5.2.3 Critical Ancillary Equipment, Components, and Parts

DWM distinguishes between equipment, components, and parts based on the following definitions.

- ***Ancillary equipment*** – Equipment that is not an asset in the WCTS, but used when performing maintenance on assets within the WCTS, are categorized as ancillary equipment. Examples of ancillary equipment include chain saws, pavement saws, ventilation blowers for confined space entry, inflatable flow control plugs, and dewatering pumps.
- ***Component*** – Stock items that may be installed into and removed from assets. Components are considered part of an asset when they are installed on the asset. When not installed, they are considered "trackable" stock items. An electric motor is an example of a component because it can be installed, de-installed, repaired, reinstalled, scrapped, or sold. Over its useful life it could be coupled with several different pumps located at different lift stations. Work history on the component is tracked both to the component and to whatever assets it is installed. This allows work history to accrue by asset location (such as "Pump #1") and by component.
- ***Parts*** – Items that are replaceable and associated with maintaining assets are categorized as parts. Examples of parts include pipe clamps, fittings, level transducers, circuit breakers, belts, and pulleys.

To be considered critical, any of the three elements in the list above must meet following criteria:

- Must be required for an asset to function or an asset to be repaired
- Cannot be obtained locally
- Cannot be serviced locally

DWM identifies components and parts that are used in emergencies as inventory requiring additional quantities to be maintained in stock. In addition, the Warehouse Manager prioritizes commonly used ancillary equipment and ancillary equipment that requires frequent servicing by ordering additional stock of this type of equipment.

DWM lift station personnel maintain a list of critical lift station components and parts as provided in Appendix B. These items represent critical equipment and parts required to maintain lift stations in good working order. In addition, equipment and parts that have longer lead times between order and receipt also are identified as critical.

DWM will be implementing the component-tracking feature within Oracle WAM to track critical components. Component tracking is a key component in tracking critical items needed to ensure critical assets remain serviceable.

5.2.4 Inventory Storage Locations

DWM stores equipment and parts inventory in strategic locations within the County. These locations maintain adequate inventory of items that are distributed among locations based on availability of items to personnel in a timely and effective manner. DWM stores parts and equipment used in maintenance of the WCTS at the Central Warehouse (Roadhaven Facility), Division crew tucks, and Snapfinger AWWTF.

Critical equipment and critical spare parts are kept on-hand. If, however, the County needs to obtain additional critical equipment or critical spare parts on an emergency basis, the County has emergency purchase procedures in place for current contracted suppliers along with the ability to utilize a P-card to secure supplies locally. In addition, the County has the ability to contact other municipalities and local governments for equipment and parts on a loaned basis. Finally, the County staff can utilize a variety of fittings or other devices to make a temporary repair until such time as a correct part is secured to make the permanent repair.

5.2.4.1 Central Warehouse (Roadhaven)

The Central Warehouse, located at the Roadhaven complex, maintains the largest stock of DWM equipment and parts. C&M personnel that are responsible for DWM gravity line maintenance primarily use equipment and parts stored at the Central (Section 6, *Gravity System Maintenance*). Gravity line spare parts are all considered critical and must be maintained in stock. Appendix B.2 provides a sample screen shot of the gravity line parts inventory (consisting of thousands of parts).

In addition, parts for force main maintenance are stored at the Central Warehouse. The Central Warehouse is equipped with secure storage locations to limit access of parts and equipment to designated personnel. For expendable inventory such as gloves and safety glasses, DWM personnel can access these items through a vending machine using their employee identification badge. This facility also includes an outdoor storage yard that is fenced and secured. Large size parts such as piping, manholes, manhole rings, covers, and risers are stored in the outdoor storage yard.

5.2.4.2 Division Crew Trucks

C&M gravity system maintenance crew trucks and lift station maintenance crews trucks are stocked with essential parts. Stock on the crew trucks is periodically replenished and available immediately for emergencies.

5.2.4.3 Snapfinger Creek Advanced Wastewater Treatment Facility

Plant Operation Division parts for treatment facilities and lift stations are stored at the Snapfinger AWWTF. Snapfinger AWWTF parts storage locations include two storerooms, the Snapfinger AWWTF parts room, and furnace room. These storerooms are located at the Administration Building.

DWM personnel use the Snapfinger AWWTF parts room to store spare parts for treatment plant and lift station maintenance. Access to this storage room is limited to designated personnel. The room is staffed during normal weekday business hours. Items such as circuit breakers, contactors, level transmitters, fasteners, and other parts of similar size are stored in the parts room. Parts are accessible to maintenance crew personnel on a 24 hours a day/7 days a week basis.

The furnace room is on the second floor of the building and is used to store heavy items that are too large to store in the parts room such as large pumps and motors. Access to the furnace room is not secured; however, it is visible from the operations room and monitored 24 hours a day/7 days a week.

5.2.4.4 Pole Bridge Advanced Wastewater Treatment Facility

Plant Operation Division personnel store spare parts for treatment plant maintenance at the Pole Bridge AWWTF parts room. Pole Bridge AWWTF parts storage locations include two storerooms, Pole Bridge "PB" and "PB-1" storerooms. These storerooms are located close to the Maintenance Office Building. Access to this storage room is limited to designated personnel. Items such as circuit breakers, contactors, level transmitters, fasteners, and other parts of similar size are stored in the parts room and are available as back up supply to Lift Station maintenance. Parts are accessible to maintenance crew personnel 24 hours a day/ 7 days a week through a code access key lock box.

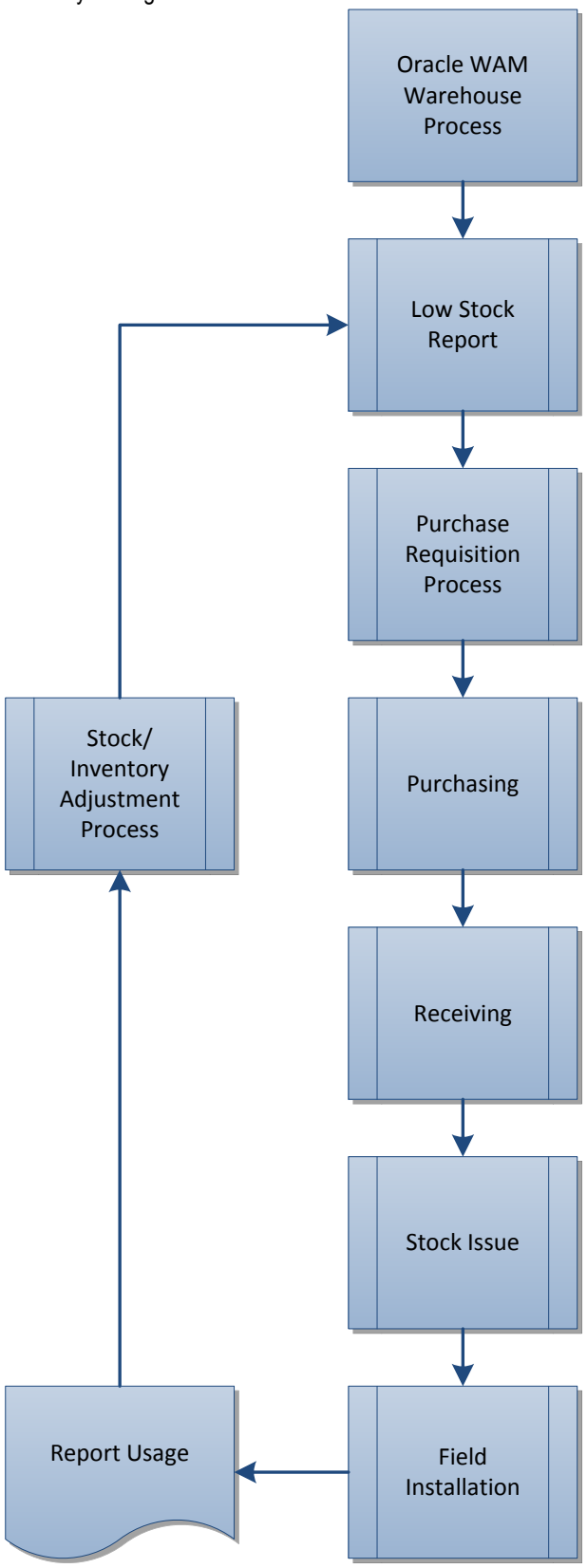
5.3 Inventory Management System

DWM uses the warehouse module of Oracle WAM Version 1.9 to manage equipment and spare parts inventory. This is a robust database application with users accessing the system through a browser-based platform. DWM personnel can query items (equipment and parts) in Oracle WAM to identify the number of items in stock and where these items are located (in what storeroom and bin location within that storeroom). In addition, physical inventory counts are conducted annually. Physical inventory counts allow DWM to account for its inventory expenditures for the year and the warehouse to reconcile and account for on hand inventory quantities to system totals. This includes inventory identified as critical. A physical inventory procedure is provided in Appendix B.

DWM warehouse staff reviews numerous reports such as the bin listing report, inventory catalog report, inventory non-usage report, deficient vendors report, inventory pick list report, new stock items report, overstock reports, purchase order report, purchase

requisition report, under stock report, and vendor listing report. Equipment needs are also submitted to the Warehouse Manager following an emergency or corrective maintenance activity. These reports provide key information to warehouse staff for inventory management and oversight. DWM's inventory management system includes steps for purchasing, receiving, and distribution of equipment and parts, as depicted on Figure 5-1 and described below.

FIGURE 5-1
Inventory Management Process



5.3.1 Purchasing

Currently, inventory purchases are made from a visual review of on hand inventory and physical inventory counts that are performed quarterly. The accuracy of "test counts" determines when a full inventory count is needed. For example: if a random inventory of 100 items achieves a 95 percent accuracy rate, then a full inventory count in most cases may not be performed. If the inventory "test count" accuracy rate is below 95 percent, then a full inventory count is scheduled and performed.

5.3.1.1 Central Warehouse

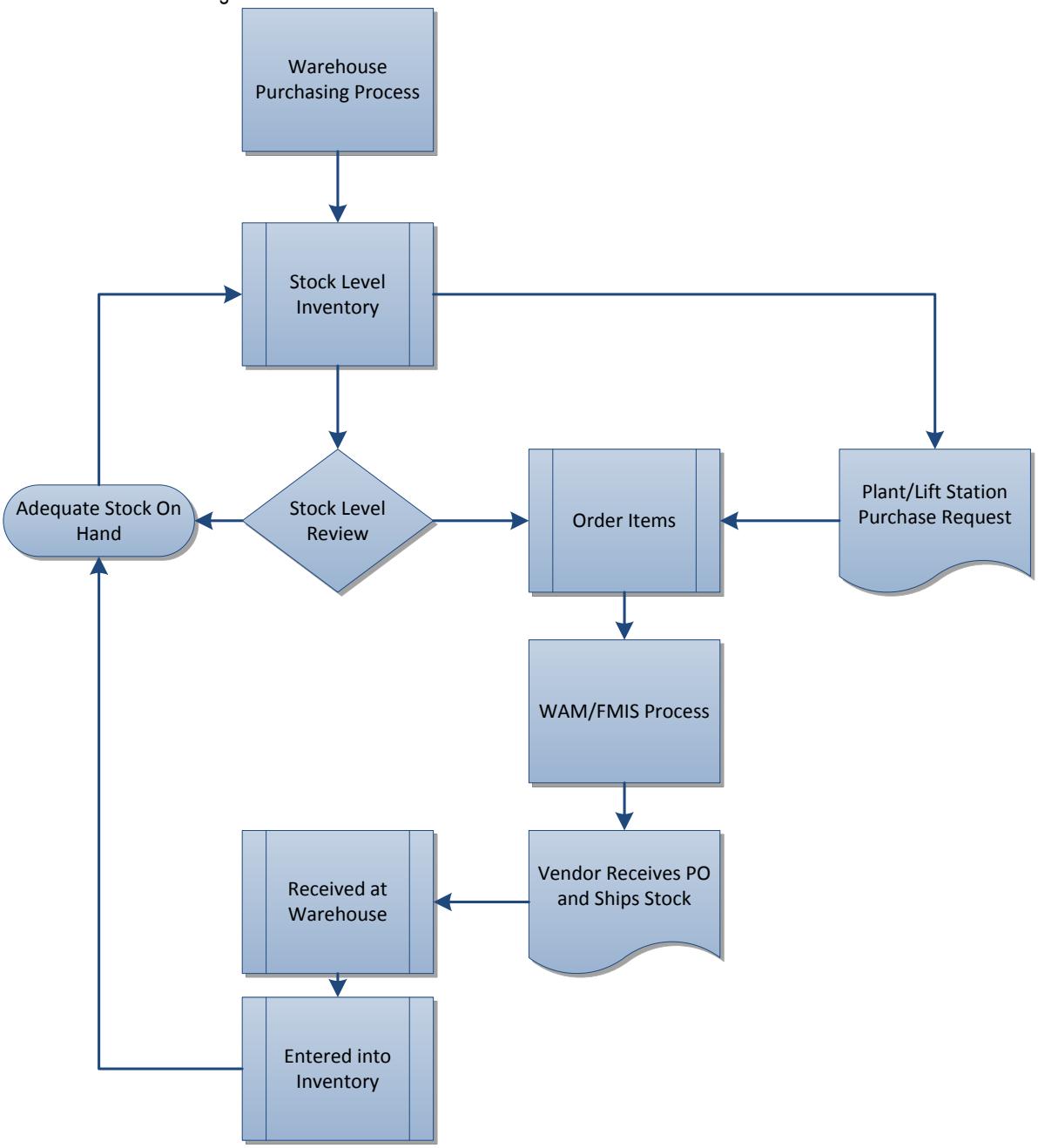
A warehouse stock worker or other warehouse personnel verify on hand inventory quantities. A low stock report is filled out by the stock worker and submitted to the supply specialist in the warehouse office. Low stock reports are researched and an inventory purchase requisition is entered into Oracle WAM. All non-stock coded items are entered into Oracle financial system directly. The requisition is transferred into Oracle financial system by a two-way interface allowing a purchase order to be returned from Oracle financial system back to Oracle WAM for stock coded inventory items. A procedure for requisitions is provided in Appendix B. Oracle WAM has the ability to input stocking levels, reorder points, and reorder quantities where feasible. Additionally, Oracle WAM has the ability to produce a reorder review report that will indicate inventory items that fall below their set reorder point and are in need of replenishment.

DWM personnel have established inventory re-order stocking levels in Oracle WAM. Reports from Oracle WAM are used to identify parts for which the quantity on hand is below the desired minimum stock level. This information is used to trigger a purchase. In addition, storeroom personnel use low-stock forms to identify parts that need to be purchased to replenish stock levels. Historical use also is considered by looking at annual consumption and a forecast is completed that set inventory levels.

5.3.1.2 Storerooms at Snapfinger and Pole Bridge Advanced Wastewater Treatment Facilities

Storage locations at the Snapfinger AWWTF are displayed in Oracle WAM as "SF" and storage locations at the Pole Bridge AWWTF are displayed in Oracle WAM as "PB".
A purchase requisition is completed manually by the Maintenance Coordinator based on Oracle WAM re-order reports. This purchase requisition is submitted in paper form to Purchasing Department personnel that enter the items into Oracle financial system and are responsible for the procurement of equipment and parts. An overview of the purchasing process is presented in Figure 5-2.

FIGURE 5-2
Overview of the Purchasing Process



5.3.1.3 Re-Order Stocking Levels

DWM personnel are working to establish levels for the following quantities:

- Maximum stocking level: The quantity above which stock levels should not rise.
- Minimum stocking level: The quantity below which stock levels should not fall.
- Re-order point: The quantity on-hand at which the process to place a purchase requisition will be triggered. The re-order point in Oracle WAM is assessed and adjusted as needed.
- Re-order quantity: The minimum quantity to be ordered when an order is placed (for example, a case, box, or pallet etc.).

Warehouse personnel use Oracle WAM stock and over stock reports to determine if quantities of equipment and/or parts on-hand are below the minimum stocking levels. These reports are used along with the reorder forms to enter purchase requisitions for inventory replenishment. In addition, stock workers who identify expendable and non-inventory items that must be ordered use low-stock forms. If an inventory item is coded as "out of stock", the stock worker records the items on the Out of Stock sheet, which is turned in daily, and the item(s) are researched for existing requisitions and ordered the next morning.

For example, a part may have the following established quantities:

- Maximum inventory = 2,560
- Minimum inventory = 640
- Re-order point = 1,920
- Reorder quantity = 640
- Available inventory = 1,912

DWM personnel would place a purchase requisition to acquire at least 640 more of this item since the quantity on-hand (1,912) is less than the re-order point (1,920) and the minimum re-order quantity is 640.

5.3.1.4 Extended Delivery Time Provisions

Several factors affect when an inventory item is considered a critical piece of equipment or part. One of the leading factors is how readily available a particular spare part or piece of equipment can be obtained. In some cases, long lead times to purchasing are required for items that need to be manufactured, because these items are not normally kept on the manufacturer's shelf. This type of item is sometimes identified as "critical," meaning that it can negatively affect and/ or impede the operation of the WCTS. Personnel would then code or identify stocking levels of this item appropriately within Oracle WAM to ensure the item remains available in the warehouse.

5.3.2 Receiving

5.3.2.1 Central Warehouse

The warehouse stock worker manually enters shipments received by the warehouse on a blue control sheet. The next step in the receiving process is for each warehouse inventory shipment to be verified by a stock worker or receiver. This stock worker verifies delivery quantities and quality. The stock worker is also responsible for locating the requisition and purchase order information for each delivery, labeling, inventory location assignment, and receiving the inventory in Oracle WAM against the correct purchase order for the supplier payment to be processed. A Receiving Material/Stock Procedure and a Checkout Request Procedure are provided in Appendix B.

5.3.2.2 Lift Station Storerooms

The maintenance coordinator manages the storerooms at Snapfinger AWWTF. The maintenance coordinator receives parts, checks them against the purchase order, and then stores them in the proper locations. Oracle WAM is also updated with current prices and quantity on hand. The re-ordering process (completion of purchase orders) is manual at present; however, Oracle WAM can be queried to see what needs to be ordered. This is done at least weekly and more frequently if necessary. Oracle financial system is used to check purchase orders against shipping manifests.

5.3.3 Distribution

5.3.3.1 Central Warehouse

The distribution of equipment and parts is tracked through stock transfers, stock checkouts (or checkout requests), and stock issue tickets. These terms are defined as follows.

- Stock transfers – a stock transfer is used to track parts being moved from one storage location to another. For example, a stock transfer is used to track parts issued from the Central Warehouse to a crew truck. A Stock Transfer Procedure is provided in Appendix B.
- Stock checkout – a stock checkout is used to issue stock from a storage location such as the warehouse (or a return to a storage location). Stock can be checked out to an account number or to an asset. An example of a stock checkout is presented in Appendix B.
- Stock checkout request – a stock checkout request is used in the work planning process. A stock checkout request allows a user to build a list of parts needed for a work order, but assignment to a work order is not required. DWM's written procedure for checkout request is provided in Appendix B.
- Stock Issue Ticket – a stock issue ticket is the printed version of a stock checkout or stock checkout request. An example of a stock issue ticket is presented in Appendix B.

DWM's written procedures for updating inventory of spare parts and equipment for lift stations is provided in Appendix B. In addition, several procedures related to issuance and returns of materials are included in Appendix B, such as material issue and return, emergency material issue, and material pick-up for contractors.

Once a stock transfer is turned in to the warehouse, the inventory items are pulled by stock workers, staged, picked up, and signed for by the crew supervisor and then the stock transfer is closed. Once the stock transfer is closed, the resulting inventory is assigned to the receiving storeroom.

Similar to stock code items, ancillary equipment can be issued on-demand. Commonly used ancillary equipment, such as pavement saws, are issued each Monday, and turned back in each Thursday. This allows warehouse staff to check the serviceability of all ancillary equipment on a weekly basis while ensuring that proper maintenance is performed. Equipment is tagged with a unique equipment code and tracked in Oracle WAM. Equipment issued to crews is treated as zero-cost rentals for tracking purposes.

The Warehouse Manager for the Central Warehouse requires equipment be returned to the equipment room at the end of each week. This serves three purposes:

- First, it ensures an accurate inventory is maintained for each equipment item.
- Second, this allows warehouse staff to clean and service the equipment. Servicing may include lubrication, sharpening blades, checking for leaks, and performing basic maintenance such as oil changes.
- Third, weekly checks allow warehouse staff to identify equipment maintenance needs that require third-party assistance.

5.3.3.2 Lift Station Storerooms

The maintenance coordinator pulls parts and issues them to mechanics upon request. When a work order is generated for the repair or replacement of a part, the assigned mechanic is responsible for investigating and troubleshooting the problem and requesting necessary parts for to maintain or repair of that equipment. When parts are issued, they are issued to a work order and the work order record in Oracle WAM is updated with the parts used on that work order. Oracle WAM then updates the parts on hand quantity automatically. The Oracle WAM system provides a warning indication when a set threshold of the stock for a specific part is depleted, indicating that parts are to be reordered to maintain the stock.

5.4 Planned Enhancements

DWM's goal is to maintain the inventory management system that is reliable and meets their business needs effectively. Table 5-2 describes DWM planned improvements and enhancements to their inventory management system.

TABLE 5-2
Inventory Management Program Planned Enhancements

Activity	2014	2015	2016	2017
Implement Barcoding System The goal is to implement the use of barcode scanners that can be used to receive parts, print barcode labels, issue parts, and assist with the physical inventory process. This would allow inventory management steps to be more efficiently entered in Oracle WAM, and staff would have an automatic method to determine current inventory stock levels. It is estimated that 35-40% of manual inventory entry time would be saved by implementing a barcoding system.	X			
Renovate the Central Warehouse The indoor storage space at the Central Warehouse is currently limited. The Warehouse Manager has implemented changes to increased indoor caged (i.e. secure) storage space by nearly a third; however, additional space is needed. The planned renovation will add indoor storage space for overhead pallet storage and increasing the overall indoor storage capacity of the Central Warehouse.	X	X	X	X
Develop Plan to Configure Re-Order Automation Process Configuring re-order automation in Oracle WAM would result in automatic generation of purchase requisitions based on reorder points and quantity on hand. The Warehouse Manager would then review the requisition(s), modify them as needed, and approve the requisition that would be automatically submitted to the Purchasing Department.		X	X	
Implement Component Tracking The purpose of this enhancement is to configure and use the component-tracking feature within Oracle WAM for tracking significant items associated with lift station maintenance.	X			

6 Gravity System Maintenance

6.1 Overview

This section presents the County's gravity line preventive and corrective maintenance schedules, practices, and procedures as well as predictive inspection practices including the maintenance of easements. Specifically, descriptions of the following program elements are included in this section:

- Resources (equipment, personnel, and contracts) dedicated to gravity line maintenance
- Preventive maintenance practices, procedures, and schedules implemented by the County (including inspection and cleaning activities) for gravity sewer lines and manholes
- Corrective maintenance practices and procedures used by the County for gravity sewer lines and manholes
- Inspection and maintenance of easements (for sewer and force mains) to maintain access and line integrity, as well as inspection of creek crossings and identification of stream bank encroachment
- DWM's strategy for focused preventive maintenance activities through planning and implementing identified enhancements
- Tracking of performance measures for gravity system maintenance (Refer to Section 8, *Key Performance Indicators)*

6.2 Resource Commitments

DWM's C&M Group oversees gravity line maintenance. The gravity system is comprised of approximately 2,600 miles of sanitary sewers and approximately 61,500 manholes within three basins (refer to Section 1 for an overview of the County WCTS). Staff based out of the Roadhaven facility inspect, maintain, and repair gravity lines.

Personnel are trained to perform the required duties to maintain the gravity system. Safety, technical, and professional certification training are described in the DeKalb County *Collection and Transmission Systems Training Program*. Table 6-1 lists equipment, personnel, contracts, and other resources available for gravity sewer line maintenance.

TABLE 6-1
Gravity Line System Maintenance Management Resources

Resource	Description
Staffing	
Gravity System Maintenance Assistant Director Operations	Oversees gravity sewer preventive and corrective maintenance. In addition, oversees management of budgets and participates in master planning.
DWM Capital Improvement Program and Engineering Department	Provides planning and design for gravity line system major upgrades and rehabilitation. Information on gravity sewer lines is integrated among the Operations, CIP, and Engineering Departments.
C&M Maintenance Superintendent	Superintendent oversees preventive and corrective maintenance
C&M General Foreman	Inspects and oversees gravity line work.
C&M Inspectors	Evaluates jobs for additional work and quality assurance.
C&M Crews	Conducts preventive and corrective maintenance.
Contracts for personnel and equipment for maintenance (cleaning and root control)	Contracted as procured.
Easement Maintenance: Assistant Director Operations	Oversees maintenance of easements.
C&M Crews and Contractors	Maintains easements, as needed for emergency access and clearing for cleaning crews.
Contracts for personnel and equipment for maintenance and clearing	Contracted as procured.
Inspection of Easements, Creek Crossings, and Stream Banks Assistant Director of Engineering and Asset Management	Oversees inspections of easements, creek crossings, and stream banks.
C&M Crews and Contractors	Crews inspect easements, creek crossings, and stream banks.
Other Resources	
Oracle Utilities Work and Asset Management (WAM)	Enterprise asset management system used to track service requests, work requests, work orders, and inventory management Refer to Section 4, Information Management for further details.
Geographic Information System (GIS) via ArcServer	Desktop and server GIS software used for mapping and spatial analysis; in the process of integrating with Oracle WAM
Oracle Financials	Used for purchasing functions, partially integrated with Oracle WAM.
Data Collection Software	Hardware and software for data collection, CCTV software
Microsoft Office	Used for common office needs such as word processing, reporting, flowcharting, presentations, and tracking of data.
Modeling Software (InfoWorks CS)	Software is used for modeling the collection system network and calculating and simulating system capacity and dry and wet weather flows. The calibrated model can be used for master planning or capital improvement studies, identifying solutions for sanitary sewer overflows, and assists in overall wastewater system assessment and management.

TABLE 6-1
Gravity Line System Maintenance Management Resources

Resource	Description
Equipment, Tools, and Parts	Vehicles for gravity line system maintenance supervisors and crews Mobile phones and Push-to-Talk Systems (PTT) Combo Units and assorted nozzles Water Jet Trucks (works with Closed Circuit Television (CCTV) equipment) Rod Machines for blockages CCTV Systems Augers (used on rod to unstop manholes) Root Cutters Sufficient tools and spare parts Safety equipment Portable Pumps Portable generators Portable lights Blowers Traffic Control Equipment Global Positioning System (GPS) equipment Refer to Section 5, Inventory Management for further details.

Resources from Contracted Services

Corrective, preventive, and predictive maintenance activities of the gravity system are performed by C&M crews and contracted vendors. Maintenance activities include sewer pipeline cleaning, manhole cleaning, surveying, and condition assessments. Contracted services include:

- Sewer pipeline external point repair
- Sewer pipeline re-lining
- Sewer pipeline replacement (via open-cut, pipe bursting or other method of construction)
- Sewer creek crossing pipeline rehabilitation and/or replacement
- Manhole rehabilitation and/or replacement

DeKalb County will continue to utilize contracted vendors to assist with corrective, preventive, and predictive maintenance of the existing gravity system now and in the future.

6.3 Gravity System Maintenance Work Flow

Gravity system preventive maintenance work is implemented through a series of planned work activities based on industry best practices, identified improvements, review of trends through review of work orders and service requests for frequent maintenance problems, and review of inspection results. Figure 6-1 provides a flow chart for gravity system maintenance workflow. As depicted in Figure 6-1, maintenance work is initiated based on results from investigation requests that lead to preventive, predictive, or corrective maintenance activities, practices, schedules, and procedures, as described in the following sections.

6.4 Preventive Maintenance Schedules, Practices, and Procedures

As depicted in Figure 6-1, preventive maintenance work performed is based on investigation activities initiated by inquiries from citizens, regulators, OSARP/PASARP studies, GIS mapping, and/or issue identified through hydraulic modeling. Figure 6-1 depicts the steps taken by field crews to categorize work activities as preventive, corrective, or predictive.

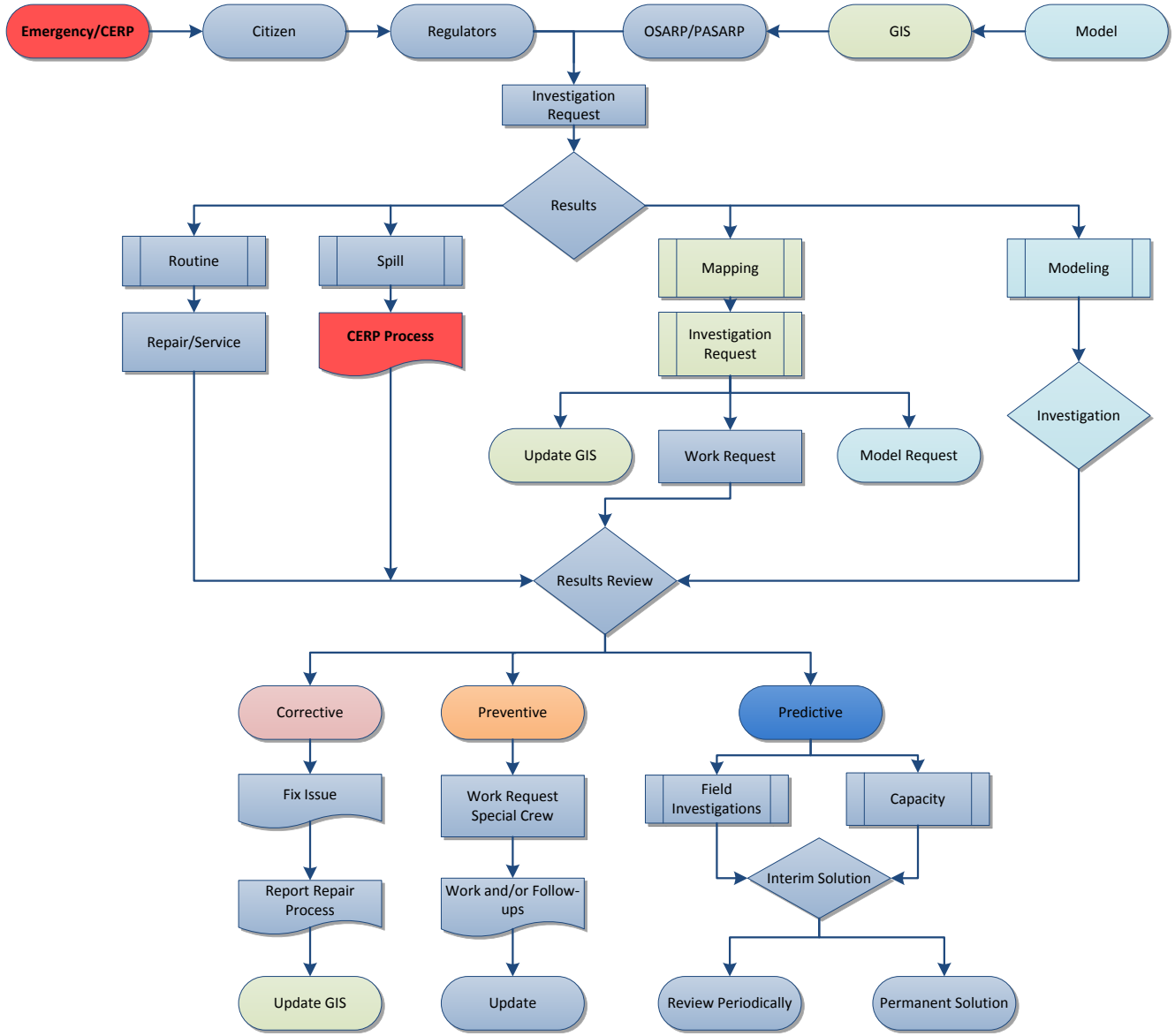
6.4.1 Preventive Maintenance Schedules

Preventive maintenance activities are planned, prioritized, and scheduled through data input into Oracle WAM. Benchmark work orders (preventive maintenance work orders) have been developed as templates for routine maintenance activities. The work order is assigned a scheduled frequency that varies from no preventive maintenance required, to work conducted quarterly, twice a year, annually, every 2 years, every 3 years, and every 10 years. The work order system will be able to track the work conducted as preventive, corrective, or emergency.

The process by which the County prioritizes and schedules preventive maintenance activities is based on assessment of data available through inspections, history of work orders, GIS mapping, flow monitoring, SSO history, capacity modeling, and other tools to systematically evaluate available data. Once areas are identified for specific maintenance activities, C&M crews are assigned work orders or contracts are issued to accomplish the work.

Categorizing of pipe segments and manholes for the establishment of routine preventive maintenance scheduling is based on data collected through several data sources, as described below. The information is used to identify appropriate routine preventive maintenance activities and frequencies of maintenance of the County WCTS. For example, factors such as results from CCTV inspections (presence of grease, roots, sediments, rags, debris, and age and type of pipe) are considered when identifying routine maintenance schedules and activities.

FIGURE 6-1
Gravity System Maintenance Flow Chart



6.4.1.1 Step One: Data Collection and Assessment

Data collection and assessment is based on the following major areas:

- PASARP Initial Priority Areas and Additional Priority Areas: DWM is in the process of assessing the condition of the Priority Areas, per the PASARP. The frequency of maintenance in the priority areas will be established based on data obtained during the condition assessment. Information obtained from the assessment of the Priority Areas will be input into Oracle WAM for planning and scheduling long-term maintenance activities.
- OSARP Areas As the MMS Program evolves and is implemented, C&M staff will continue to meet long-range goals in coordination with the OSARP. The OSARP proactively identifies, delineates, and prioritizes areas or sewer segments within the WCTS for condition assessment and rehabilitation, as appropriate, (for areas not being addressed under the PASARP).
- High Frequency Service Areas: The current, identified service areas (hot spots or high frequency maintenance areas) that require increased cleaning and service will be incorporated into the Oracle WAM work order system in 2014. The *Clean All Required Line List*, also called the *CARL List,* consists of approximately 193 sites that identify the address, Section, Land Lot and District, maintenance activity, and cleaning frequency (three to six months). Maintenance activities are continuously occurring under the scheduled frequency, and the list is updated as repairs, relining, rehabilitation, or replacement occurs as appropriate.
- Service Requests and Corrective Maintenance Data: Service request information is evaluated based on type, frequency, location of the work covered by the service request, and observations from field crews. For instance, if grease related issues are recurring frequently in a specific area or sewer segment, the affected area is prioritized for further evaluation by C&M crews and by the FOG Group for enhanced inspection, cleaning, and FOG Ordinance compliance enforcement. Repair codes are also evaluated and used for planning and prioritizing areas for preventive maintenance activities.
- SSO Occurrence Data: Areas and sewer segments are also prioritized by the Assistant Director and the Superintendent based on an evaluation of number, location, and cause of SSOs. Areas and sewer segments observed to experience recurring SSOs are identified for cleaning activities or further investigation. The team establishes short and long-term priorities based on data evaluation (of back-ups and overflows) and identifies areas where other factors are contributing to SSOs. This data is input into Oracle WAM to better track data on problem areas. The CERP provides detailed descriptions of SSO investigation practices that include root cause analysis and documentation.
- Assessment Data from Capital Services Contracts: Data is gathered through multiple Capital Service contracts currently in place. This data will be incorporated into Oracle WAM in 2014 and 2015 and used in the establishment of preventive maintenance work orders and schedule.

6.4.1.2 Step Two: Establish Work Orders from Assessment Data and Schedule Based Prioritized Categories

Work orders for preventive maintenance activities involving pipe and manhole cleaning and inspection are generated based on maintenance data and typically prioritized such as follows:

1. Priority 1 categorized pipe segments/areas (scores of 81 to 100) require monthly to quarterly cleaning and annual inspection.
2. Priority 2 categorized pipe segments/areas (scores of 61 to 80) require annual cleaning and annual inspection.
3. Priority 3 categorized pipe segments/areas (scores of 31 to 60) require cleaning within one year of inspection and re-inspection in 3 years.
4. Segments categorized below 30 require inspection every 5 years. No cleaning required.

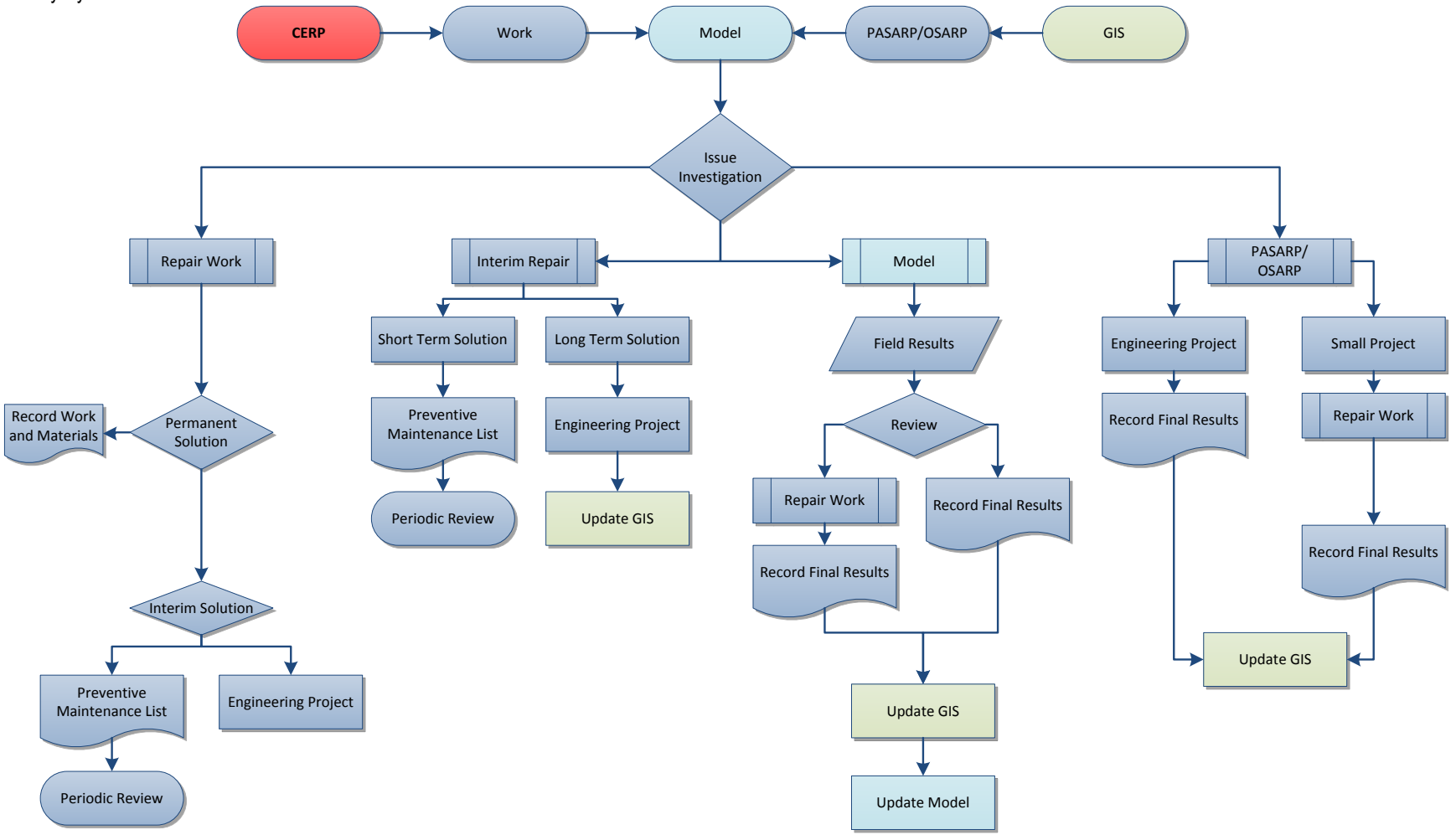
This prioritization process is based on the National Association of Sewer Service Companies (NASSCO) Pipe Assessment Certification Program (PACP), Manhole Assessment and Certification Program (MACP), and Lateral Assessment and Certification Program (LACP) guidelines.. DWM has adopted methods consistent with standards established by NASSCO MACP, PACP, and LACP.

DWM will be able to import data from Microsoft® databases (Excel/Access), MACP databases, CCTV, and PACP as the data links are customized. The Microsoft databases will retain multiple occurrences of asset data enabling planners to view the history of an asset and to determine historic aspects such as condition of assets and performance before and after maintenance work.

6.4.1.3 Step Three: Establish Overall Target

The County has established a preventive maintenance target of cleaning 10 percent to 20 percent of the gravity pipe segments per year (which is equivalent to approximately 260 to 520 miles of sewer lines cleaned per year). Cleaning activities include hydraulically flushing, CCTV activities, mechanical cutting of roots, and vacuum removal of sediment, grease, and other debris. The prioritized areas will be cleaned based on the prioritization categories described above. Figure 6-2 provides an overview of preventive maintenance activities undertaken by DWM.

FIGURE 6-2
Gravity System Preventive Maintenance Flow Chart



6.4.2 Preventive Maintenance Practices and Procedures

Preventive maintenance practices and procedures include contracted and in-house activities as described below. Based on finding of investigations of areas and line segments, preventive measures are assigned and scheduled. In the future as mapping is completed, schedules can be assigned based on data input and analysis.

In 2014, approximately 475 miles of sewer pipe were cleaned (equivalent to approximately 20 percent of the system) through primarily contracted resources. In addition, approximately 8,600 manhole inspections were conducted (equivalent to approximately 12 percent of the County's approximate 70, 000 manholes).

6.4.2.1 Contracted Preventive Maintenance

The County routinely maintains contracts with private contractors specializing in WCTS maintenance. The private firms augment the County's WCTS maintenance capacity allowing the County to meet targeted goals. The County provides oversight of contractors performing preventive maintenance activities. A General Foreman reviews and manages services provided by contractors including cleaning areas such as the following:

- Areas affected by SSOs, gravity sewer lines, and manholes
- Defined areas map related to each spill
- Defined areas of 50 to 60 miles within the Priority Areas

Criteria used to define and prioritize areas to be cleaned include evaluation of problem areas color-coded on GIS maps, review of maps showing the location of SSOs, and identification of areas based on assessments, spill occurrences, and other data sources.

The DeKalb County sewer system cleaning specifications for contracts defines cleaning requirements. Contractors must comply with the County's performance criteria as described in these specifications. DWM inspectors oversee contract activities and DVDs that are submitted by the contractor to document activities conducted.

This oversight is for the following process:

1) Clean the gravity line
2) Conduct pole camera inspection of manholes
3) Review data and CCTV problem areas or CCTV at least 5 percent of what the contractor cleaned

Sewer lines (8-inch pipe and above) are cleaned prior to conducting a CCTV inspection. Contractors are paid based on the number of linear feet cleaned. DWM provides maps to contractors showing the areas or sewer segments to be cleaned and inspected utilizing CCTV inspection method. County inspectors maintain field records of the sewer lines cleaned including estimated lengths of linear feet completed. This information is entered into GIS. C&M maintains a current list of cleaning priorities and oversees data management.

The following preventive maintenance practices are conducted by C&M as routine activities, or are managed through Capital Services Group through contracts.

6.4.2.2 Routine Hydraulic Cleaning Practices

Hydraulic cleaning practices include activities such as identification of hydraulic cleaning needs, established priorities, scheduled cleaning activities, support of an appropriate number of crews and personnel, acquisition of necessary equipment (e.g., jet units, combination vacuum units, etc.), written standard hydraulic cleaning procedures, standard forms, performance measures, and a mechanism for including hydraulic cleaning information in GIS.

Critical, high frequency maintenance areas are cleaned on a scheduled more frequent basis and are completed in conjunction with CCTV inspection prior to and after cleaning activities, as needed. Data is recorded in Oracle WAM and GIS. A vacuum jet cleaning procedure is provided in Appendix C.

6.4.2.3 Routine Mechanical Cleaning Practices

Mechanical cleaning practices include activities such as identification of mechanical cleaning needs, established priorities, scheduled cleaning activities, support of an appropriate number of field crews and personnel, and acquisition of necessary equipment (e.g., rodders, bucket machines, etc.). Written standard mechanical cleaning procedures, standard forms, performance measures, and a mechanism for including mechanical cleaning information in Oracle WAM has been established.

Mechanical cleaning (contracted or conducted by C&M crews) is conducted based on customer service requests as a follow-up to any spills in the system and based on above identified prioritization scheduling. As part of gravity line preventive maintenance, a routine mechanical cleaning program is established based on mechanical cleaning needs in coordination with the hydraulic cleaning program. Routine mechanical cleaning is also completed in conjunction with CCTV inspection prior to and after cleaning activities. All information is recorded in Oracle WAM and/or GIS. A mechanical rodding and jet rodding procedure is provided in Appendix C.

6.4.2.4 Root Control Practices

Root control practices include activities such as the following:

- Identifying root control needs, root control methods and procedures, and criteria for establishing root control priorities
- Scheduling root control activities
- Ensuring that adequate resources are available to complete and document scheduled root control activities including the securing the following:
  - Necessary equipment (e.g., mechanical, chemical, etc.)
  - Written standard root control procedures
  - Standard forms
  - Performance measures
  - Mechanisms for including root control information in Oracle WAM and/or GIS

Data on blockages and SSOs caused by root intrusion in the WCTS is routinely collected. Ongoing root control activities are completed primarily under County contracts. Contracts are established as multi-year contracts. The schedule and location of contract activities are

based on priority areas identified for root control. Critical areas identified for root control (such as pipes in low-lying creek areas) undergo root control activities on a more frequent basis than non-priority areas. Roots either are cut by hydraulic and mechanical means or are treated with root control chemicals available in the market. C&M has root saw type cutters that work effectively on roots, grease, and other blockages.

Root control will also be conducted for stream crossings identified with root intrusion. The County will have a contract in place in 2015 for root control within sewers primarily located along water bodies where typically roots are associated along creeks.

6.4.2.5 Manhole Preventive Maintenance Practices

Manhole preventive maintenance practices include activities such as:

- Identification of manhole maintenance needs, manhole preventive maintenance methods and procedures, criteria for establishing manhole preventive maintenance priorities
- Scheduling manhole preventive maintenance activities
- Ensuring that adequate resources are available to complete and document scheduled manhole preventive maintenance activities, which include the following:
  - Support of an appropriate number of crews and personnel
  - Acquisition of necessary equipment (rings and lids, structural repair, etc.)
  - Written standard manhole inspection and maintenance/cleaning procedures
  - Standard forms
  - Performance measures
  - Mechanisms for including manhole maintenance information in Oracle WAM and/or GIS

Currently, C&M crews inspect manholes when responding to service calls or conducting preventive maintenance activities. The crews document the condition of the manhole. If additional inspection is needed, and/or if spot repairs are required, data obtained by field crews are entered into the Oracle WAM and GIS to track asset condition.

DWM preventive maintenance activities (including inspection and cleaning) include a target goal of 8,000 manholes per year. Repair activities are conducted by C&M repair crews through work orders that were generated based on results from inspections and identification of defects.

Manhole condition assessment is being conducted as part of the *Sewer Mapping Program* but assessment procedures will be standardized under the *PASARP Program* to reflect current assessment system updates and technology improvements. Manholes are located, inspected, and surveyed utilizing conventional or GPS surveying methods. *PASARP* manholes with structural defects are to be coded utilizing the MACP system. Manhole defects will be scored and prioritized for rehabilitation, replacement, or future re-inspection. Cleaning of manholes is also prioritized based on data obtained as part of the *Sewer Mapping Program* and will be corrective action resulting from the *PASARP* condition assessment inspections. Results of inspections will be entered into Oracle WAM/GIS.

Critical areas are inspected and cleaned on an established schedule, and less critical areas on a less frequent basis. Information is recorded in Oracle WAM or GIS. A Manhole Cleaning Procedure is provided in Appendix C.

6.5 Predictive Inspection and Maintenance

Predictive inspection and maintenance for gravity sewers includes activities such as sewer mapping, historical and current investigation results, population of GIS of asset parameters, hydraulic modeling of capacity, and ongoing contracted inspection services as described in the following sections. In addition, inspections of easements, creek crossings and stream banks, and easement maintenance are included as predictive inspection and maintenance tools in the subsections below.

The *Sewer Mapping Program* includes asset inventory, location, and inspection data collected by sewershed and sub-basin for gravity lines, force mains, air valves, and manholes. Data will be provided in digital format and uploaded to InfoMaster™.

The *System-Wide Hydraulic Modeling Program* provides predictive data for potential maintenance practices in specific areas. Data incorporated into the hydraulic model includes input from the *Infrastructure Acquisitions Program* and the *System-Wide Flow and Rainfall Monitoring Program*.

Contracts for predictive inspection and maintenance include the following:

- Sewer Pipe Inspection
  - Current CCTV contract that includes CCTV inspection and cleaning.
  - A new CCTV contract (inspection) that will be implemented to conduct CCTV in the same area as the cleaning contract (as discussed in preventive maintenance)
- Manhole Inspection:
  - From 2007-2010, 27,000 manholes were assessed under a contract
  - Current sewer mapping contracts provide preliminary assessment on manhole conditions (good, fair, or poor). As mentioned above, approximately 8,588 manholes were inspected and assessed in 2013 (12.5 percent of the system of the County's 69,000 manholes)

6.5.1 Inspection of Easements, Creek Crossings, and Stream Banks

The goal of the inspection of easements, creek crossings, and stream banks practice is to inspect, remove debris, and repair as required, major sewer trunk crossings and perform regularly scheduled preventive maintenance inspections. Sanitary sewer lines that are constructed in areas along streams, terrain that is difficult to navigate, and other locations where access is limited to easements require inspection and maintenance on an ongoing basis to protect the area from vegetative over growth, erosion, and construction of fences or other structures by the public.

Inventory of sewer line creek crossing areas is ongoing. In addition, DWM is digitizing paper copies of easements, verifying easement locations, and collecting information through

record drawings. The Engineering and Technical Services Division of the DWM is incorporating this information into GIS.

Inspection of easements, creek crossings, buffer zones, and stream banks within the WCTS are conducted by C&M crews. This enables DWM to identify existing structural damage and conditions that may cause damage to sewers and manholes within these locations, such as obstruction of pipes, stream bank conditions and erosion, and high water flow impacts on pipes and stream banks so that appropriate response can be deployed to correct deficiencies in a timely manner. This data is entered into GIS as collected. Inspection practice goals include reduction of potential SSOs at vulnerable points identified along creek crossings and easements.

There are approximately 1,000 creek crossings in the County consisting of approximately 800 aerial crossings and 200 buried crossings. Benchmark work orders are generated in Oracle WAM as planned activities. An annual condition-based inspection has been initiated for 300 aerial crossings and stream bank assessments. Inspectors promptly report observed SSOs to their supervisors and record evidence of SSOs that may have occurred since the last inspection. Observed SSOs are promptly reported as described in the CERP.

GIS analysis, rainfall events, customer calls, and inspection results will be used to determine the need to inspect creek crossings. Inspection procedures are provided in Appendix C, which contains an inspection form to allow the inspectors to grade each crossing and determine the extent of debris removal or repair that may be required. Additional data on the crossings are noted such as manhole numbers upstream and downstream, general condition, type of crossing, easement condition, and a photograph and sketch.

DWM will use Oracle WAM and/or GIS to store inventory and inspection data, digital photographs, and to generate preventive maintenance work orders for periodic inspection of sewer aerial crossings. From an initial inspection, crossings will be graded (good, fair, or poor) based on criteria established (such as evaluation of pipe support, debris accumulating against the pipe, stream bank erosion, and other factors) to determine the frequency of future inspections. Additional data on crossings such as manhole numbers upstream and downstream, general condition, type of crossing, easement condition, stream bank condition, and a sketch of the site will be collected.

Digital photographs from the initial inspection will be compared to future inspection data and photographs, and then the inspection frequency and grade will be adjusted. The work order system will automatically generate work orders to conduct repeat inspections. GIS maps, which track the stretches of stream basins inspected to date, are currently maintained. The County will enhance its creek crossing inspection practice based on ongoing assessments.

6.5.2 Easement Maintenance

Easement maintenance practices enable DWM to provide safe and efficient access to inspect and maintain the WCTS, establish criteria to prioritize maintenance needs and activity schedules, define appropriate resources (personnel and equipment) required to provide the level of service needed, and minimize impacts on sewer lines from tree roots that infiltrate joints and weak points in sewer lines and manholes. The following frequency schedule for priority easement clearing will be implemented:

- Easements with overgrowth of kudzu or vegetative growth will be cleared annually
- Easements with small trees will be cleared once every three years
- Easements with large trees will be cleared once every ten years

The County will coordinate with a vendor for clearing of easements designated as priority sewer easements. Areas under Army Corp of Engineers purview will be cleared contingent on accessibility and permitting requirements.

A comprehensive program for the maintenance of easements, including schedules for clearing activities, will be established as information is collected from field activities.

6.6 Corrective Maintenance Practices and Procedures

Corrective maintenance practices occur based on triggers identified in Figure 6-1 above, such as SSOs, Dispatch calls, and other factors. Refer to Appendix A for list of repair codes used by C&M. Depending on results of investigations, corrective maintenance activities may be initiated by C&M crews. A description of contracted and in-house services for corrective maintenance activities are described as follows:

- On a day-to-day basis, C&M crews perform corrective maintenance activities. DWM Dispatch creates and routes service requests to C&M crews to investigate, inspect, and determine repair needs for various WCTS assets. DWM utilizes Oracle WAM Customer Service Subsystem for C&M service requests, which are tracked by address. Refer to Section 4, *Information Management* for a detailed description of the service request process.

- C&M Superintendents manage DWM C&M crews. Crews are dispatched according to call priority. The Superintendent assists the General Foreman in coordinating maintenance crews and oversees maintenance activities in response to corrective and emergency maintenance needs. The Superintendent oversees repairs to sewer mains, laterals on County property side, manholes, and creek crossing pipes.

- If a SSO event occurs, the field crew identifies corrective maintenance needs and determines the cause of the SSO as described in the CERP. Crews undertake immediate corrective actions such as hydraulic or mechanical cleaning to remove a blockage. More in depth analysis may require CCTV inspection to determine the cause of a SSO. C&M maintains corrective program resources to respond to WCTS problems that may occur as the County transitions from corrective to predictive and preventive maintenance. Corrective maintenance procedures are provided in Appendix C.

In addition, cleaning contracted resources are in place as follows:

- General Cleaning Contracts – on call services
- Specific Area Cleaning Contracts – focus on cleaning of Priority Area lines

Contracts in place for corrective maintenance activities include the following:

- Sewer Pipe Rehabilitation
  - Pipe Bursting, Jack and Bore
  - Open cut replacement, sewer realignment
  - Cured in Place Pipe (CIPP) (relining)

  - Point repairs Contracts

- Manhole Rehabilitation
  - Manhole Rehabilitation contracts for cleaning then repair (e.g. manhole lining)
  - Locate/raise manholes, replace frame and cover as needed, approximately 100 manholes were rehabilitated or repaired in 2013

6.7 Planned Enhancements

DWM ensures that the gravity system maintenance is reliable and is maintained to meet the County's needs effectively. Table 6-2 describes planned improvements and enhancements to their gravity system maintenance.

TABLE 6-2
Gravity System Maintenance Program Planned Enhancements

Activity	2014	2015	2016	2017
Review and Revise Maintenance Procedures Review and revise gravity system maintenance procedures. Determine if additional procedures need to be developed.		X		X
Assess the Condition of Assets Conduct gravity line maintenance asset condition assessment and prioritize based on condition and risk (using industry practice of assessing likelihood and consequence methodology) in coordination with the PASARP and OSARP Programs.		X	X	X
Establish Overall Target An appropriate target will be established based on sewer basin. On average 10 to 20 percent of entire system will be cleaned per year. Implement scheduled comprehensive Preventive Maintenance Program.		X	X	X
Input Repair and Maintenance Data Input data on repair and maintenance needs into Oracle WAM/GIS/Model.	X	X	X	X
Establish Priorities and Schedule Establish priorities and schedule for inspection and clearing activities.	X	X	X	X

7 Lift Stations, Force Mains, and Appurtenances Maintenance

7.1 Overview

This section presents the County's lift stations, force mains, and appurtenances, preventive and corrective maintenance, and predictive inspection schedules, practices, and procedures. Specifically, descriptions of the following program elements are included in this section:

- Resources (equipment, personnel, and contracts) dedicated to lift station maintenance and inspections
- Preventive maintenance practices, procedures, and schedules implemented by the County for lift stations
- Corrective maintenance practices and procedures used by the County for lift stations
- Predictive inspections practices and procedures used by the County for lift stations
- DWM's strategy for focused preventive maintenance activities through planning and implementing identified enhancements
- Tracking of performance measures for Lift Stations, Force Mains, and Appurtenances is provided in Section 8, *Key Performance Indicators*

7.2 Resource Commitments

Water Quality Control (WQC) Maintenance oversees O&M of lift station, force mains, ARVs, and other associated appurtenances (such as pumps, valves, etc.). Section 1 provides an overview of the DWM organization. The WQC Manager, the Lift Station Maintenance Supervisor, and lift station mechanics and electricians are based out of the Snapfinger AWWTF. Personnel are trained to perform the required duties to maintain lift stations. Safety, technical, and professional certification training provided to lift station maintenance staff (wastewater, electrical, mechanical, and instrumentation and control) is described in the DeKalb County *Collection and Transmission Systems Training Program*. Table 7-1 lists the staffing and other resources available for lift station, force mains, and appurtenance maintenance management.

TABLE 7-1
Lift Stations, Force Mains, and Appurtenances Maintenance Management Resources

Resource	Description
Staffing	
DWM Assistant Director of Operations	Oversees lift station management.
WQC Superintendent	Oversees O&M of lift stations, as part of larger duties in Plant Operations. Oversees force mains, ARVs, and associated assets preventive and corrective maintenance.
DWM Engineering Department	Provides planning and design for lift station upgrades and rehabilitation
WQC Maintenance Manager	Supervises the Wastewater Maintenance Area and oversees O&M of lift stations, also provides maintenance supervision over ARVs.
Assistant Maintenance Supervisor	Provides oversight in the inspection and preventive and corrective maintenance of lift stations, ARVs, and associated assets.
Senior WQC Maintenance Mechanics	Conducts inspection and maintenance activities (corrective and preventive) related to lift stations, ARVs, and associated assets or appurtenances.
WQC Maintenance Mechanics	Conducts inspection and maintenance (corrective and preventive) related to lift stations, force mains, and ARVs. In addition, monitors force main pressure.
C&M Maintenance Superintendent, Foremen, and Crews	Maintains and repairs force mains. Coordinates with the Lift Station Group in identifying maintenance and repair needs.
Electronics Technician (E-Tech)	Conducts lift stations electrical inspection and maintenance.
Electricians	Snapfinger AWWTF has electricians available as support staff to assist lift station personnel, as needed.
Instrumentation Control (I/C) Specialist	Provides oversight of SCADA system at Plants and Lift Stations.
Spare Parts Coordinator Supply Specialist	Oversees spare parts and equipment inventory management.
Contracted Resources	• Small industrial plumbing companies to assist the crews on bigger projects. • Portable pump company that can provide sewer bypass services, if necessary. • Generator contract that provides service and routine checks of lift station generators, as needed. • Electrical company contract that provides electrical services, as needed. • Pump repair contract for larger repairs. • Heavy equipment contract for rental of backhoes, large cranes, etc. • Welding contract that provides welding services.
Administrative Assistant	Performs data entry for work order management for lift stations, force mains, and ARVs, maintains the Oracle WAM database

TABLE 7-1
Lift Stations, Force Mains, and Appurtenances Maintenance Management Resources

Resource	Description
Other Resources	
Oracle WAM	Enterprise asset management system used to track service requests, work requests, work orders, and inventory management Refer to Section 4, Information Management for further details.
Telemetry	SCADA for Lift Stations Monitoring. The SCADA system receives and monitors Lift Stations and associated alarms at the Control Room at Snapfinger AWWTF
Geographic Information System (GIS) via ArcServer	Desktop and server GIS software used for mapping and spatial analysis; integrated with Oracle WAM
Oracle Financials	Used for purchasing functions, integrated with Oracle WAM
Microsoft Office	Used for common office needs such as word processing, reporting, flowcharting, presentations, and tracking of data
Equipment, Tools, and Parts	• Vehicles for Lift Station staff • Mobile phones • Sufficient tools and spare parts • Vacuum truck for removal of grease and obstructions • Mobile crane • Safety equipment (gas detectors, blowers, and tripods) • Portable Pumps (6-inch and 4 inch hydraulic or diesel) for use at larger Lift Stations • Two portable generators (60kw and 200kw) • Portable lights • Blowers • Infrared camera (third-party inspects the large lift stations annually) • GPS equipment • Refer to Section 5, Inventory Management for further details.

7.3 Summary Description of Lift Stations, Force Main, and Appurtenances

7.3.1 Lift Stations

DWM currently operates and maintains 66 lift stations throughout the County. A GIS map showing the locations of lift stations, force mains, and ARVs is provided in Section 1. Table 7-2 (located at the end of this section) provides summary information on each lift station, including station name, station type, address, installation date, age of station, rehabilitation/ improvement, date of improvement, capacity or volume of station, response time to spill (hours), depth to high level float, and wet well volume (gallons).

DWM currently operates and maintains the following types of lift stations:

- Major lift stations, dry pit
- Aboveground lift stations (Smith and Loveless suction stations; this provides for redundancy of parts and equipment and efficiencies in maintenance)
- Belowground, dry pit lift stations (Smith and Loveless and Allis-Chalmers package units)
- Submersible stations

7.3.1.1 Technical Specifications

In 2010, DWM completed a comprehensive report entitled *Lift Station Inventory, Survey, and Drawdown Testing Report*. The *Inventory Survey and Drawdown Testing Report* provides detailed specifications for 60 out of 66 lift stations such as wet well dimension, pump on/off and alarm level, pump capacity determined through fill-and-draw down tests, control/ monitoring system, survey maps, and legal description (land lot and land district). Improvements have been made based the findings of this report. This report is maintained at the Snapfinger Creek AWWTF in the Superintendent's Office. A sample of a Lift Station Drawdown Testing Report is provided in Appendix D. A summary of technical specifications for each station is provided in Table 7-2 (located at the end of this section).

In addition, Manufacturers O&M manuals also contain technical specifications on each pump type and are maintained at the Snapfinger AWWTF Superintendent's Office.

7.3.1.2 Critical Response Time Data

Critical response time is defined as the time interval between activation of the high wet well level alarm and the commencement of a SSO, under peak flow conditions. DWM has documented critical response time data over a 12-month period (July 2012 to June 2013) for each lift station in a spreadsheet that tracks the following:

- Station name
- Station number
- Monthly pumping duration (hour)
- Monthly pumping volume (gallon)
- Average daily pumping volume (gallons per day)
- Maximum monthly pumping volume during the past year (gallons)
- Total pumping volume over the 12-month period (gallon)
- Maximum monthly pump flow (gallons per minute [gpm])
- Wet well depth, wet well diameter
- Depth above the high level float
- Wet well area
- Wet well volume above the high level float(in cubic feet and gallons)
- Time to spill in minutes
- Time to spill in hours

From this data, critical response time is calculated using the following formula:

$$\textit{Critical Response Time} = \frac{\textit{Volume (V) in gallons above the high level alarm}}{\textit{Monthly Flow (Maximum) in gpm}}$$

Where

$$V = \pi r^2 \text{ x Depth (in feet) (multiply by 7.481 to convert to gallons)}$$

The volume of the wet well above the high level float is measured and converted into gallons. Most wet wells are cylindrical in design, therefore the volume is calculated by using the equation V = πr^2 * Depth (in feet) (multiply by 7.481 to convert to gallons). Approximate volumes are calculated for wet wells with non-cylindrical shape in design using a different formula.

The pump run times were measured each month and converted to flow. The highest monthly flow (peak wet weather induced flow condition) was divided by days in the month to get daily flow, and divided by 1,440 to convert the flow to gpm. Critical response time data for each station is provided in Table 7-2 and the data spreadsheets are maintained at the Snapfinger AWWTF WQC Superintendent's Office.

7.3.1.3 Lift Station Monitoring System

In 2010, the County converted to a more advanced lift station monitoring system with enhanced capabilities. A digital SCADA system using Telog telemetry was installed at the lift stations. DWM personnel monitor lift station SCADA data continuously in the Operations Center at Snapfinger AWWTF. Monitoring parameters include real time data for the following:

- Pump operations (run times/performance, pump failures and failure codes)
- High wet well status and alarms
- Calculated average flow (real-time flow not monitored)
- Facility alarms (for example power supply alarms automatically alert of power failure and/or generator run and having an open SCADA box will trigger an alarm)

In the event of an alarm originating from the Lift Station SCADA, for parameters listed above, the Assistant Maintenance Supervisor and senior mechanic are notified and mechanics are dispatched immediately to the lift station for inspection and response.

DWM and contracted staff maintain the telemetry system in proper working order. The Operations Center and SCADA system has battery backup power in the event of a power outage. In the future, pressure gauges and flow meters will be installed in every lift station to better monitor pressure and flow, which will be monitored through the SCADA system. Refer to Section 4, *Information Management*, for further details on the DWM SCADA system.

7.3.1.4 Site Security

Each lift station facility is maintained in a locked status and is enclosed by a site perimeter security fence and gate that is also locked. Pump access hatches are also locked as well as wet well entry points. Each lift station has a sign in/sign out sheet to record site entry; the sheet is signed by personnel visiting the lift station (date, name, time in/time out), including the reason for the visit. Security evaluation was made by DeKalb County Homeland Security and is in the evaluation process.

7.3.1.5 Emergency Back-up Generators

All Lift stations are equipped with standby emergency back-up generators, with the exception of Johnson Creek's generator which was lost due to a flood and is being replaced in 2017. Lift station standby emergency generators are sized to provide full redundant power and are fueled by either natural gas or diesel. Generators are activated automatically by means of an automatic transfer switch in the event of a utility power outage. Portable generators are also available if needed.

- On a weekly basis: Standby emergency generator fluid levels and alarms are checked, good housekeeping is performed, and generators are operated to check for functionality and performance.
- Preventive Maintenance is performed on generators and switch gears annually.
- Electrical panels are checked using infrared testing.

In the event of a power loss, lift stations switch to emergency power (standby generators), an alarm is activated inside the station, and a signal is sent to the Operations Room at Snapfinger AWWTF by the SCADA system.

7.3.1.6 Emergency Standby Pump Systems

Emergency standby pump systems are being tested. Currently, only Harmony Hills has a standby pump. Standby pumps are scheduled to be installed at Royal Atlanta I and the Pepperwood stations. These installations will serve as test cases for reliability in comparison to having a generator. However, the test for Harmony Hills showed that the pump did not function well during freezing conditions; therefore, the County is still evaluating the application after making adjustments to the existing pump and designs for the new pumps.

7.3.2 Force Mains and Air/Vacuum Release Valves

DWM maintains approximately 40 miles of force mains. Approximately 15 miles of force main is polyvinyl chloride (PVC) pipe and 25 miles of force main is ductile iron pipe. Replacement life span of a force main is estimated at 50 years. Force mains are replaced with lined ductile iron pipe, as needed.

ARVs are being identified as outlined in the *Sewer Mapping Program*. To date, all known ARVs have been mapped using GPS units and included in the County's GIS database. ARVs are replaced with models that are easier to clean and maintain. A GIS map showing lift station and force main locations has been developed.

7.4 Lift Stations, Force Mains, and Air/Vacuum Release Valves Corrective and Preventive Maintenance and Predictive Inspection

DWM performs preventive and corrective maintenance, and predictive inspection activities to maintain lift stations, force mains, and ARVs. Maintenance schedules are based on proximity of one station to another to minimize staff travel time between stations in the north and south. Maintenance schedules, practices, and procedures undertaken by the County are described in the following subsections.

7.4.1 Preventive Maintenance Schedules, Practices, and Procedures

7.4.1.1 Lift Stations Preventive Maintenance

The Lift Station Maintenance Supervisor and Assistant Maintenance Supervisor plan and schedule preventive maintenance for lift stations based on manufacturers O&M manuals, lift station performance history, and corrective maintenance issues identified. The Lift Station Group includes dedicated crews to perform physical maintenance of the County's lift stations on routine schedules and routes. Through increased preventive maintenance, reliability of system assets is also increasing.

Inspection and Routine Preventive Maintenance Schedules

Mechanics conduct inspections and routine preventive maintenance at lift stations on the following schedule:

Daily – Four Major Lift Stations:

- Inspection

Weekly - All Stations:

- Inspect wet wells for grit and solids deposition, floatables, fats, oil, and grease
- Operational inspections and preventive maintenance
- Check Telog at each station, test remote monitoring and alarms
- Check high wet well float, check set points, check for floatables and grease accumulation, high wet well alarm and sensor
- General housekeeping
- Site security and alarms
- Generator test runs

Monthly - All Stations:

- Check all pump run-times from the elapsed time meters
- Electrical maintenance
- Generator checks
- Audit inspection of stations by Supervisor

Monthly and Quarterly - All Stations:

- Record Amp and Volt readings of each pump at each station (recording of name plate amps, and voltage for Leg 1-2, Leg 1-3, and Leg 2-3 on a spreadsheet)
- Clean stations: Vacuum /jet wet wells of grit and solids deposition, floatables, fats, oil, and grease

Annual - All Stations:

- Safety inspection
- Valve exercise
- Check pressure gauges and flow (flow for stations with flow mag meters)
- Starter contact inspection by contractor
- Infrared scans of lift stations
- Auto Transfer switch maintenance
- Electrical maintenance
- Structural inspection

Three Years - All Stations:

- Air Release Valve checked and exercised

Written Lift Station Operations, Practices, Procedures, and Work Orders

Work orders generated in Oracle WAM database are distributed on Mondays and mechanics perform the tasks within a scheduled timeframe. Crews note any additional work needed while at the lift station and report this to the Maintenance Supervisor. An Administrative Assistant records completed work order information in Oracle WAM. In addition, mechanics record the work performed on *Daily Field Reports* including the work order number, arrival time, departure time, and summary of observed maintenance concerns at the stations and repairs that need to be performed. Work order reports for lift station maintenance are routinely generated through Oracle WAM, and Supervisors regularly review the reports and assign work orders to mechanics. Refer to Section 4 of the MMS Program, *Information Management*, for information on the Lift Station Group work order process.

Preventive maintenance tasks are also posted at each station and are called "Benchmark Tasks". Aboveground stations require one mechanic and belowground stations require two mechanics for preventive maintenance activities. A Technician conducts maintenance activities at submersible stations because of the programmable logic controllers at the station.

Lift Station Group Crews follow written procedures that have been established by the County based on manufacturers' recommendations for lift station preventive maintenance (major, belowground, aboveground, recess, and submersible lift stations), generator maintenance, electrical maintenance, mechanical maintenance, predictive inspections, and other activities (such as bypass pumping). Appendix D provides a list and copies of written maintenance procedures followed by the DWM. These procedures will be updated or modified, as needed, to reflect operational requirements or equipment changes that may periodically occur. Record drawings, equipment manuals, operation manuals, and technical specifications are available at the Snapfinger Creek AWWTF for reference when conducting maintenance activities.

Electrical systems for lift stations are designed and installed in conformance with National Fire Protection Association (NFPA) 70 "National Electric Code", NFPA 820 Standard for Fire

Protection in Wastewater Treatment and Collection Facilities, American National Standards Institute (ANSI), as well as applicable state and local codes, or standards in place at the time of construction.

The Electrical Maintenance Program includes annual inspection of major facilities using thermal photography to identify electrical connection issues. A Technician conducts routine inspections and specific checks on electrical equipment and controls. If additional assistance is required, DWM utilizes and mobilizes additional technicians assigned to Snapfinger AWWTF or an on-call contractor for emergency assistance.

Periodic Service and Calibration of Flow Meters, Liquid Level Sensors, Alarm Systems, Elapsed Time Meters, and Remote Monitors:
DWM performs periodic service and calibration of equipment used in the O&M of lift stations. Calibration of flow meters and remote monitoring equipment is discussed in DWM *System-Wide Flow and Rainfall Monitoring Program*, (specifically Procedure 2.6, Flow Meter Maintenance and Procedure 2.7, Rain Gauge Maintenance).

Liquid level sensors (such as wet well floats), pump run time meters, and the lift station monitoring system (SCADA) are inspected, serviced, and calibrated only when triggered by performance measures as outlined in the manufacturer's manual. Some performance measures include, for example, drift percentages or tolerance levels. Therefore, if a vibration monitor starts showing a pattern of increased vibration, the pump system may be taken off line for further evaluation by either staff or a contracted vendor.

7.4.1.2 Force Main and ARV Preventive Maintenance

Force Mains
The Lift Station Group has implemented a force main preventive maintenance and inspection program. Visual inspection of force mains occurs every 5 years and includes inspection of the following:

- Visual inspection of force main easement and receiving manholes
- Pipeline connections
- Areas or points where unusual noise is prevalent
- Areas and points with excessive or increased vibration
- Pipe and pipe joint leakage and displacement
- Valve arrangement and leakage
- Hydrogen sulfide measurement
- Calibration of float balls at wet well or when the station has major improvements
- Force main cleaning

Force mains that are identified as high risk (force mains that have had failure in the last 5 years or are determined to be at risk of failure based on historic maintenance data and repair) are visually inspected more frequently. In addition, force mains are evaluated for replacement needs as part of lift station rehabilitation activities.

Inspection data of lift station parameters are also used to identify potential force main maintenance needs. Non-routine inspections of force mains may occur based on identification of the following:

- Potential corrosion problems identified based on hydrogen sulfide logs
- Lift station operation and performance issues
- When discharge pump flow rates do not meet design capacity needs
- Pump suction and discharge pressures do not meet design capacity needs
- Routine pump station inspection and maintenance issues

Force main performance is directly related to the performance of the lift station. Pump-force main performance curves are used to determine the operating characteristics of pumps and the associated force main. Overall pump efficiency depends on the type of pumps, control system, head condition, and fluctuation of influent wastewater flow.

Should routine visual inspections, or identification during non-routine inspections based on lift station parameters, indicate that there is a potential need for further inspection or maintenance, Lift Station Group field crews may clean the force main. Should there be evidence of corrosion associated with the force main, ultrasound testing may be conducted to determine the extent of the problem and evaluate remedial options for identified defects.

Cleaning under pressure may be required to remove sediment, solids, and grease build up that create operational problems. In addition, wastewater may be treated with chemicals that provide for oxidation in the force main in order to minimize the formation of hydrogen sulfide gas.

When conditions are observed that may be attributed to blockages in a force main, the need for cleaning or maintenance of force mains is evaluated and prioritized. This determination is based on the overall performance of the lift station-force main system and the extent of accumulations and build-ups in the force main. If there is an excessive increase in pump head and the head-loss increase is caused by grease build-up, sediments, and solids, the pipeline can be flushed periodically by increasing the velocity of wastewater to scour the force mains.

Stubborn accretions (pipe corrosion, solidified rags, grease, etc.) may not be dislodged by hydraulic force. For deposited sediments and lighter solids, re-suspension can occur at velocities above 3 feet per second. Since velocity increases as area reduces (for a constant flow rate), it is possible that increased sediments will increase velocity to a point where they are re-suspended and transported; however, flow rate decreases as head loss increases. While the approach of flushing force mains would have a beneficial effect, it may not be a guarantee against the development of hard accretions or corrosion tubercles.

Once build up occurs to the point of significant headloss, flow rate and velocity will diminish as noted above. Therefore, the provision of additional driving head by using multiple pumps or having a “bypass” pump (engine driven pump) may be necessary. For example, hydraulic effects may not scour corrosion effects and grease build up completely. Cleaning of sediment in force mains using ice pigging is in the early planning stages at DWM. Infrastructure needs associated with ice pigging are being evaluated to implement this technique. Force main maintenance that does not resolve problems identified may indicate the need for force main rehabilitation or replacement.

ARVs

The air release component of force main ARVs vent pockets of gas from the force main automatically and close automatically on liquid level rise. The valve is designed to open

under pressure or vacuum. Grease can build up inside the valve body, which prevents the ARV from releasing air and gas pockets under pressure or opening under vacuum to prevent water hammer. Lack of regular service can greatly shorten service life and ultimately may require replacement.

The Lift Station Group is undertaking a thorough inspection of ARVs in the system. The group is documenting data from name plate information (including valve model numbers, orifice diameters, and psi range) and photos (before and after cleaning). Lift Station Group personnel have initiated replacement of ARVs determined based on evaluation of condition assessment data.

Air/vacuum release combination valves are torn-down, inspected, cleaned inside, and back-flushed on a 3-year rotating cycle basis to ensure efficient operation of the ARV. ARVs on larger force mains or high-risk force mains are cleaned and inspected on a 12-month schedule. This is within the industry standard of a 2- to 5-year inspection and maintenance cycle.

ARV tear down includes the following inspection and maintenance activities and requires a crew of two mechanics:

- Tear down of the ARV for cleaning and inspection
- Replacement of damaged or corroded parts
- Lubrication of moving parts
- Installation of new cover gasket

Inoperable or damaged ARVs are required to be removed from service and replaced. In order to maintain service, DWM maintains a stock of ARVs on hand for replacement needs.

7.4.2 Predictive and Physical Inspection

Lift station predictive inspection employs several tools to assess lift station asset condition, described as follows:

- Major lift stations pumps under ongoing vibration monitoring testing as appropriate
- Thermal scans and infrared spectroscopy inspections are conducted on equipment (electrical)
- Fill-and-draw down pump testing is conducted every 5 years
- DWM is evaluating the majority of its stations to accommodate built-in by-pass pumps
- Pump capacity performance is evaluated every 2 years
- System pressure measurement is performed every 3 years

Inspection results are verified with the flow monitoring data to ensure that the recorded information is correct. Lift Station Group crews perform predictive inspections to determine existing pumping efficiencies and to determine if corrective maintenance is needed (replacing impellers, etc.).

The Lift Station Group prioritizes lift station assets (mains, pumps, or other appurtenances) for repair or replacement based on data collected on repeated repair call-outs, labor hours spent on corrective repair versus routine preventive maintenance, and other factors.

In general, the recommended repair and replacement schedule that the County has established includes:

- A major station has a replacement period of 50 years and a rehabilitation period of 25 years.
- Other stations have a replacement period of 25 years and a rehabilitation period of 20 years.
- Belowground stations are being replaced with submersible stations where appropriate or those that are shallow will be replaced with aboveground stations on the existing wet well based on studies and recommendations.

DWM has identified lift stations that require rehabilitation or replacement based on age, industrial discharge impacts, and other corrective maintenance data gathered during maintenance activities. Frequencies are based on manufacturer's recommendations, follow up investigative activities, experience of staff in working with the system, results of testing and evaluation, results of inspections, and maintenance history.

The current repair and replacement schedule for every lift station is listed in Table 7-2, Column 7. The listing in Column 7 also includes information on when the County last performed any repair or rehabilitation (as available).

7.4.3 Corrective Maintenance Practices and Procedures

7.4.3.1 Lift Stations

WQC Mechanics conduct corrective maintenance or repair activities immediately as identified. Lift station mechanics ensure immediate response for various alarm conditions conveyed to the Control Room at Snapfinger Creek AWWTF from the lift station SCADA system. Corrective maintenance is also scheduled when a routine inspection identifies a high-risk condition. Incidents that involve an overflow at a station would trigger response in coordination with the DWM CERP. Corrective maintenance work order hours for lift stations, force mains, and ARVs currently vary from 20 to 50 percent of total work hours.

When emergency maintenance is required for immediate repair of an ARV, force main, or lift station asset, Supervisors generate a work order in Oracle WAM and plan activities to correct the deficiency. Refer to Section 4 of the MMS Program, *Information Management*, for information on the Lift Station Group work order process. Appendix D provides corrective maintenance procedures used by Lift Station Group personnel.

7.4.3.2 Force Mains

C&M maintains and repairs force mains. Corrective maintenance follows the same work order process described above in Section 7.4.3.1. If a force main fails, corrective activities are immediately implemented. Corrective maintenance activities are dependent on age of pipe and what repairs are required.

7.4.3.3 ARVs

The Lift Station Group maintains and repairs ARVs through its corrective maintenance program. If an ARV fails, it is replaced immediately. Corrective maintenance follows the same work order process described in Section 7.4.3.1.

7.4.3.4 Emergency Temporary Bypass Pumping for Repair

DWM has developed and implemented a temporary bypass procedure to facilitate maintenance and provide redundant emergency capabilities at lift stations. The written Lift Station Temporary Bypass and Repair Procedure is provided in Appendix D. DWM has portable pumps that can be used to bypass wastewater around a lift station when needed during repairs. For larger repairs, such as repairs to force mains at the major stations, pump and bypass equipment can be contracted if necessary. Specialty contractors can be retained for emergency bypass pumping. Bypass pumping can be connected from the wet well to the force main or from the wet well to the first manhole after the force main. Bypass piping can also be connected overground to another station or gravity sewer, depending on site requirements. DWM is in the process of upgrading several lift stations to accommodate built-in bypasses.

7.5 Planned Enhancements

DWM ensures that the lift station, force main, and ARV operations and maintenance program is reliable and meets the County's business needs effectively. Table 7-3 describes planned improvements and enhancements to their lift station, force main, and ARV operations and maintenance program.

TABLE 7-3
Lift Station, Force Main, and Air/Vacuum Release Valve Operations and Maintenance Program Planned Enhancements

Activity	2014	2015	2016	2017
Review and Revise Maintenance Procedures Review and revise lift station maintenance procedures. Determine if additional procedures need to be developed.		X		X
Construct Bypass Connections Continue to construct bypass pumping connections for temporary bypassing at stations. Alternatively, construct permanent bypass pumps. Prioritize needs. Evaluate and establish prioritization plan. Secure funding and schedule implementation.		X		X Re-evaluate
Locate and Replace ARVs ARV locate and replacement	X	X		
Force Main Performance Monitoring Force main performance monitoring, using pressure and flow (on stations equipped with pressure logger and flow meter)	X	X	X	X
Develop Ground Testing Procedure Ground testing procedure utilizing new electrical trouble shooting equipment		X	X	X

TABLE 7-2
List of DeKalb County Lift Stations

Number	Station Name	Station Type	Station Address	Original Install Date	Age in 2013 (years)	Date/ Description of Major Mechanical Rehabilitation and Replacement	Pump Capacity (gpm)		Minimum Estimated Time to Spill Response (hours)	Yearly Maximum Pump Flow (gpm) (June 2012 to June 2013)	Depth above High Level Float (feet)	Wet Well Volume (gallons)
1	Ward Lake	Aboveground S&L	4218 Ward Lake Road	Apr-93	20		Pump 1	80	1.71	14	6.67	1,411
							Pump 2	80				
2	Removed											
3	Columbia Drive	Below Ground S&L	2547 Columbia Drive	Dec-68	45	2016* Rehabilitate and upgrade	Pump 1	100	0.12	27	2	188
							Pump 2	100				
4	Fairington	Below Ground S&L	2000 Fairington Blvd	Jan-69	44	2015* Scheduled to be eliminated	Pump 1	200	0.59	32	4	1,151
							Pump 2	200				
5	Scarborough Square	Aboveground S&L	5810 Covington Hwy.	Apr-81	32	2015* Rehabilitate and upgrade	Pump 1	180	0.86	31	4.41	1,582
							Pump 2	180				
6	Lithonia I	Below Ground S&L	7850 Covington Old Hwy.	Oct-73	40	2016 To be replaced by a new station (Stonecrest)	Pump 1	920	0.3	558	7.62	716
							Pump 2	920				
7	Lithonia II	Below Ground S&L	7850 Covington Old Hwy.	Oct-73	40	2016 To be replaced by a new station (Stonecrest)	Pump 1	920	0.1	329	8.33	1,223
							Pump 2	920				
8	Lower Crooked Creek III	**Major Station, Dry Pit**	7120 Maddox Road	Sep-84	29	2013 Force main upsized and replaced completely	Pump 1	5,300	0.5	2,443	9	77,383
							Pump 2	5,300				
							Pump 3	5,300				
							Pump 4	5,300				
9	Lower Crooked Creek II	**Major Station, Dry Pit**	1485 Rock Chapel Road	Sep-84	29	2010 Replaced portion of force main, valves, and permanent bypass installed	Pump 1	5,300	1.4	1,909	17	154,932
							Pump 2	5,300				
							Pump 3	5,300				
10	Lower Crooked Creek I	**Major Station, Dry Pit**	7364 Drake Avenue	Sep-84	29	2013 Replaced electrical, controls, channel grinder, and installed flow meter.	Pump 1	5,300	1.1	3,182	22	203,226
							Pump 2	5,300				
							Pump 3	5,300				
							Pump 4	5,300				
11	Rogers Lake	Aboveground S&L	1750 Rogers Lake Road	Mar-89	24		Pump 1	100	13.32	2	8	1,692
							Pump 2	100				
12	Pennybrook	Aboveground S&L	2240 Catrina Court	Sep-84	29	2018* Rehabilitate and upgrade	Pump 1	370	0.5	59	8.31	1,757
							Pump 2	370				
13	New Gibraltar	Below Ground S&L	1099 New Gibraltar Square	Mar-83	30	2019* Rehabilitate and upgrade	Pump 1	80	5.1	2	6.25	587
							Pump 2	80				

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14	Pepperwood	Aboveground S&L	780 Pepper Wood Trail	May-83	30	2015* Rehabilitate and upgrade	Pump 1	150	0.16	60	6.26	589
							Pump 2	150				
15	Fourth Street	Below Ground S&L	930 Fourth Street	Dec-72	41	2018* Rehabilitate and upgrade	Pump 1	300	2.79	42	10.5	6,941
							Pump 2	300				
16	Stone Mountain Park	Below Ground S&L	6804 Memorial Drive	Feb-02	11		Pump 1	866	3.5	73	10.5	15,397
							Pump 2	866				
17	Stone Mill II	Below Ground S&L	5128 Stone Mill Way	Dec-84	29	2018* Rehabilitate and upgrade	Pump 1	809	0.06	163	6.33	595
							Pump 2	809				
18	Stone Mill I	Below Ground S&L	1313 Stone Mill Way	Feb-72	41	2013 Design 2018* Rehabilitation / Upgrade	Pump 1	315	0.29	70	8.39	1,232
							Pump 2	315				
19	Stone Mill III	Aboveground S&L	1391 Juliette Road	Oct-85	28	2013 Upgraded	Pump 1	125	1.56	13	8.1	1,190
							Pump 2	125				
21	Hammer Mill II	Aboveground S&L	4880 Hammer Mill Road	Jun-09	4		Pump 1	100	6.32	5	8.91	1,884
							Pump 2	100				
22	Hammer Mill I	Aboveground S&L	4760 Hammer Mill Road	Jan-85	28	2017* Rehabilitate and upgrade	Pump 1	700	0.17	161	11.48	1,686
							Pump 2	700				
20	Hammer Mill III	Below Ground S&L	2301 Mountain Industrial Blvd.	Aug-63	50	2012 Civil engineering upgrade and installed bypass system 2015* Complete station replacement from below ground to aboveground and addition of backup pumping system	Pump 1	200	0.34	47	6.5	955
							Pump 2	200				
23	Royal Atlanta III	Aboveground S&L	5238 Royal Woods Parkway	Sep-84	29	2017 Rehabilitate and upgrade	Pump 1	95	0.37	33	5.06	743
							Pump 2	95				
24	Royal Atlanta I	Aboveground S&L (Originally below ground)	4949 S. Royal Atlanta Drive	Apr-98	15	2015* Rehabilitate and upgrade	Pump 1	600	0.18	144	7.28	1,540
							Pump 2	600				
25	Royal Atlanta II	Aboveground S&L	4991 S. Royal Atlanta Drive	Sep-85	28	2013 Rehabilitated and upgraded	Pump 1	100	0.64	22	9.07	853
							Pump 2	100				
26	Camp Creek	Below Ground S&L	4877 Lawrenceville Hwy	May-74	39	2018* Rehabilitate and upgrade	Pump 1	100	0.7	52	9.5	2,160
							Pump 2	100				
27	Leeshire	Below Ground S&L	5031 Leeshire Trail	Feb-02	11	2016* Design 2019* Rehabilitate and upgrade	Pump 1	100	0.6	39	6.74	1,425
							Pump 2	100				

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28	Mountain Industrial	Aboveground S&L	2301 Mountain Industrial Blvd.	Feb-86	27	2011 Rehabilitated and upgraded 2015* Replace new force main	Pump 1	575	0.5	46	9.83	1,444
							Pump 2	575				
29	Lehaven	Aboveground S&L	2610 Oak Avenue	Aug-11	2	Station replaced completely	Pump 1	80	0.7	16	7.84	737
							Pump 2	80				
30	Perimeter Park	Aboveground S&L	4182 Decon Lane	Apr-64	49	2015* Rehabilitate and Upgrade	Pump 1	450	0.19	62	7.73	727
							Pump 2	450				
31	South River Bend II	Aboveground S&L	4834 Carly Way	Jun-92	21		Pump 1	80	1	22	6.37	1,347
							Pump 2	80				
32	Johnson Creek	Below Ground S&L	8312 Union Grove Road	Dec-87	26	2017 New station to be completed (Stonecrest)	Pump 1	132	0.47	26	7	724
							Pump 2	132				
33	Kings Way	Aboveground S&L	5985 King Way Walk	May-87	26	2019* Rehabilitate and upgrade	Pump 1	80	1.11	7	4.72	444
							Pump 2	80				
34	Honey Creek	**Major Station, Dry Pit**	7501 Rockland Road	Nov-78	35	2016 Design for rehabilitate and upgrade	Pump 1	1,260	1.1	940	21	62,152
							Pump 2	1,260				
							Pump 3	1,260				
35	American Fare	Aboveground S&L	1701 Mountain Industrial Blvd.	Jun-88	25	2017 Rehabilitate and upgrade	Pump 1	175	1.02	21	8.7	1,278
							Pump 2	175				
36	Salem Road	Aboveground S&L	5337 Salem Road	Jun-90	23		Pump 1	615	0.26	109	7.9	1,671
							Pump 2	615				
37	Briarwood Field	Recess Station	2465 Field Way	Nov-02	11		Pump 1	100	48	3	19.13	8,121
							Pump 2	100				
38	Sweet Water	Aboveground S&L	4100 Sweetwater Falls	Aug-93	20		Pump 1	468	0.58	77	12.66	2,677
							Pump 2	468				
39	Oak Hill Springs	Aboveground S&L	1916 Ivory Oak Court	Apr-04	9		Pump 1	100	2.39	12	8.01	1,694
							Pump 2	100				
40	Harmony Hills	Aboveground S&L	1801 Harmony Hills Court	Dec-98	15	2013 (Upgraded) Added standby pump and bypass system	Pump 1	80	3.44	9	8.61	1,821
							Pump 2	80				
41	River Vista	Aboveground S&L	5505 River Road	Dec-04	9		Pump 1	225	5.9	26	21.93	9,309
							Pump 2	225				

TABLE 7-2
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42	Burlington	Aboveground S&L	3585 Wolverton Circle	Nov-98	15		Pump 1	225	0.63	58	10.3	2,178
							Pump 2	225				
							Pump 3	225				
							Pump 4	225				
43	Greenridge	Aboveground S&L	1396 Greenridge Avenue	Nov-99	14		Pump 1	80	0.77	22	4.75	1,005
							Pump 2	80				
44	Holly Hills	Aboveground S&L	3481 Hickory Walk Lane	Jul-99	14		Pump 1	132	1.46	27	11.15	2,358
							Pump 2	132				
45	Hearn Road	Below Ground S&L	4319 Hearn Road	Feb-99	14	2017 Rehabilitate and upgrade	Pump 1	350	0.58	138	16.61	4,782
							Pump 2	350				
46	Medlock Place	Aboveground S&L	2466 Vivian Circle	Jun-99	14		Pump 1	80	11.4	7	16.34	4,704
							Pump 2	80				
47	Camelot	Aboveground S&L	4051 English Valley Drive	Nov-99	14		Pump 1	230	0.76	47	10.21	2,160
							Pump 2	230				
48	Lewis Way	Aboveground S&L	1664 Lewis Way	Dec-72	41	2018* Rehabilitate and upgrade	Pump 1	80	0.7	77	15.4	3,257
							Pump 2	80				
49	Beechwood Forest	Aboveground S&L	5396 Beachwood Forrest Drive	Nov-99	14		Pump 1	250	1.1	37	11.64	2,462
							Pump 2	250				
50	Stratfield	Aboveground S&L	3274 Stratfield Drive, N.E.	Jan-00	13		Pump 1	80	8.47	2	8.18	1,202
							Pump 2	80				
51	Green Pastures	Aboveground S&L	5205 River Road	Nov-04	9		Pump 1	388	0.74	51	10.58	2,238
							Pump 2	388				
52	Summit Glenn	Aboveground S&L	1734 Summit Glenn Lane	Aug-98	15		Pump 1	80	10.85	2	7.61	1,609
							Pump 2	80				
53	South River Bend I	Aboveground S&L	4674 Brandy Bay	Aug-02	11		Pump 1	486	0.1	265	7.18	1,518
							Pump 2	486				
							Pump 3	486				
							Pump 4	486				
54	Chester Hills	Aboveground S&L	565 Dove Lane	Nov-02	11		Pump 1	80	0.54	67	8.23	1,741
							Pump 2	80				

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55	Boulder Walk	Aboveground S&L	2976 Boulder Walk Court	Nov-02	11		Pump 1	110	0.93	34	8.94	1,891
							Pump 2	110				
56	Klondike Manor	Aboveground S&L	4440 English Loop	Dec-02	11		Pump 1	80	3.4	11	10.15	2,147
							Pump 2	80				
57	Serenity Village	Aboveground S&L	3649 Serenity Lane	Aug-02	11		Pump 1	80	2.71	11	8.17	1,728
							Pump 2	80				
58	Windy Ridge	Aboveground S&L	6203 Windy Ridge Trail	Oct-04	9		Pump 1	100	4.1	13	15.18	3,210
							Pump 2	100				
59	Oak Leaf Glenn	Aboveground S&L	2475 Oak Leaf Circle	Nov-04	9		Pump 1	84	12.2	3	10.94	2,314
							Pump 2	84				
60	Thurgood Estates	Aboveground S&L	4453 Equity Court	Feb-06	7		Pump 1	110	88.17	2	22.11	9,386
							Pump 2	110				
61	Moss Stone	Aboveground S&L	7316 Moss Stone Drive	Nov-05	8		Pump 1	N/A	17.1	3	15	3,172
							Pump 2	N/A				
62	River Vista IV	Submersible	4722 River Front Way	Mar-08	5		Pump 1	124	16.53	3	15.75	9,254
							Pump 2	124				
63	Baranco	Submersible	1500 Agape Way	Feb-02	11		Pump 1	117	39.22	0.31	3.5	740
							Pump 2	117				
64	Turnbury Gates	Submersible	2403 Johnson Ferry Road	Sep-09	4		Pump 1	114	9.8	2	2.4	902
							Pump 2	114				
65	Stoney Creek	Submersible	3762 River Rock	Nov-09	4		Pump 1	815	3.81	10	6	2,256
							Pump 2	815				
66	Browns Mill	Submersible	4925 Browns Mill Road	Dec-08	5		Pump 1	106	32.4	2	6.5	3,819
							Pump 2	106				
	DWM evaluates all stations for rehabilitation or replacement based on age (greater than 25 years old), mechanical issues, electrical issues, force main size and capacity issues, pump station type and physical configuration, etc.											

gpm: gallons per minute

S&L: Smith and Loveless Pumps

* Denotes undated schedule

8 Key Performance Indicators

Key Performance Indicators (KPIs) are important management tools that allow for continuous measurement and evaluation of program activities. KPIs are designed to collect information that enable DWM to determine if established level of effort and level of effectiveness goals and objectives are being met and, if not, what activities need to be adjusted to track and meet program goals. Table 8-1 provides the Maintenance Management System KPIs established by DWM. These KPIs will be reviewed periodically and, when necessary, modified to ensure that system performance is measured reasonably accurately.

The following table is categorized as follows, where applicable:

- PM: Preventive Maintenance
- CM: Corrective Maintenance
- EM: Emergency Maintenance

TABLE 8-1
Key Performance Indicators

KPI	Formula	Definition	Target Result	Data Interval	Division/ Group
Communication System Program					
Landline dropped calls	Number of dropped calls	Successful calls connected to Dispatch that ends before normal conclusion.	0	Monthly	Customer Support
Landline missed calls	Number of missed calls	Attempted calls to Customer Support where a connection is not established.	0	Monthly	Customer Support
Call Duration	Duration of calls in minutes divided by the number of calls	The average call time for each call by employee.	To be provided determined by data gathered	Monthly	Customer Support
Information Management					
Emergency Work Order Percentage (Future)	Number of completed emergency work orders ÷ total number of completed work orders in the reporting period x 100.	Emergency work orders are defined as those requiring an immediate response (i.e. no planning/scheduling possible).	<5%	Monthly	Lift Station Group and C&M (future)
Active SSO-Driven Sewer Service Request Percentage	Number of Active SSO-driven sewer service requests ÷ number of Finished sewer service requests in the reporting period x 100	Designed to check that SSO-driven sewer service requests are completed in a timely fashion.	<5%	Monthly	Customer Service
Inventory Management					
Percent out-of-stock items	For the reporting period, the number of parts out of stock when requested ÷ total number of parts requested x 100	The number of occurrences when stock checkouts could not be completed because requested parts were out of stock. This KPI is tracked at the “part” level, not the “checkout” level since multiple parts can be on a single checkout.	≤ 5%	Monthly	Central Warehouse
Physical Inventory Performance	The percentage of items whose quantity on hand does match the quantity in Oracle WAM	This KPI tracks the performance of the warehouses in accounting for the inventory of parts and materials.	≤ 10%	Annually	Central Warehouse

TABLE 8-1
Key Performance Indicators

KPI	Formula	Definition	Target Result	Data Interval	Division/ Group
Physical Inventory Audit	The net cost difference in the value of the physical count vs. the value of inventory shown in Oracle WAM	This KPI tracks the performance of the warehouses in accounting for the cost of parts and materials.	≤ 10%	Annually	Central Warehouse
Gravity System					
PM: PM Hours versus CM and EM Hours Worked	Oracle WAM Value: PM hours total ÷ total hours worked. CM and EM hours total ÷ total hours worked. Each Number x 100 to show percentage. Display as ratio.	Estimated hours from work orders	80%/20%	Annually	Operations/ C&M (future)
PM: Backlogged PM Work Orders	Oracle WAM Value. Number of work order not completed ÷ Total number of work orders (X 100)	Number of work orders not completed	<5%	Annually	Operations/ C&M (future)
PM: CCTV Inspection of Sewer Lines, C&M and Contractors	Number of miles inspected ÷ Total miles of sewer line (X 100)	Annual miles of sewer line inspected (does not include laterals in the calculation).	Report of % miles CCTV inspected. Comparison value only and no target number defined.	Annually	Operations/ C&M
PM: Percent Sewer Lines Cleaned	Number of miles cleaned ÷ Total Miles (X100)	Annual miles of sewer line cleaned (does not include laterals in the calculation).	15 to 20% of total sewer lines cleaned per year (based on PASARP and OSARP defined areas)	Annually	Operations/ C&M
PM: Linear feet Root Treatment per year	Number of feet of roots removed ÷ Number of linear feet of sewer system (X 100) Conversion factor: 5,280 feet/mile	Expression of the amount of roots removed and/or treated in the system.	Report on linear feet root treatment	Annually	Operations/ C&M

TABLE 8-1
Key Performance Indicators

KPI	Formula	Definition	Target Result	Data Interval	Division/ Group
PM: Annual cost for maintenance per mile of sewer pipe	Cost per year = O&M cost for gravity line system ÷ mile of sewer pipe	Annual $ spent for O&M of the gravity line system. Includes direct and indirect costs. This calculation does not include capital improvement program cost. Miles of pipe includes gravity sewers.	Cost Report	Annually	Finance and Administration (future)
PM: Number /Percent of manholes inspected per year	Number manholes inspected ÷ Total number of manholes in system (X100)	Routine inspection of manholes throughout system. Measurement of manhole inspection activities.	12-15% of total WCTS manholes	Annually	Operations/ C&M
PM and CM: Percent preventive maintenance versus corrective maintenance	Number of preventive maintenance work orders completed ÷ Total preventive and corrective work orders (X 100)	Resources allocated to preventive maintenance work (to decrease corrective maintenance work).	>80 to 90% completed	Monitor Quarterly; Report Annually	Operations/ C&M (future)
PM: Percent aerial creek crossings inspected	Number of creek crossing inspections ÷ Total inventory of creek crossings (X 100)	Measurement of inspection of creek crossings	Report on creek crossings inspected	Annually	Operations/ C&M (future)
EM: Number of SSOs per mile of gravity sewer line	Number of SSOs ÷ WCTS total miles of gravity lines (X 100)	Measurement of SSOs per 100 miles (also qualify as to wet weather or dry weather SSOs) Wet weather SSO: SSO related to a wet weather event Dry weather SSO: SSO occurred when there is no rain greater than 0.5” during the past two days period	5% reduction per year	Annually	Operations/ C&M
Lift Stations, Force Mains, and Appurtenances					
PM: PM Hours Worked versus CM and EM Hours Worked	Oracle WAM Value: PM hours total ÷ total hours worked. CM and EM hours total ÷ total hours worked. Each Number x 100 to show percentage. Display as ratio.	Estimated hours from work orders	80%/20%	Annually	Plant Operations/ Lift Station Group

TABLE 8-1
Key Performance Indicators

KPI	Formula	Definition	Target Result	Data Interval	Division/ Group
PM: Backlogged PM Work Orders	Oracle WAM Value. Number of work order not completed ÷ Total number of Work Orders (x 100)	Number of work orders not completed	<1%	Annually	Plant Operations/ Lift Station Group
PM: Completed PM Work Orders (based on timeframe specified)	Oracle WAM Value. Number of work orders completed by timeframe	Number of work orders completed within: 0-2 days 3-6 days 7-13 days 14-29 days 30-59 days > 60 days	<1 over 60 days	Monthly	Plant Operations/ Lift Station Group
CM: Percent lift stations with pumps out (by month)	Percent Value. Number of stations with pumps out ÷ Total number of stations (X 100)	Stations with pumps out	<5%	Monthly	Plant Operations/ Lift Station Group
PM: Percent of ARVs inspected, flushed, and serviced	Number of ARVs inspected, flushed, and serviced per year ÷ Total number of ARVs (X 100)	Number of ARVs maintained in the WCTS	33% per year	Every 3-year flushing schedule	Plant Operations/ Lift Station Group