

ASSET MANAGEMENT PROGRAM

July 2017

Orange Water and Sewer Authority
Carrboro, North Carolina



A public, non-profit agency providing water, sewer and reclaimed water services to the Carrboro-Chapel Hill community.

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OVERVIEW

The Orange Water and Sewer Authority (OWASA) is a community-owned utility providing water, wastewater and reclaimed water services to approximately 83,000 people in the Town of Carrboro, Town of Chapel Hill and the University of North Carolina at Chapel Hill. OWASA owns and operates a complex system of assets distributed primarily across southern Orange County.

OWASA's assets include three raw water reservoirs, a drinking water treatment plant, 396 miles of raw water and drinking water distribution pipes, six water storage tanks, four water booster pump stations, 342 miles of sewer collection pipes and force mains, 21 wastewater pump stations, five miles of reclaimed water pipes, a reclaimed water pumping station with an associated ground storage tank, a wastewater treatment plant, support facilities, 150 vehicles/equipment and over 3,700 acres of land. The net book value of OWASA's assets is approximately \$267 million.

Asset management is a process that guides the lifecycle of all of OWASA's assets from acquisition to renewal or replacement through either capital improvement program or operating budget. OWASA's comprehensive asset management program is used to assess and prioritize infrastructure improvements needed to achieve desired customer and environmental service level objectives, minimize critical asset failures and ensure the long-term viability of the water, wastewater and reclaimed water systems. OWASA's Mission, Vision and Values statement and Key Indicators and Performance Measurements help define the desired level of service. While the asset management process cannot be used to predict failures, it can help identify and manage risk.

Over time, OWASA has developed various tools and practices to manage its assets including a geographic information system, computerized maintenance management systems, hydraulic models, condition assessments, performance metrics, risk/prioritization models, standard operating procedures, preventive and corrective maintenance programs, emergency management plans, renewal and replacement forecast model, energy management plan and capital improvements program project prioritization model. The asset management program tools and practices are aligned with industry best practices and ensure the sustainable long-term operation, maintenance, replacement and expansion of OWASA's assets. The 5-year, \$96.5 million dollar capital improvements program for fiscal years 2018-2022 was developed using these tools.

SECTION 1 BACKGROUND

Asset management is a process that guides the acquisition, use and disposal of assets. An asset management program is necessary to optimize service and minimize cost over the life of the asset. Asset management helps ensure that utilities achieve defined levels of service and maintain and renew their assets in a cost-effective manner.

Guiding Principles

OWASA owns and operates a complex system of assets distributed primarily across southern Orange County (see Figure 1). We recognize that comprehensive asset management is essential to the sustainable operation of the water, sewer and reclaimed water systems serving the Carrboro-Chapel Hill community. Our asset management program is guided by the following principles:

- Maintain a reliable level of water, wastewater and reclaimed water services to the community.
- Maximize the life of the facilities, equipment and assets that OWASA is responsible for.
- Ensure that customer funds are wisely invested at the right time on the right assets.

OWASA's Asset Management program is based on the Water Environment Research Foundation's Simple Infrastructure Management Program Learning Environment's five core questions of asset management:

- What is the current state of my assets?
- What is my required sustained level of service?
- Which of my assets are critical to sustained performance?
- What are my best minimum life-cycle cost capital improvements program (CIP) and operation and maintenance (O&M) strategies?
- What is my best long-term funding strategy?

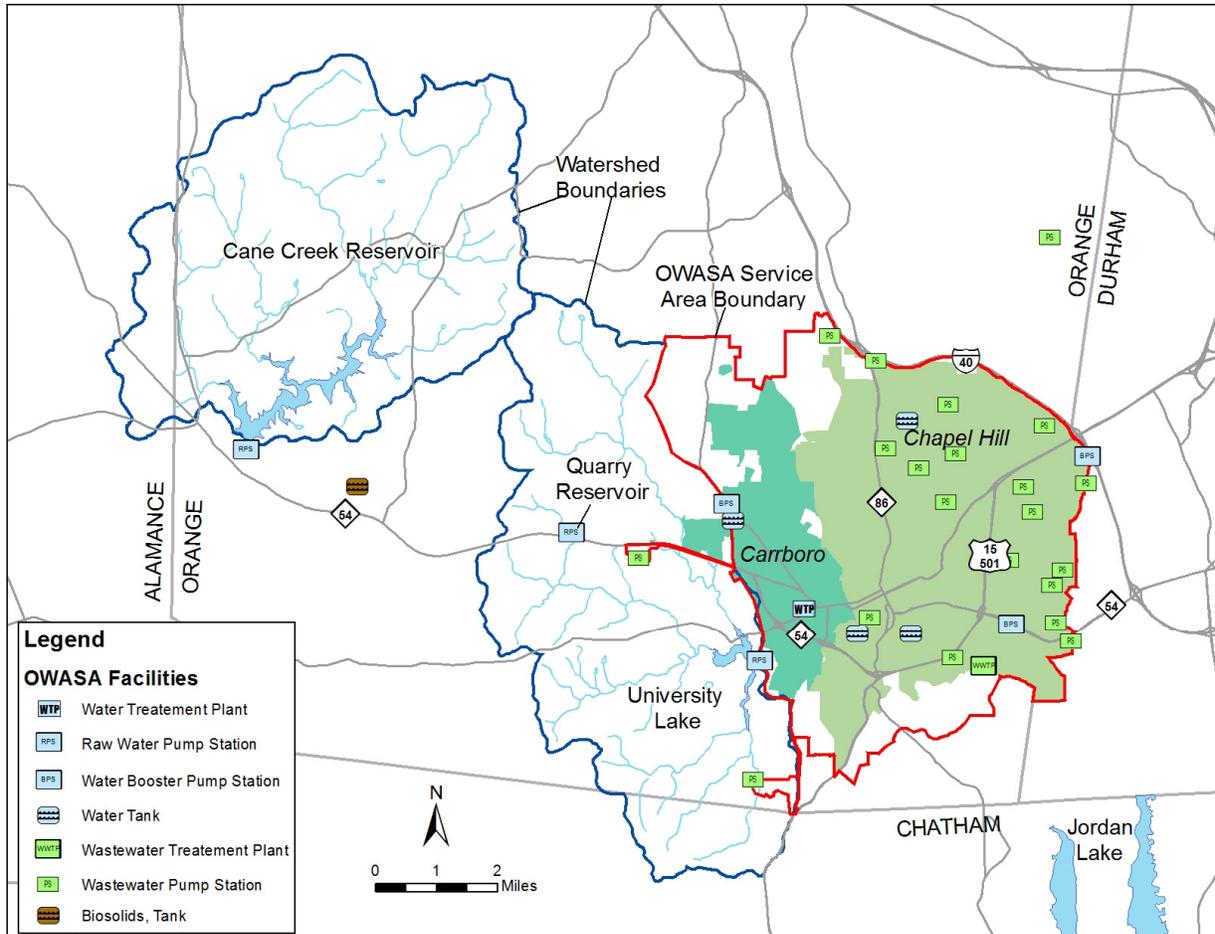
Assumptions

Key assumptions that underlie OWASA's asset management planning include:

- OWASA's utility service area boundary, as shown on Figure 1 and defined by the urban services boundaries of Carrboro, Chapel Hill and Orange County, will remain unchanged.
- We do not anticipate any retail or wholesale water, wastewater or reclaimed water sales or service outside of the existing service area.

- The cost of extending the OWASA water, sewer and/or reclaimed water system to properties not served by the system shall be borne by those parties benefiting from the extension.
- The regulatory environment will remain similar to current conditions. Changes in regulation will allow sufficient time to implement changes to our asset management program.

Figure 1. Map of OWASA Facilities



SECTION 2 OWASA'S ASSETS

The first question of asset management “*What is the current state of my assets?*” is critical to building a strong foundation for an asset management program. We need to know what assets we own, their location, condition, remaining useful life and economic value.

OWASA owns and operates a variety of assets, which can be broadly categorized as either vertical assets or horizontal assets. Horizontal assets include the water pipes, valves, meters, fire hydrants, sewer pipes, manholes and reclaimed water pipes. Vertical assets include all of the equipment and facilities at the water treatment plant, wastewater treatment plant, pump stations, dams, water storage tanks and support facilities.

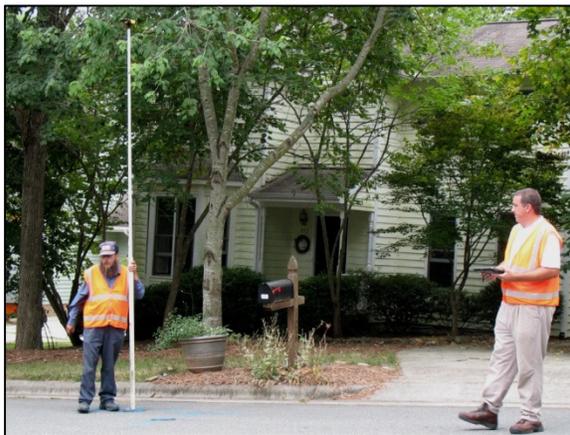
The horizontal assets and land inventories are stored in the geographic information system (GIS) geodatabase. The geodatabase includes each asset's location and a variety of attribute information including size, material, installation date and rehabilitation date. Easement and as-built records are also documented in the geodatabase. The vertical assets, miscellaneous structures and vehicle inventories are stored in a computerized maintenance management system (CMMS). The CMMS database includes each asset's location, equipment type, size, installation date, rehabilitation date, manufacturer, model, serial number, original cost, life expectancy and condition. The value of OWASA's assets is documented in the fixed asset register. OWASA's assets, associated inventories and valuation are discussed in more detail below.

Horizontal Assets

Raw Water Transmission and Drinking Water Distribution System

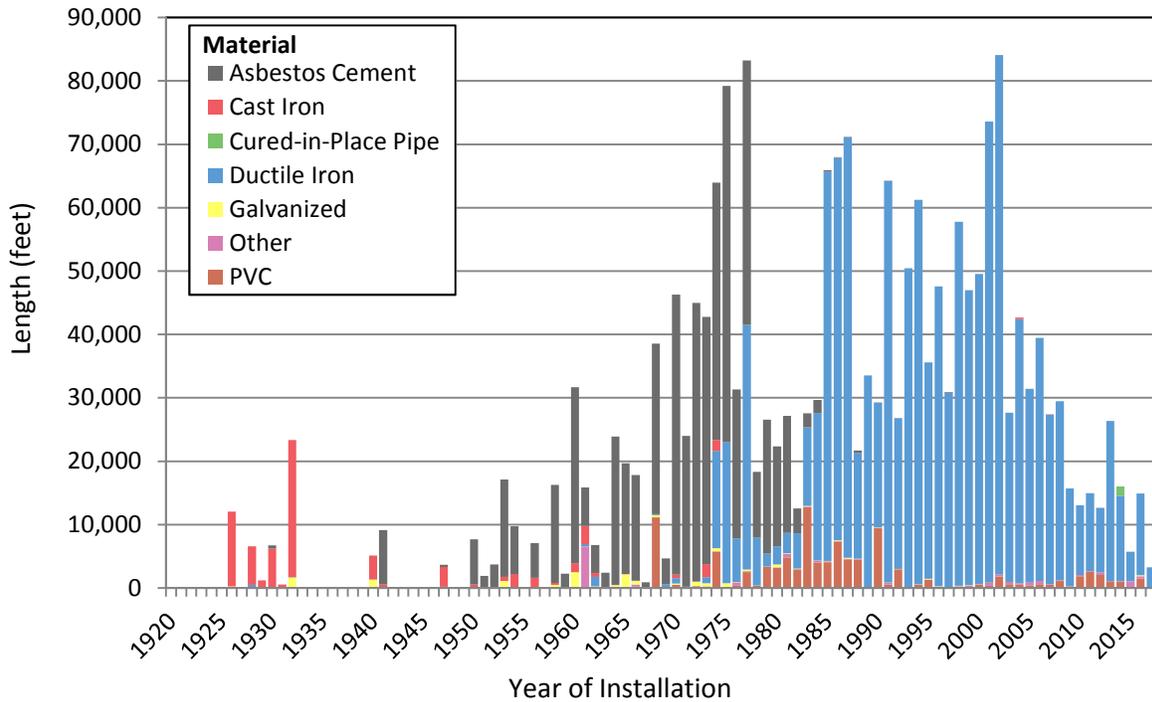
OWASA's raw water is conveyed through approximately 16 miles of transmission pipes and drinking water is conveyed through approximately 380 miles of distribution pipes. Transmission and distribution pipes range in size from 2- to 42-inches in diameter and pipe materials include cast iron, ductile iron, polyvinyl chloride (PVC), galvanized steel, copper and asbestos cement. Figure 2 illustrates the water transmission and distribution system's year of installation and material. Over 80% of the transmission and distribution system has been installed since 1972 for system expansion or replacement. The transmission and distribution system includes about 2,300 fire hydrants, 21,700 meters and 12,700 valves.

OWASA staff completed a multi-year field verification effort in 2014 to improve the accuracy of the distribution system asset inventory. All distribution system assets were located and mapping grade global position system (GPS) equipment was used to document asset location and attribute information.



Engineering Technicians field verify system assets using GPS.

Figure 2. Raw Water Transmission and Drinking Water Distribution System Length of Pipe in Service, by Installation Year and Type of Material



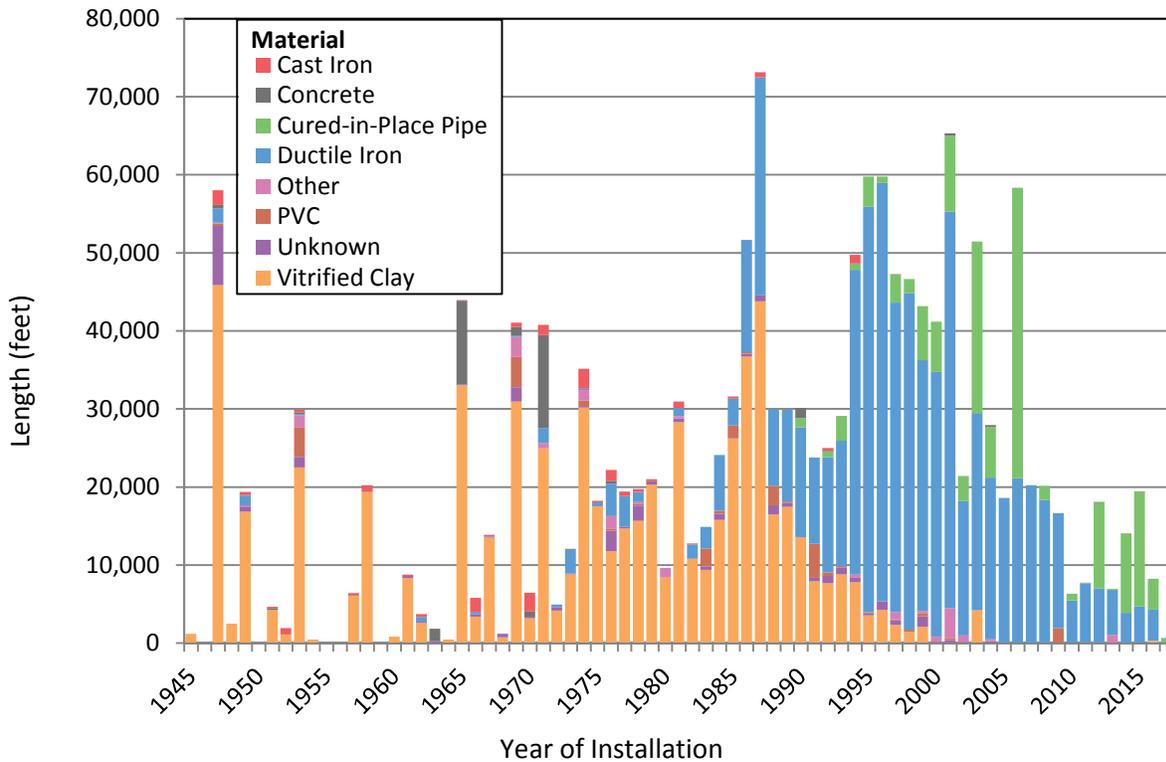
OWASA’s inventory of transmission and distribution system assets stored in the GIS includes the following:

- Backflow assemblies (privately owned)
- Fire hydrants
- Fittings
- Meters
- Pipes
- Manholes
- Service laterals
- Valves and Blow-Offs

Wastewater Collection System

The wastewater collection system, also called the sanitary sewer system, includes approximately 328 miles of gravity sewer pipes ranging in size from 4- to 60-inches in diameter, of which over 80% is 8-inch diameter pipe. Ductile iron and vitrified clay represent approximately 90% of pipe material by length, however the collection system also contains pipe materials such as cast iron, reinforced concrete, cured-in-place pipe (CIPP), PVC and various other materials. Figure 3 illustrates the gravity sewer pipe’s year of installation and material. The collection system also includes about 10,700 manholes installed on the gravity sewer pipes.

Figure 3. Gravity Sewer System Length of Pipe in Service, by Installation Year and Type of Material



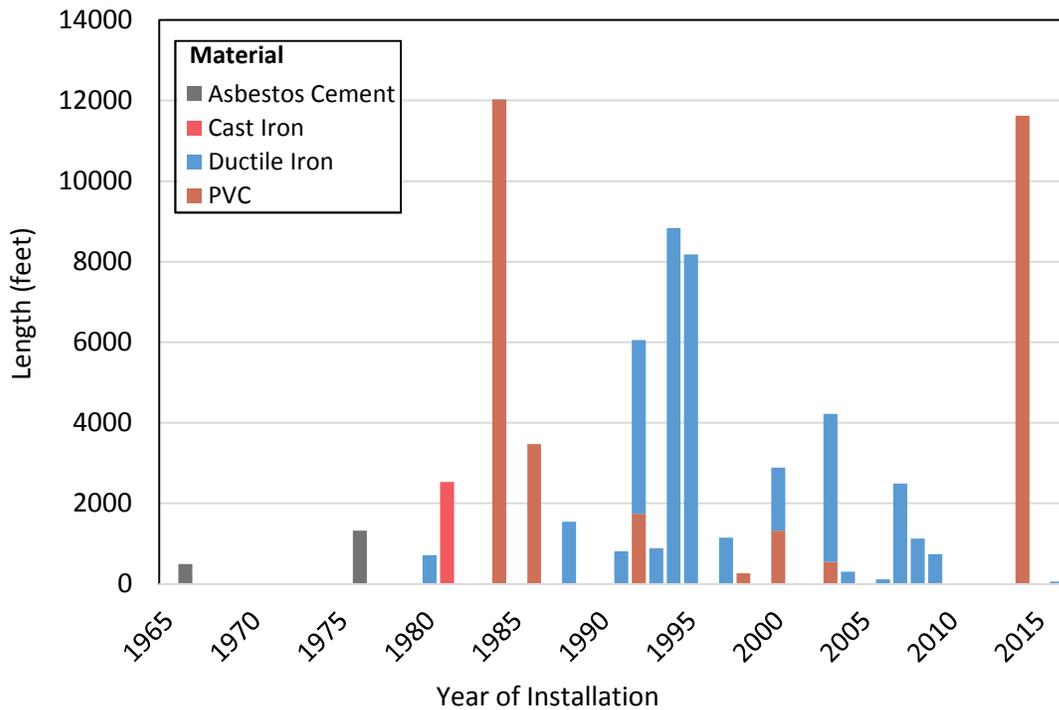
Note: An additional 117,600 LF of vitrified clay sewer pipe or approximately 7% of the collection system has an unknown installation year. Historical archives and staff knowledge will be used to estimate the installation year.

In addition to the gravity sewer pipes, there are 14 miles of pressurized sewer pipes, also called force mains, in the service area that convey pumped sewage. The pressurized sewer pipes vary in size from 2- to 48-inches in diameter and materials include PVC, ductile iron, cast iron and asbestos cement. Figure 4 illustrates the pressurized sewer collection system's year of installation and material. Approximately 97% of the pressurized sewer pipes were installed since 1980 and 94% of these pipes are made of PVC and ductile iron.

OWASA's inventory of wastewater collection system assets stored in the GIS includes the following:

- Fittings
- Pipes
- Grease traps (privately owned)
- Manholes
- Valves
- Creek Crossings

Figure 4. Pressurized Sewer System Length of Pipe in Service, by Installation Year and Type of Material



Ongoing Work

OWASA staff began a field verification effort in 2013 using survey grade GPS equipment to improve the accuracy of the collection system asset inventory. We expect the first phase (collecting x-y coordinates and manhole rim elevations) of this staff-led effort to be completed in 2021. Figures 5 show an example of the type of changes we are making to the GIS as part of the field verification program.

Figure 5. Wastewater Collection System Field Verification



Sewer Location as Shown in GIS Before Field Verification

Sewer Location Shown in GIS After Field Verification

Reclaimed Water Distribution System

The reclaimed water system consists of approximately five miles of ductile iron pipe ranging in size from 6- to 24-inches in diameter. The system was constructed between 2005 and 2011 and includes 137 valves and 11 meters. OWASA's inventory of reclaimed water system assets stored in the GIS includes the following:

- Backflow assemblies (privately owned)
- Fittings
- Hydrants
- Laterals
- Meters
- Pipes
- Manholes
- Valves and Blow-Offs

Vertical Assets

OWASA's water system vertical assets include supply, treatment, pumping and drinking water storage facilities. The wastewater system vertical assets include pumping, treatment and biosolids facilities. The vertical assets associated with treating and pumping reclaimed water are part of the Mason Farm Wastewater Treatment Plant (WWTP) asset inventory. Figure 6 shows the location of OWASA's vertical assets throughout the service area.

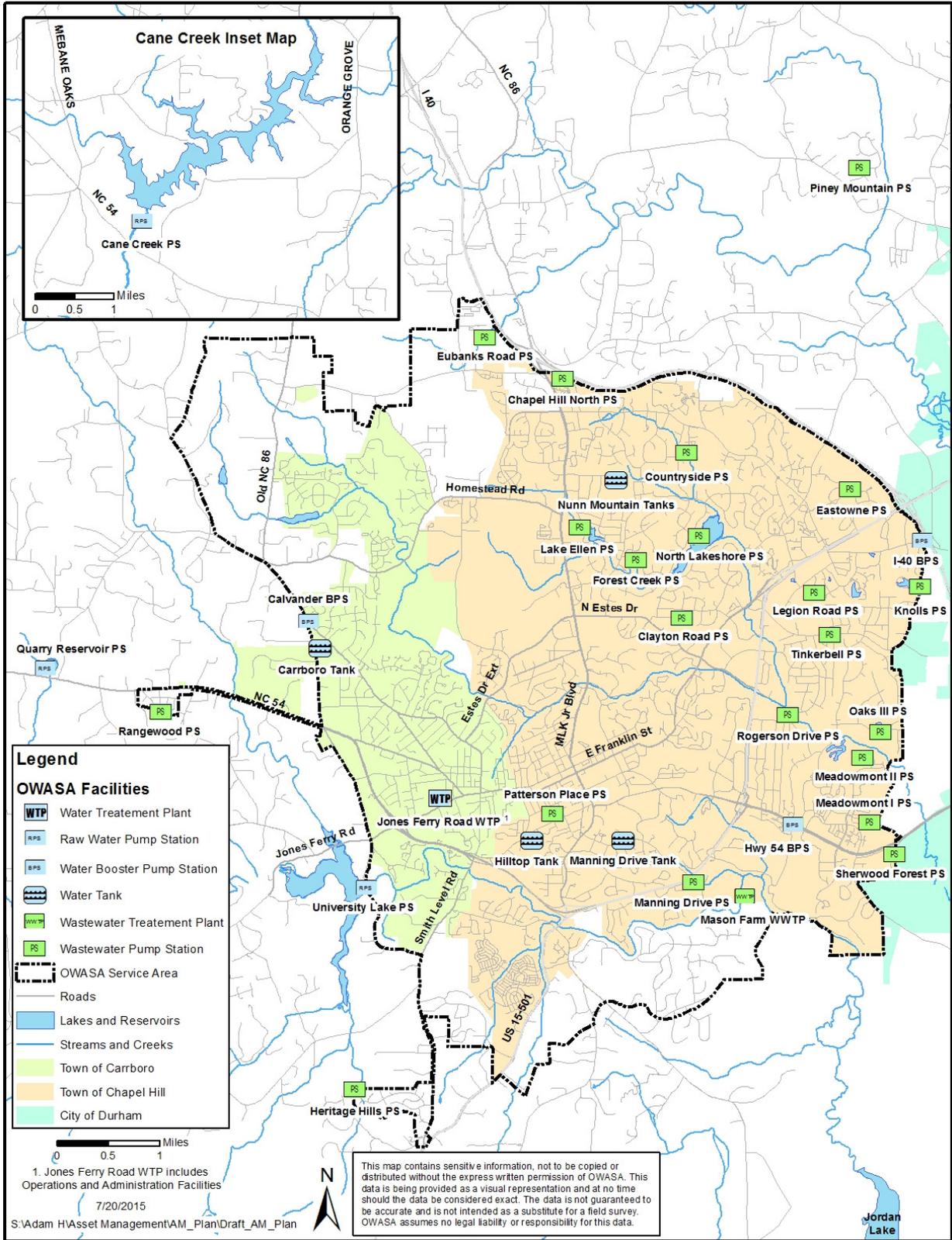
Water System Vertical Assets

The water system vertical assets include OWASA's reservoirs, raw water pump stations, Jones Ferry Road Water Treatment Plant (WTP), booster pump stations and storage tanks. These assets are essential for treating, storing and pumping drinking water to meet customer demands and to ensure adequate flow and pressure for firefighting purposes. Table 1 provides a summary of these assets. OWASA's inventory of individual assets located at these facilities is stored in the CMMS database. The database contains 2,161 mechanical, electrical and structural assets for the water system.

Table 1. Water System Vertical Assets

Asset Type	Purpose	Count	Capacity
Reservoirs	Water source for water treatment plant.	3	200-3,000 million gallons (MG)
Raw Water Pump Stations	Pump raw water from the reservoirs to the water treatment plant.	3	4-18 million gallons per day (MGD)
Water Treatment Plant	Remove impurities from raw water using chemical and physical processes. Treated drinking water is then pumped into the distribution system.	1	20 MGD
Booster Pump Stations	Transfer drinking water from lower pressure zones to higher pressure zones in the distribution system. Also used during emergencies to convey water to and from neighboring water systems.	4	2-7 MGD
Storage Tanks	Store drinking water in order to maintain adequate flow and pressure throughout the system.	6	0.5-3.0 MG

Figure 6. Vertical Asset Facility Map



Wastewater System Vertical Assets

The wastewater system vertical assets include OWASA’s wastewater pump stations, Mason Farm WWTP, reclaimed water storage tank and pump station, and remote biosolids storage tanks. These assets are used for pumping and treating wastewater and storing biosolids. Table 2 provides additional information on these assets. OWASA’s inventory of individual assets located at these facilities is stored in the CMMS database. The database contains 3,883 mechanical, electrical and structural assets.

Table 2. Wastewater System Vertical Assets

Asset Type	Purpose	Count	Capacity
Wastewater Pump Stations	Pump wastewater from areas in the collection system where gravity flow is not feasible.	21	0.06-18.5 MGD
Wastewater Treatment Plant	Remove impurities from wastewater using biological, chemical and physical processes. Treated water is then discharged to Morgan Creek or pumped into the reclaimed water distribution system.	1	14.5 MGD permitted capacity for max-month of flow, 43 MGD for short-term peak flow conditions
Reclaimed Water Storage Tank	Store reclaimed water before pumping into distribution system.	1	0.60 MG
Reclaimed Water Pump Station	Pump water into the reclaimed water distribution system to maintain flow and system pressure.	1	3 MGD
Remote Biosolids Storage Tanks	Store liquid biosolids during extended periods when land application is not possible.	2	0.9-1.5 MG

Administrative Office and Operations Center

OWASA's administrative offices and operations center are co-located with the Jones Ferry Road WTP at OWASA’s 17-acre site in Carrboro. The Administration Building was built in 1990 and houses OWASA’s administrative office. The Operations Center was built in 2004 and houses the Distribution and Collection departments, warehouse operations, fleet maintenance, material and equipment storage and a vehicle wash facility. OWASA’s inventory of individual assets located at these facilities is stored in the CMMS database. The database contains 351 mechanical, electrical and structural assets.

Other Assets

Vehicles and Associated Equipment

OWASA owns 150 vehicles and associated equipment. Vehicles and equipment are used to maintain OWASA’s water, wastewater and reclaimed water systems and transport staff, equipment and material. OWASA’s inventory of vehicles and associated equipment is stored in

the CMMS database. Table 3 provides a summary of OWASA’s vehicles and associated equipment.

Table 3. OWASA Vehicles and Associated Equipment

Vehicle Category	Examples	Count
Pickup Trucks	All Trucks (1/4 to 2 Ton)	51
Vans and Sedans	Vans, Sedans, Sport Utility Vehicles	10
Heavy Duty Vehicles	Road Tractors, Dump Trucks, Vacuum Trucks	19
Equipment	Tractors, Backhoe Loaders, Excavators, Forklifts and Mowers	47
Trailers	Tanker Trailers, Trailers	23
Total		150

Land

OWASA owns 3,744 acres of land that is used for a variety of purposes including facilities, biosolids management, reservoirs and watershed protection, and potential future facility sites (such as water supply facilities at Jordan Lake and future elevated water storage tanks). OWASA’s land inventory is stored in the GIS. Each feature includes the land asset’s spatial location and a variety of attribute information including the parcel identification number, area, physical address, date of purchase and deed reference. Table 4 provides a summary of OWASA-owned land.

We will be developing a plan and policy framework for long-term management and disposition of OWASA lands as part of Strategic Initiative 6 in the OWASA Strategic Plan adopted on June 9, 2016.

Table 4. OWASA-Owned Land

Category	Acres
Biosolids	710
Cane Creek Reservoir & Watershed	2,544
Jordan Lake	125
OWASA Facilities	113
Quarry Reservoir	251
University Lake & Watershed ¹	0
Total	3,744

1. University Lake and about 500 acres of adjacent lands are owned by University of North Carolina (UNC). OWASA is entitled to use University Lake as a water supply source and controls all land within 100 feet of the shoreline through a contractual agreement with UNC.

Treatment Plant Process Piping

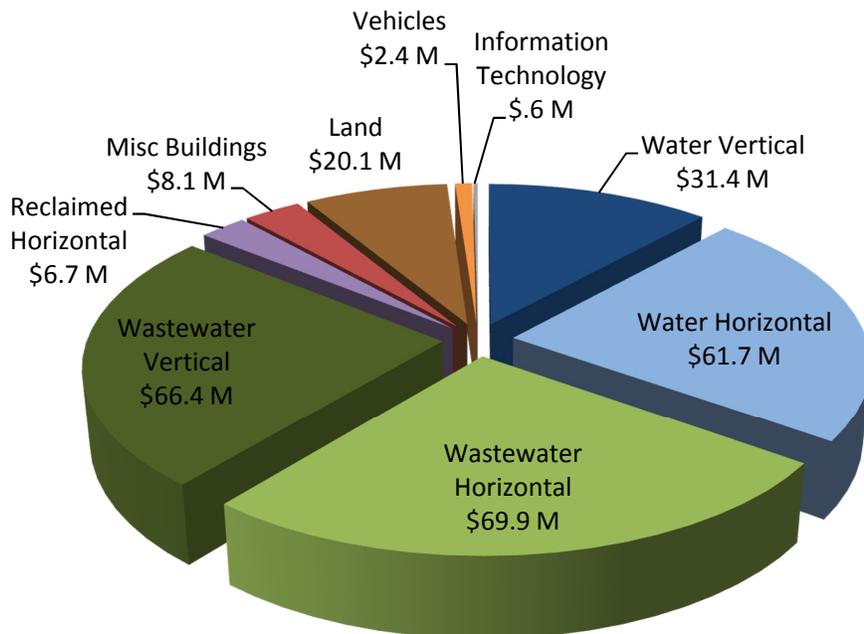
Asset information for the buried pipe networks that connect process units at the Jones Ferry Road WTP and Mason Farm WWTP is available through record drawings. We have an ongoing field verification effort at the Mason Farm WWTP to survey the process pipes and add them to the GIS. This effort started in 2013 and to date we have inventoried 4.7 miles of pipe. We expect the Mason Farm WWTP work to be completed in 2018. Upon completion, we will begin field verification of the process piping at the Jones Ferry Road WTP.

The Value of OWASA’s Assets

The value of OWASA’s assets is documented in the fixed asset register, which is stored in the Great Plains database. The asset’s cost or original purchase price is recorded in the fixed asset register for all new assets that are either purchased by or dedicated to OWASA. With the exception of land, the recorded cost of the assets is depreciated using the straight-line method, which is calculated as the original purchase price divided by the expected useful life, following generally accepted financial accounting guidance. The expected useful life ranges from 5-60 years depending on the type of asset. The recorded cost for land is not depreciated. An asset’s cost less the associated depreciation is known as net book value. Net book value by asset category as of March 2017 is illustrated in Figure 7. Water and wastewater assets account for 35% (\$93.1 million) and 51% (\$136.3 million) of the total fixed asset register net book value of \$267 million (M), respectively.

Figure 7. 2017 Asset Value

Fixed Asset Register Net Book Value = \$267 M



SECTION 3 LEVEL OF SERVICE

Once we have an inventory of the assets we own, where they are located, their age, value, etc., we need to understand “*What is my required sustained level of service?*” Levels of service are defined by community and customer expectations and regulatory requirements. We then compare actual performance to the desired level of service.

Service levels are a utility’s stated commitment to deliver service to a customer at a specific level of quality and reliability. The long-term effectiveness of OWASA’s asset management program can be assessed by comparing OWASA’s historical performance to these service level goals. A failure to meet these goals may indicate capacity limitations, aging equipment or infrastructure, inadequate operations and maintenance activities, etc. The goal of asset management is to achieve level of service targets at an acceptable level of risk. Level of service is defined by several of OWASA’s Key Indicators and Performance Measurements including the following:

- Ratio of Water Sold to Water Produced
- Water Pipe Breaks per 100 Miles of Pipe
- Primary and Secondary Drinking Water Violations
- Reportable Sewer Overflows per 100 Miles of Pipe
- Collection System Operating Permit Violations
- Water Treatment Plant and Wastewater Treatment Plant NPDES Permit Violations
- Wastewater Treatment Plant Odor Events
- Biosolids Operating Permit Violations
- Reclaimed Water System Operating Permit Violations

Our Key Indicators and Performance Measurements are updated monthly and posted on the OWASA website, www.owasa.org. The level of services and specific targets are discussed below.

Water Treatment and Distribution

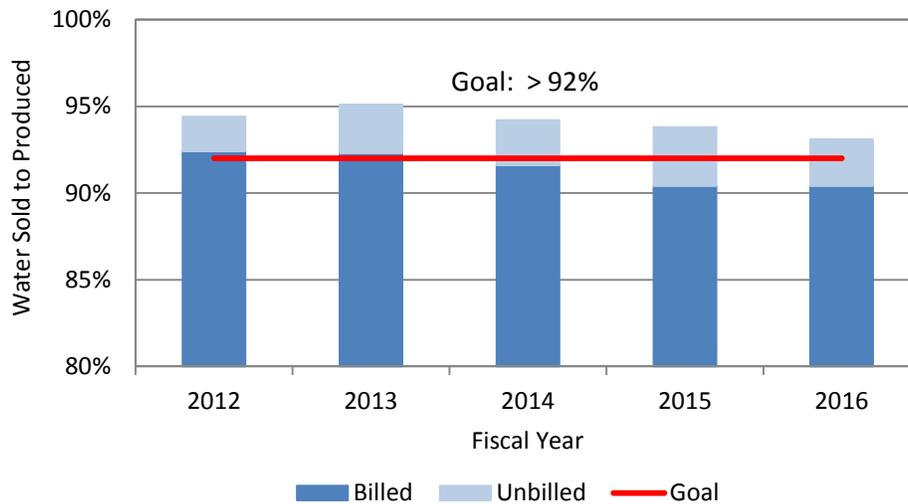
Ratio of Water Sold to Water Produced

The ratio of water sold to water produced level of service is defined as the volume of billed water use as a percentage of the volume of water pumped into the water distribution system from the Jones Ferry Road WTP, commonly referred to as revenue water. Water loss is defined as the difference between water produced and authorized water usage, which includes unbilled, but known, as well as billed water use. Unbilled water use is actual or estimated volumes of water used for authorized purposes, such as our unidirectional flushing program, blow-off of water associated with the installation and testing of new lines, etc. Primary causes of water loss include unauthorized water usage, meter inaccuracies, or leaks.

The ratio of water sold to water produced can be used to gauge the overall condition of the distribution system. An excessive amount of leakage indicates that the distribution system may be deteriorating. OWASA’s goal is for billed and unbilled water use as a percent of water pumped to be greater than 92%. The goal of 92% was calculated using American Water Works Association’s (AWWA) Water Audit methodology to calculate Unavoidable Annual Real

Losses, which is a theoretical value representing the technical low limit of leakage that could be achieved if all of today’s leak detection technology could be successfully applied. Historical values from Fiscal Year (FY) 2012-2016 are presented in Figure 8. The ratio of water sold to water produced has exceeded 92% eight out of the last ten years. However, it has been trending downward for the past three years.

Figure 8. Fiscal Year 2012-2016 Ratio of Water Sold to Water Produced



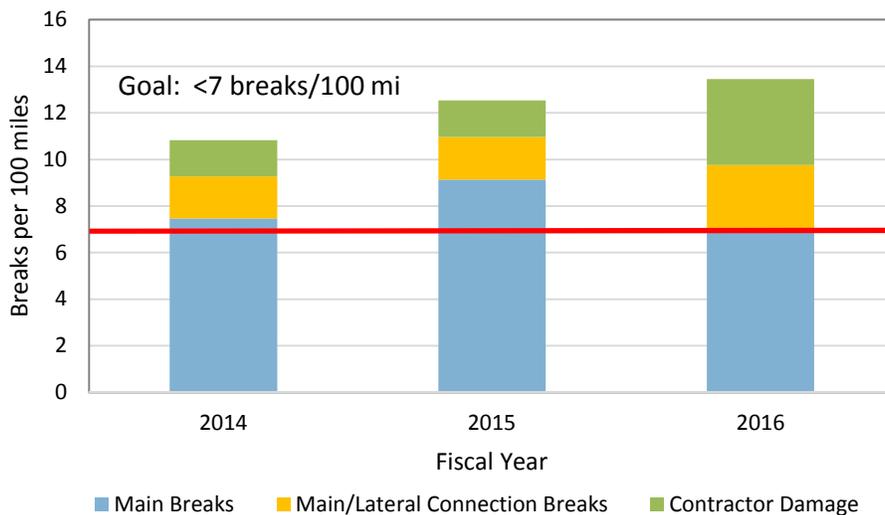
Water Pipe Breaks per 100 Miles of Pipe

The water pipe breaks per 100 miles of pipe level of service is defined as the number of water pipe breaks per hundred miles of water distribution pipes. For this indicator, a water distribution pipe is pipe owned by OWASA that is greater than 2 inches in diameter. A water distribution lateral is a pipe that connects the piping in a customer’s building to OWASA’s pipe. There are three categories for pipe breaks:

- Pipe Breaks
- Pipe/Lateral Connection Breaks
- Contractor Damage

The quantity of pipe breaks not caused by contractors can be used to gauge the overall condition of the distribution system. An excessive amount of pipe breaks per 100 miles of pipe indicates that the overall integrity of the distribution system may be declining. OWASA’s goal is for water pipe breaks to be less than 7 breaks/100 miles, which is the national median reported in AWWA’s 2016 Benchmarking Report. Historical values from FY 2014-2016 are presented in Figure 9. The number of water pipes breaks per 100 miles of pipe has exceeded the 7 breaks/100 miles for the last three years. We will be evaluating our water pipe replacement program in 2017 and will discuss our water pipe breaks per 100 miles of pipe performance and goal.

Figure 9. Fiscal Year 2014-2016 Number of Water Pipe Breaks per 100 Miles of Pipe



Primary and Secondary Drinking Water Violations

National Primary Drinking Water Regulations are limits set for substances that are thought to pose a threat to health when present in drinking water at certain levels. Secondary Drinking Water Regulations are non-enforceable federal guidelines regarding taste, odor, color and certain other non-aesthetic effects of drinking water. These contaminants normally do not have any health effects and normally do not affect the safety of our water. Primary and Secondary Drinking Water Regulation violations may indicate that the water plant or distribution system is not operating as intended due to capacity limitations, aging equipment, inadequate operations and maintenance activities, etc. OWASA’s goal is to be in full compliance with the Primary and Secondary Drinking Water Regulations. OWASA was in compliance with these regulations throughout FY 2016.

Wastewater Collection and Treatment

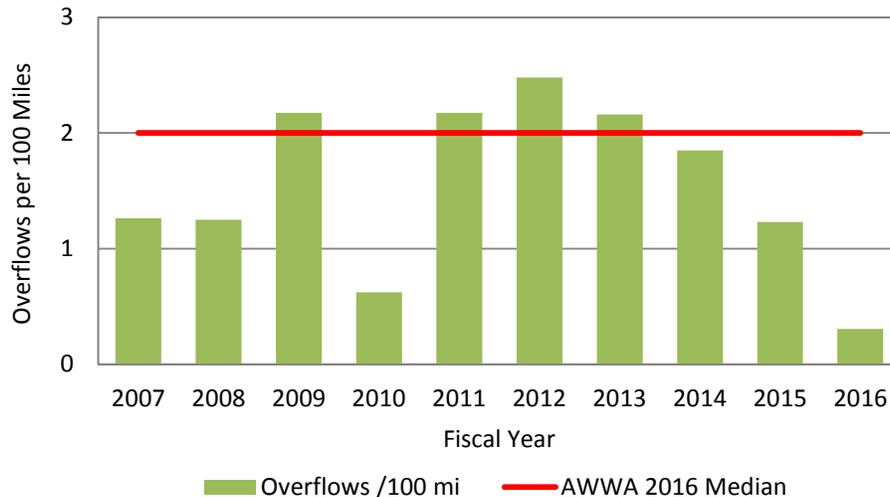
Reportable Sewer Overflows per 100 Miles of Pipe

The reportable sewer overflows per 100 miles of pipe level of service is defined as the number of reportable sewer overflows per hundred miles of gravity sewer and pressurized sewer pipes. A sewer pipe is a pipe owned by OWASA that is greater than 4 inches in diameter and conveys sewage from our customers to the Mason Farm WWTP. A sewer overflow is reportable if the volume of sewage is equal to or greater than 1,000 gallons or any amount of sewage reaches the surface waters of the State (including through ditches, storm drains, etc.). Overflows are typically caused by pipe breaks, pipe blockages, excessive inflow and infiltration, malfunctioning pump stations and electrical power failure.

The quantity of overflows can be an indication of the overall condition of the collection system and the effectiveness of the collection system maintenance program. An excessive amount of reportable sewer overflows per 100 miles of pipe indicates that the integrity of the collection system may be declining and/or maintenance activities may be inadequate. Historical values from FY 2007-2016 are presented in Figure 10. For the last three years the number of overflows

has been less than 2 per 100 miles of pipe, which is the national median per the AWWA’s 2016 Benchmarking Report. Per North Carolina Division of Water Resources guidance, OWASA strives to have no overflows.

Figure 10. Fiscal Year 2007-2016 Number of Reportable Sewer Overflows per 100 Miles of Pipe



Collection System Operating Permit Violations

Requirements for the wastewater collection system’s design and construction, operation and maintenance, and overflow reporting are included in the Wastewater Collection System Operating Permit. Collection System Operating Permit violations indicate that the collection system may be deteriorating or that maintenance, renewal and replacement activities may be inadequate. OWASA’s goal is to be in full compliance with these requirements. OWASA was in compliance with this permit throughout FY 2016.

NPDES Permit Violations

The National Pollution Discharge Elimination System (NPDES) is a permit system for regulating point sources of pollution. The goal of the NPDES program is to reduce pollution by establishing effluent discharge limits and monitoring requirements.

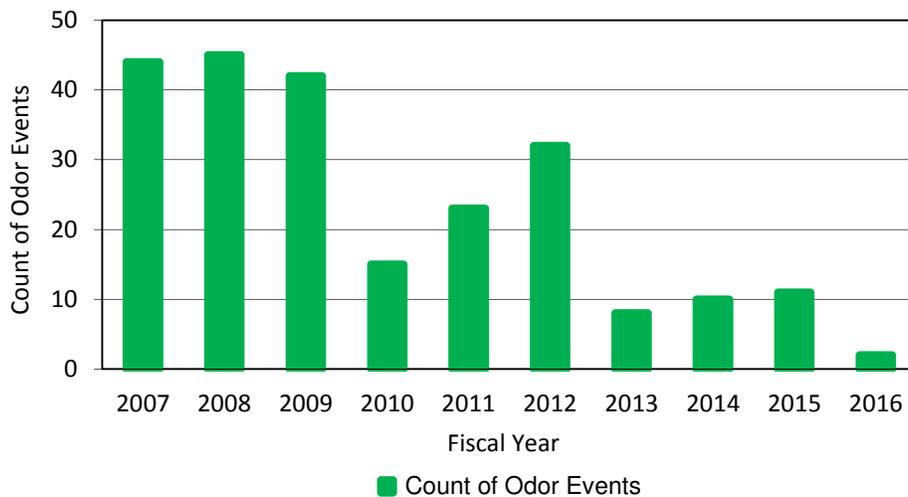
OWASA’s NPDES permitted discharges are located at the Jones Ferry Road WTP and Mason Farm WWTP. The Jones Ferry Road WTP is permitted to discharge wastewater associated with backwash clarifier effluent into Rockybrook Creek. The Mason Farm WWTP is permitted to discharge treated wastewater effluent into Morgan Creek. NPDES Permit violations may indicate that either the WTP or WWTP is not operating as intended due to capacity limitations, aging equipment, inadequate operations and maintenance activities, etc. OWASA’s goal is to be in full compliance with the requirements in both NPDES permits. OWASA was in compliance with these permits throughout FY 2016.

Wastewater Treatment Plant Odor Events

On March 1, 2004, the Chapel Hill Town Council approved a Special Use Permit (SUP) for an OWASA project to upgrade and expand the Mason Farm WWTP which was completed in 2007. The SUP included a provision that OWASA eliminate odor from the Mason Farm WWTP to the

satisfaction of the Town Council and that OWASA regularly report to the Council on the progress of its off-site odor elimination program. Wastewater treatment plant odor events indicate that the odor control equipment may not be operating as intended due to capacity limitations, aging equipment, equipment malfunction, inadequate operations and maintenance activities, etc. Odor events are reported by neighboring property owners and documented by OWASA staff. A summary of system compliance for FY 2007-2016 is presented in Figure 11. The notable reduction in odor events over the past four years is due to several capital improvement projects that were completed as part of the WWTP’s Odor Elimination Program.

Figure 11. Fiscal Year 2007-2016 Count of Wastewater Treatment Plant Odor Events



Biosolids Operating Permit Violations

OWASA is permitted for both Class A – Exceptional Quality and Class B land application of biosolids. The biosolids permits include treatment requirements, metal concentration limits, land application restrictions, and operation and maintenance requirements. Biosolids operating permit violations may indicate that the treatment process may not be operating as intended due to capacity limitations, aging equipment, equipment malfunctions, inadequate operations and maintenance activities, etc. OWASA’s goal is to be in full compliance with the requirements in both permits. OWASA was in compliance with these permits throughout FY 2016.

Reclaimed Water System

Reclaimed Water Utilization System Operating Permit Violations

The Reclaimed Water Utilization System Permit includes design and construction, operation and maintenance, and effluent limit and monitoring requirements for the reclaimed water system. Reclaimed Water Distribution System Operating Permit violations may indicate that the treatment, storage, pumping or distribution system may not operating as intended due to capacity limitations, aging equipment, equipment malfunctions, inadequate operations and maintenance activities, etc. OWASA’s goal is to be in full compliance with the permit’s requirements. OWASA was in compliance with this permit throughout FY 2016.

SECTION 4 RISK FRAMEWORK

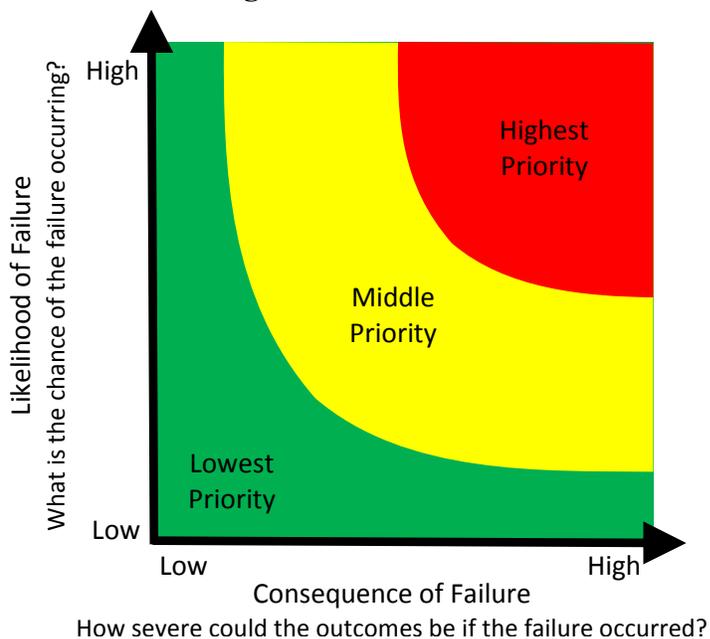
Knowing “*Which of my assets are critical to sustained performance?*” requires us to understand how assets fail, the likelihood of failure and the consequences of failure.

Risk framework is a tool used to calculate the nature and level of exposure that an organization is likely to confront through a potential failure of a specified asset or group of assets. OWASA’s asset groups have different terminology and methods for quantifying risk; however, the goal of each process is to prioritize assets in order to develop effective funding strategies for risk reduction. OWASA has developed frameworks for calculating risk in four separate asset groups: water horizontal assets, wastewater horizontal assets, vertical assets and vehicles. The four risk assessment frameworks were customized to the unique characteristics of each asset group.

Regardless of the framework used, the risk being evaluated centers on the failure of an asset. Failure is defined as the inability of any asset to do what its users need it to do. Under this definition, an asset may be operating, but if it is not meeting intended performance standards it may be considered in a failed state. Asset failure modes include mortality, capacity, level of service and financial efficiency.

The two primary inputs of the risk framework are likelihood of failure and consequence of failure. Likelihood of failure describes the quantification of uncertainty related to a failure actually occurring. Consequence of failure is typically associated with the severity of the outcome. A risk matrix schematic is shown in Figure 12. The first priority should be to focus on the high risk assets in the red area (high likelihood and consequence of failure), then the yellow area and finally the green area.

Figure 12. Risk Framework



Vertical Assets

OWASA’s water, wastewater and reclaimed water vertical assets were divided into 109 subprocess groups (e.g. Rogerson Drive pump station, WTP hypochlorite feed system, Manning Drive tank) for the purposes of the risk analysis. Risk for vertical asset subprocesses is defined as the product of consequence and likelihood of failure. In the framework developed by CH2M HILL as part of the Asset Management Project Implementation, consequence and likelihood scores are assessed based on a number of factors. Weighting is applied to each of the following consequence and likelihood factors so that relative importance of each criterion is captured.

Likelihood of Failure:

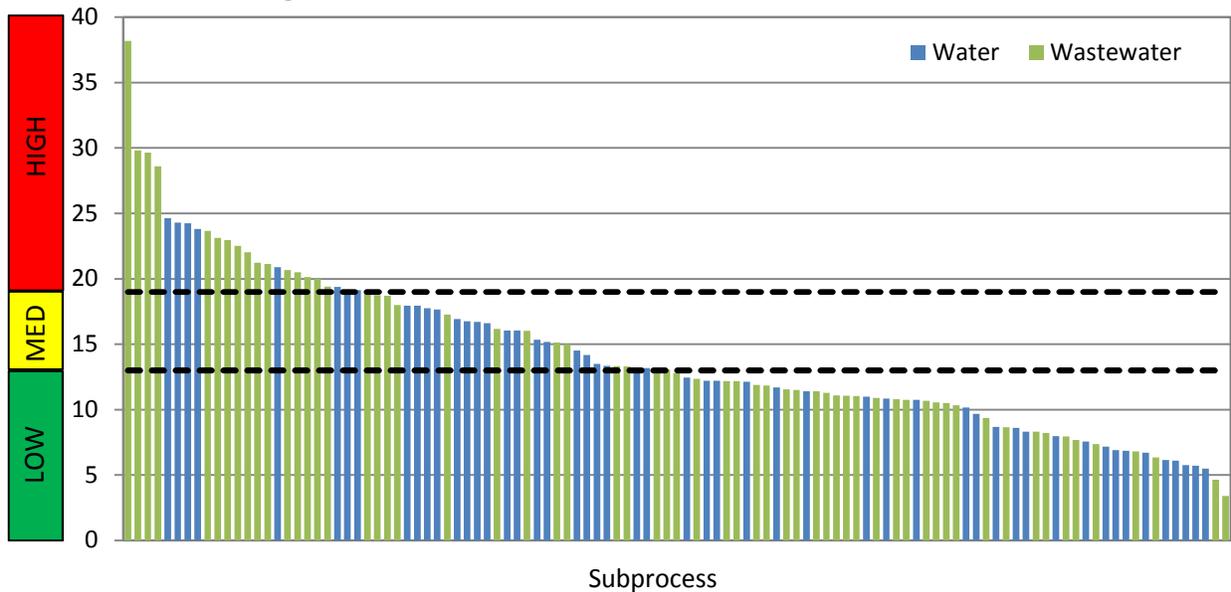
- Condition
- Maintainability
- Operability and functionality

Consequence of Failure:

- Health and safety
- Compliance
- Financial impact
- Levels of customer service

The results of the risk analysis are presented in Figure 13. Each bar represents a subprocess with the risk score on the y-axis. Water (blue) and wastewater (green) subprocesses were evaluated together. CH2M HILL divided the subprocesses into three bands (high, medium and low) based on the risk score.

Figure 13. Vertical Asset Prioritization Model Results



The risk score was used to prioritize field condition assessment with the highest risk assets being evaluated first. In 2012, maintenance specialists from CH2M HILL conducted condition assessments on nearly 2,000 assets (pumps, motors, electrical, etc.). About 77% of the assessed assets are in good condition. Approximately 23% of the assets may need corrective maintenance, rehabilitation or replacement in the next three to five years. The field condition results are used to update the prioritization model and to develop rehabilitation and replacement projects.

The vertical asset risk assessment framework also takes into account capacity failures. The following hydraulic models and studies are used to determine which vertical asset facilities may need future capacity expansions:

- OWASA’s 2010 Long-Range Water Supply Plan (LRWSP) indicates that under most hydrologic conditions, the existing raw water supplies and associated facilities will have sufficient capacity through approximately 2055 based on current estimates of yield and expected demand projections. Demand projections will be revised as part of the ongoing LRWSP update (part of Strategic Initiative 1).
- According to the LRWSP, the Jones Ferry Road WTP 20 MGD capacity is adequate until 2060 given current growth projections and levels of treatment.
- The 2011 distribution system hydraulic model was used to determine that the existing booster pump stations have sufficient capacity and additional distribution storage is not required in the study's 20-year planning period.
- The 2011 collection system hydraulic model indicates that there is sufficient capacity at eight of the pump stations that were evaluated in the study's 20-year planning period. A project was awarded to CDM Smith in April 2017 to update the collection system hydraulic model. An evaluation of pump station capacity will also be included in this project.
- The 2010 Mason Farm WWTP Hydraulic and Treatment Capacity Study prepared by Hazen and Sawyer states that the 14.5 MGD plant will need to be upgraded in 2030 to a capacity of 18.5 MGD. The plant’s future capacity needs will be reevaluated in FY 2020.

Water Horizontal Assets

The *Water Main Rehabilitation and Replacement Prioritization Model* was developed by AECOM in 2003 and updated in 2010 to provide guidelines on the annual reinvestment decisions for water pipes and to provide a dynamic model for prioritizing the replacement/rehabilitation of water pipes. The prioritization model’s risk assessment framework evaluates pipes using the following factors:

Likelihood of Failure:

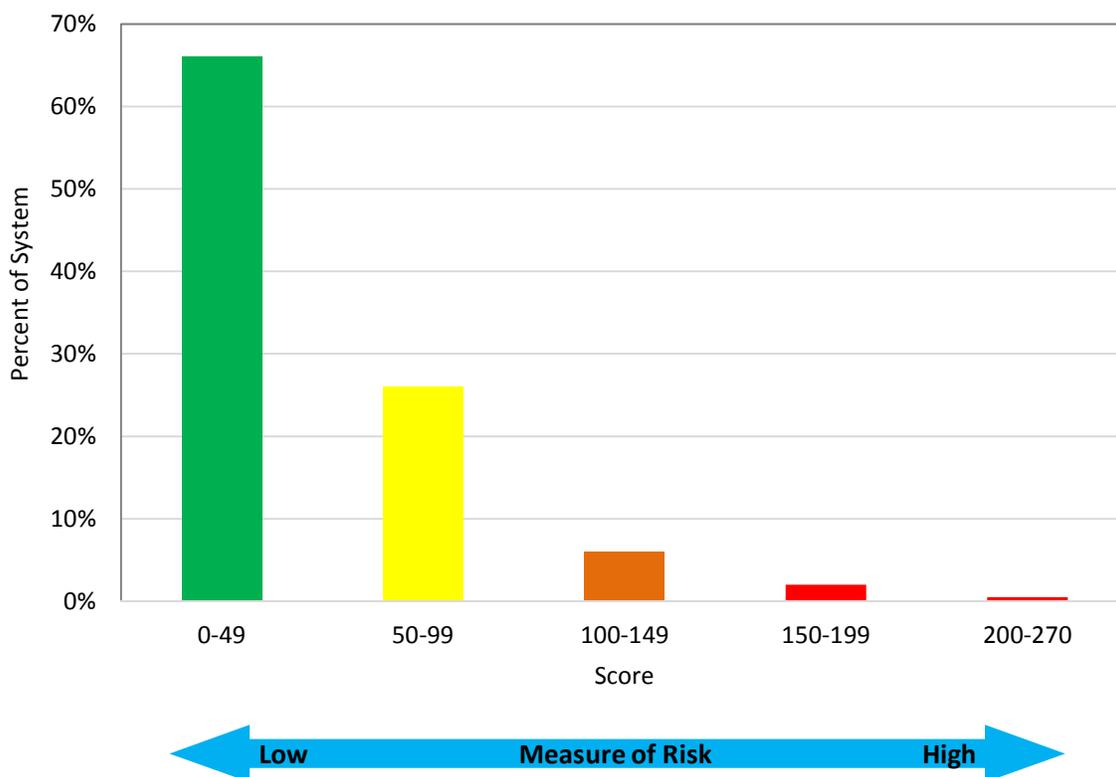
- Pipe age
- Pipe breaks and leaks
- Pipe material
- System pressure

Consequence of Failure:

- Location of the pipe
- Critical customer impact

The sum of the weighted values for the above factors is the priority (risk) score for each pipe. A summary graph of the prioritization model results are displayed in Figure 14. Due to the relatively young age of the distribution system, 66% of the distribution system has a priority score below 50. The higher priority pipes make up about 8% of the distribution system.

Figure 14. Distribution System Prioritization Model Results



Current and future capacity needs are accounted for in the *2011 AECOM Water Distribution System Hydraulic Model*. According to the model, OWASA’s distribution system has relatively few hydraulic deficiencies through 2030.

We will be evaluating our current water pipe risk framework in 2017 and determining if it needs to be updated. We will discuss our prioritization methodology, condition assessment feedback into the risk framework, rate of replacement, level of service performance and determining project extents.

Wastewater Horizontal Assets

The wastewater collection system prioritization model was developed as part of the *2011 Sanitary Sewer Service Area Study* prepared by CDM Smith. The prioritization model’s risk assessment framework quantifies the consequence of failure and likelihood of failure. The study also included hydraulic modeling of the interceptors and critical collector pipes. Existing and potential future capacity deficiencies identified by the hydraulic modeling were incorporated into the framework’s likelihood of failure. The prioritization model’s risk assessment framework evaluates pipes using the following factors:

Likelihood of Failure:

- Structural
- Maintenance
- Capacity

Consequence of Failure:

- Quantity of flow conveyed
- Transportation/urban impact
- Environmental impact
- Difficulty of emergency repair

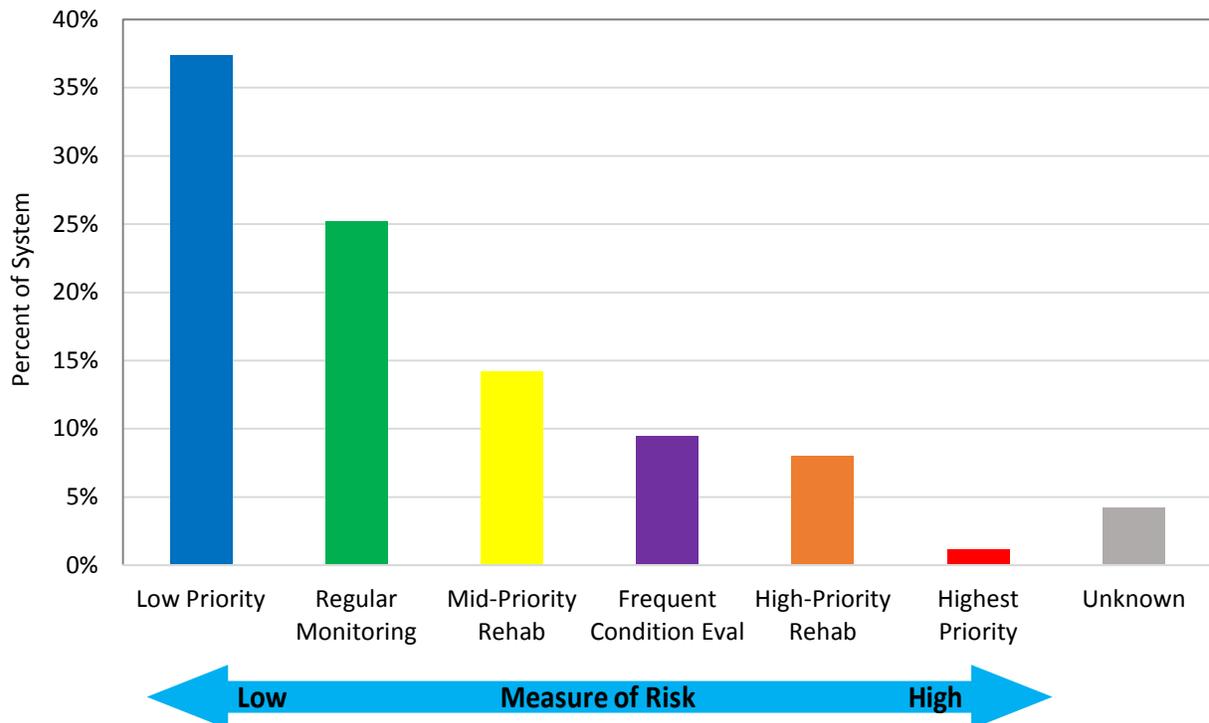
The six priority categories from the analysis are shown in Figure 15. The results from the model are used to prioritize pipes for condition assessments. The condition assessment results are used to update the prioritization model by overriding the likelihood of failure calculations.

Figure 15. Collection System Risk Framework

		CONSEQUENCE OF FAILURE				
		1	2	3	4	5
LIKELIHOOD OF FAILURE	5		High Priority Rehab.		Highest Priority	
	4	Mid-Priority Rehab.				
	3				Frequent Condition Eval.	
	2		Low Priority			
	1			Regular Monitoring		

A summary of the results from the wastewater collection system prioritization model is presented in Figure 16. About 2% of the collection system is in the highest priority for condition assessment. Over 60% of the collection system is in the two lowest categories of low priority or regular monitoring.

Figure 16. Collection System Prioritization Model Results



In April 2017, CDM Smith was selected to update the collection system hydraulic model. The collection system prioritization model will also be updated with the revised capacity information from the hydraulic model. The prioritization model's update will also include categorizing 4% of the collection system with an unknown priority. This unknown category includes newly installed sewer pipes and existing sewer pipes that were recently located during the collection system field verification.

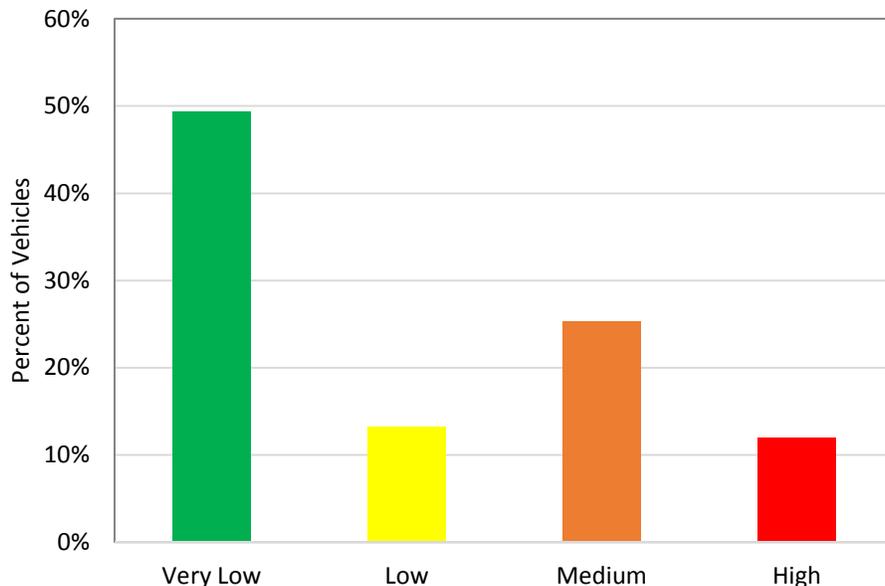
Reclaimed Water Horizontal Assets

OWASA's reclaimed water distribution system was installed after 2005 and has decades of useful life remaining, therefore a replacement program has not yet been implemented for these assets. As the system ages and has increased demand placed on it, a reclaimed water distribution system replacement program will be developed that includes a hydraulic model and risk-based prioritization model. The development of both models will be facilitated by the reclaimed water distribution system's asset inventory, which is accurate, and work order history, which is documented.

Vehicles and Associated Equipment

The vehicle risk assessment framework relies on knowledgeable staff to quantify likelihood and consequence of failure. The condition or likelihood of failure is assessed by maintenance mechanics familiar with the fleet of vehicles and equipment and the individual vehicle or equipment's performance. The criticality or consequence of failure is determined by the manager responsible for the asset. A risk score, which is the product the likelihood and consequence of failure, and associated risk category (very high, high, medium, low) is determined for each assets. The results from the risk model are presented in Figure 17. Managers' vehicle and equipment replacement requests are then prioritized by risk category and risk score.

Figure 17. Vehicle Risk Model Results



SECTION 5 OPERATION AND MAINTENANCE AND CAPITAL IMPROVEMENT STRATEGIES

After we determine which assets are critical to performance, we need to know “*What are my best minimum life-cycle cost capital improvements program (CIP) and operation and maintenance (O&M) strategies?*” to keep the assets operating to meet the level of service goals.

OWASA has met most level of service targets due to well-managed O&M Programs and continued CIP investment in the community’s infrastructure. The CIP has been effective by identifying high risk assets and developing rehabilitation and replacement projects to mitigate these risks. Additionally, the proactive O&M Program has been successful by ensuring that assets receive appropriate preventative and corrective maintenance from qualified staff and contractors. OWASA’s O&M Program and CIP are discussed in more detail below.

Operation and Maintenance Program

Recognizing that proper operation and maintenance is key to long-term management and protection of its assets, OWASA has prepared operations and maintenance plans and Standard Operating Procedures/Protocols (SOPs) for its critical infrastructure assets, including but not limited to:

- the Mason Farm WWTP
- the Jones Ferry Road WTP
- raw water supply and pumping facilities
- the water distribution system
- the wastewater collection system
- the reclaimed water system

OWASA employs a qualified staff to maintain the water, wastewater and reclaimed water systems. On-call staff is available 24 hours per day to respond to emergencies. Most OWASA facilities are equipped with stand-by power generators, and we maintain a fleet of portable generators and pumps if permanent generators are not installed. We stock a warehouse of parts for repairing and maintaining the distribution, collection and reclaimed water systems and an inventory of critical spare parts is maintained at the treatment plants. The FY 2018 budget includes \$3.1 million (about 14% of the total annual Operating budget) for maintenance expenses.

OWASA has a Comprehensive Emergency Management Plan that addresses emergency prevention, preparation, response and recovery.

Horizontal Asset Maintenance

OWASA’s distribution system maintenance program includes hydrant inspection and maintenance, unidirectional flushing and fixed flushing devices at certain locations for water quality, valve and hydrant inspection and maintenance, and backflow and cross-connection control program. OWASA’s revised Ordinance for the Control of Backflow and Cross-

Connection and associated Cross-Connections Control Manual became effective in January 2017.

The collection system maintenance program includes easement mowing, aerial crossing inspections, sewer pipe cleaning, root control and sewer pipe video inspections. Distribution, collection and reclaimed water system maintenance activities are tied to individual assets through the integration of the CMMS and GIS.

OWASA's customer education programs for backflow and cross-connection control; proper disposal of fats, oils and grease; and materials that should and should not be disposed of in the sewer also help with proper operation of the distribution and collection systems.

Vertical Asset Maintenance

Maintenance of OWASA's treatment plants, pump stations, tanks, etc. is accomplished using a combination of OWASA staff and contractors. OWASA staff complete most routine preventive and corrective maintenance activities. Contractors perform maintenance on assets such as HVAC, roofing, generators, large pumps and motors, and instrumentation and controls. Vertical asset maintenance activities are tied to individual assets in the CMMS.

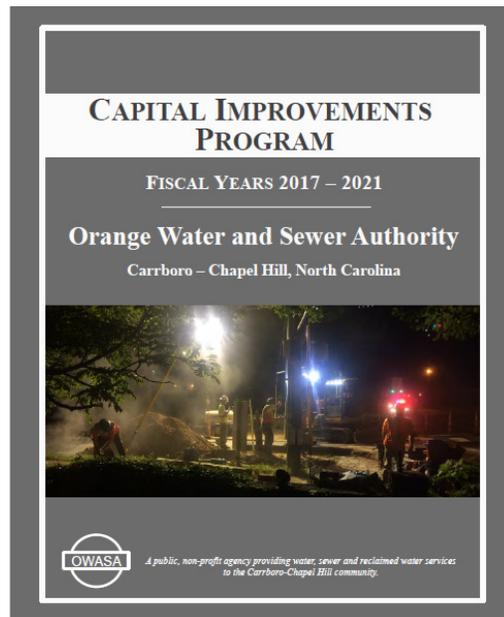
Vehicle Maintenance

Routine vehicle and equipment maintenance, such as oil changes and vehicle inspections, and smaller repairs are performed by OWASA staff at the vehicle maintenance facility located in the Operations Center. Non-routine maintenance and large repairs are contracted out. Vehicle asset maintenance activities are tied to individual assets in the CMMS. Vehicles and equipment are replaced as part of the capital equipment budget. Capital equipment is defined as motorized/rolling stock, lab equipment and IT equipment valued greater than \$5,000.

Capital Improvements Program

Assets identified for renewal, replacement and/or expansion by models, studies, performance, etc. are developed into capital improvements program (CIP) projects. Asset renewal, replacement and expansion is key to sustaining the levels of service discussed in Section 3. CIP projects are defined as any major (greater than \$10,000), non-recurring (greater than 5 years) capital expenditures for the construction, expansion, improvement, repair or replacement of a building, utility system, or other physical structure or property.

OWASA's CIP document, updated annually, summarizes OWASA's planned capital investments for a 5-year period. Its objective is to help guide OWASA's efforts to meet the community's evolving needs for sustainable, reliable and high quality water, wastewater and reclaimed water services. For long-term financial planning purposes, the CIP extends out 15-years to include projects



outside of the five year window to ensure adequate lead time for evaluation of alternatives, advance studies and to inform long-term financial planning. The CIP is updated annually with the Annual Budget.

Capital project needs are identified by staff observation, regulatory or contractual requirements, work order evaluation, hydraulic models, risk/prioritization models, coordination with other projects (e.g. street resurfacing, greenways, etc.) and master planning studies.

Horizontal Assets

Water Distribution System

OWASA's water distribution system replacement program relies on information from staff as well as the *2003/2010 AECOM Water Main Replacement and Prioritization Model* and *2011 AECOM Water Distribution System Hydraulic Model*. The 2003 water system prioritization modeling study recommended that OWASA would need to replace 1.7 miles of water pipe per year (over the next 50 years) using optimistic (long) life expectancy and 3 miles of pipe per year using the pessimistic (short) life expectancy in order to provide reliable, sustainable service to our customers.

The pipe replacement program is currently focused on replacing galvanized water pipes due to the water quality and reliability issues associated with this specific material. We have about 3.2 miles of galvanized pipe in the distribution system. The individual pipe replacement projects are typically less than 500 feet in length, located in older neighborhoods and often require easement acquisition. The overall rate of galvanized pipe replacement is somewhat slow due to these challenges. The pipe replacement program is also focused on replacing asbestos-cement pipes in high pressure areas that have had higher rates of pipe breaks and leaks. The average rate of water pipe renewal/replacement in the FY 2018-2022 CIP is 3.1 miles per year (0.8% of the system).

Wastewater Collection System

Wastewater collection system renewal and replacement projects are developed from the *2011 CDM Smith Sanitary Sewer Service Area Study* and subsequent field inspections. CDM Smith's prioritization model guides closed-circuit television (CCTV) field inspections, which are performed by consultants and OWASA staff. The CCTV inspections identify structural deficiencies such as broken, sagging and corroded pipes and manholes that allow inflow/infiltration into the sewer system. Renewal or replacement projects are subsequently developed to correct these issues. OWASA typically repairs deteriorated pipes by installing CIPP liners or replacing individual segments between manholes. Field inspection results are also used to update CDM Smith's prioritization model and prioritize renewal or replacement projects. The study also identified hydraulic capacity deficiencies in the critical



CCTV image of a broken sewer pipe

portions of the sewer collection system (10-inch and larger pipe plus critical 8-inch pipe) through 2035.

Since that program was initiated in FY 2012, OWASA has inspected over 173 miles of sewer pipe and rehabilitated a total of 8.4 miles of pipe. The 2011 study recommends OWASA gradually increase rehabilitation of the sewer system from 0.75% to 1.5% (from 2.4 to 4.9 miles) per year by 2025 to maintain or reduce the current levels of inflow and infiltration into the system. The average rate of sewer pipe renewal/replacement in the FY 2018-2022 CIP is 2.2 miles per year (0.7% of the system).

OWASA is in the process of transitioning its CCTV software from ITpipes to WinCan. The new software has better Cityworks and GIS integration and will simplify how we share and access CCTV records. Historical data will be preserved and staff will be provided training as the new software is implemented.

Reclaimed Water System

Since all of the pipes were installed since 2005 and have decades of useful life remaining, there is not a replacement strategy in place for reclaimed water distribution system at this time.

Vertical Assets

The vertical asset (treatment plants, pump stations, reservoirs, etc.) replacement program relies on information from the *2015 CH2M HILL Renewal and Replacement (R&R) Forecasting Model* and various hydraulic and capacity studies. The R&R Forecasting Model was built from asset inventory data such as asset type, installation year, condition, and assumptions such as life cycle and replacement value. The R&R Forecasting Model, maintenance cost history from the CMMS and risk scores are used by staff to develop CIP projects.

Based on current demand projections, capacity expansion is not needed at the Jones Ferry Road WTP within a 20-year planning horizon and capacity expansion is not needed at the Mason Farm WWTP until at least 2030. Demand projections will be revised as part of the ongoing Long-Range Water Supply Plan update (part of Strategic Initiative 1).

Aside from the programming of known CIP project needs, funds are also set aside for not yet defined capital needs for asset renewal, replacement, or enhancement. To accomplish this objective, the CIP includes funds for the recapitalization of certain asset systems based on the current replacement value and theoretical service life of the assets. A recapitalization rate of 2% of the asset system value is used for long-term financial planning for the following asset systems:

- Administration Building
- Operations Center
- Jones Ferry Road WTP
- Mason Farm Road WWTP
- Wastewater Pump Stations

Recapitalization funding for these asset systems begins in the fourth year of any given CIP, and is reduced by the amount of known projects for each fiscal year.

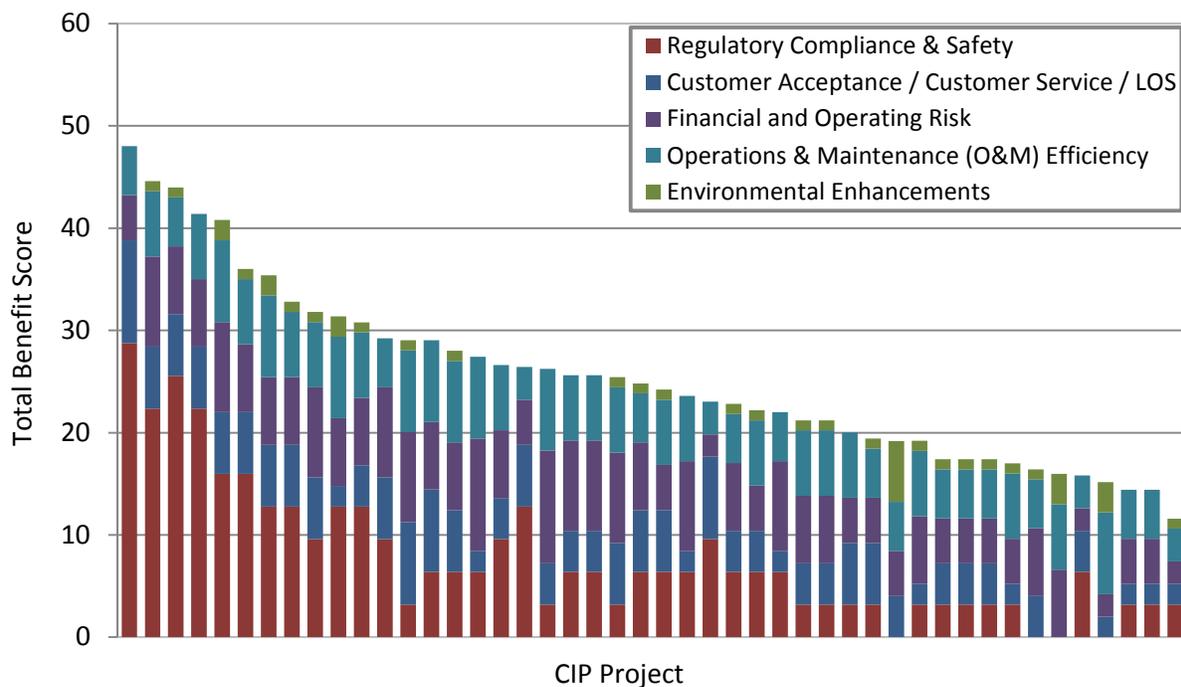
CIP Project Prioritization

After CIP projects are identified, a staff committee prioritizes project using a weighted criteria model developed for OWASA by CH2M HILL as part of the *2013 Asset Management Project Implementation*. The model was updated in 2017, and the original seven decision criteria were consolidated into five decision criteria. The weighting for the five consolidated decision criteria was also reevaluated. The decision criteria are aligned with OWASA’s Mission, Vision and Values statement and include:

- Regulatory compliance and safety
- Financial and operating risk
- Customer acceptance/customer service/levels of service
- Operation and maintenance efficiency
- Environmental enhancement

The results of the FY 2018-2022 CIP project prioritization are presented in Figure 18. Each column in the graph represents a CIP project. The colors in each column indicate the decision criteria that comprise the project’s total benefit score.

Figure 18. FY 2018-2022 CIP Prioritization



The CIP project prioritization model allows staff to evaluate projects against one another. Water, wastewater, pipeline and facility projects are rated using the decision criteria listed above. Projects with higher scores are typically scheduled to occur earlier in the CIP. In addition to the results of the project prioritization model, staff accounts for project interrelationships, project implementation considerations and other external schedule constraints when programming projects into the CIP. A summary of the FY 2018-2022 CIP is presented in Table 5.

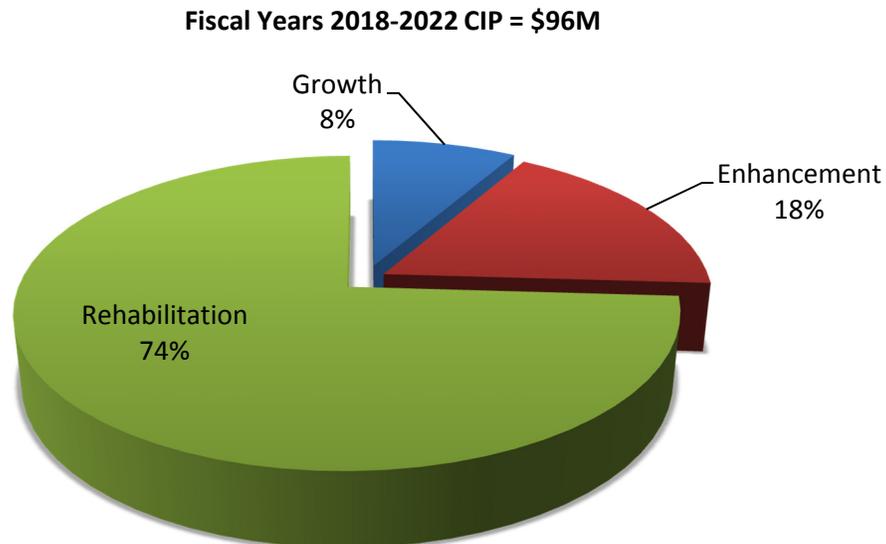
**Table 5. OWASA Capital Improvements Program
Five-Year Overview for FY 2018-2022¹**

Project Category:	Annual Totals					5-Year Total
	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022	FY 2018-22
Raw Water Supply Sources	\$105,000	\$1,095,000	\$2,070,000	\$20,000	\$305,000	\$3,595,000
Raw Water Transmission	\$0	\$40,000	\$0	\$0	\$0	\$40,000
Water Treatment Facilities	\$1,607,000	\$2,686,000	\$2,027,000	\$2,585,000	\$2,729,000	\$11,634,000
Finished Water Pumping	\$0	\$75,000	\$0	\$0	\$0	\$75,000
Finished Water Storage	\$0	\$0	\$0	\$0	\$0	\$0
Water Transmission and Distribution	\$4,417,000	\$8,773,000	\$6,053,000	\$5,065,000	\$5,610,000	\$29,918,000
Wastewater Collection Lines	\$2,793,000	\$4,614,000	\$2,435,000	\$4,247,000	\$5,561,000	\$19,650,000
Wastewater Pump Stations and Force Mains	\$3,155,000	\$1,840,000	\$1,046,000	\$326,000	\$398,000	\$6,765,000
Wastewater Treatment and Recycling	\$2,013,000	\$3,253,000	\$3,266,000	\$4,957,000	\$7,911,000	\$21,400,000
Reclaimed Water	\$0	\$0	\$0	\$0	\$162,000	\$162,000
Central Office and Operations	\$995,000	\$1,080,000	\$0	\$474,000	\$498,000	\$3,047,000
FY 2018 - 2022 CIP	\$15,085,000	\$23,456,000	\$16,897,000	\$17,674,000	\$23,174,000	\$96,286,000

¹Budget amounts are escalated at 5% annually (with some exceptions)

A breakdown of CIP spending for system rehabilitation, enhancement and growth is presented in Figure 19. Approximately 74% of the projected funding for the FY 2018-2022 CIP is for rehabilitation or replacement of existing infrastructure. The need for additional system capacity is limited as determined by the various hydraulic models and capacity studies. Only 8% of the CIP funds are designated for system growth.

Figure 19. CIP Funding by Project Type



Rehabilitation and Replacement Benchmarking

As noted above, about three-quarters of our CIP funding is for rehabilitation and replacement of our infrastructure. CIP funding for rehabilitation and replacement is developed using the practices described in the previous sections of this report. A top down indicator that we use to compare OWASA's level of investment to other utilities is the benchmarking survey conducted periodically by AWWA. AWWA's 2016 Benchmarking Report included system renewal (also called rehabilitation) and replacement performance indicators for the following seven asset groups:

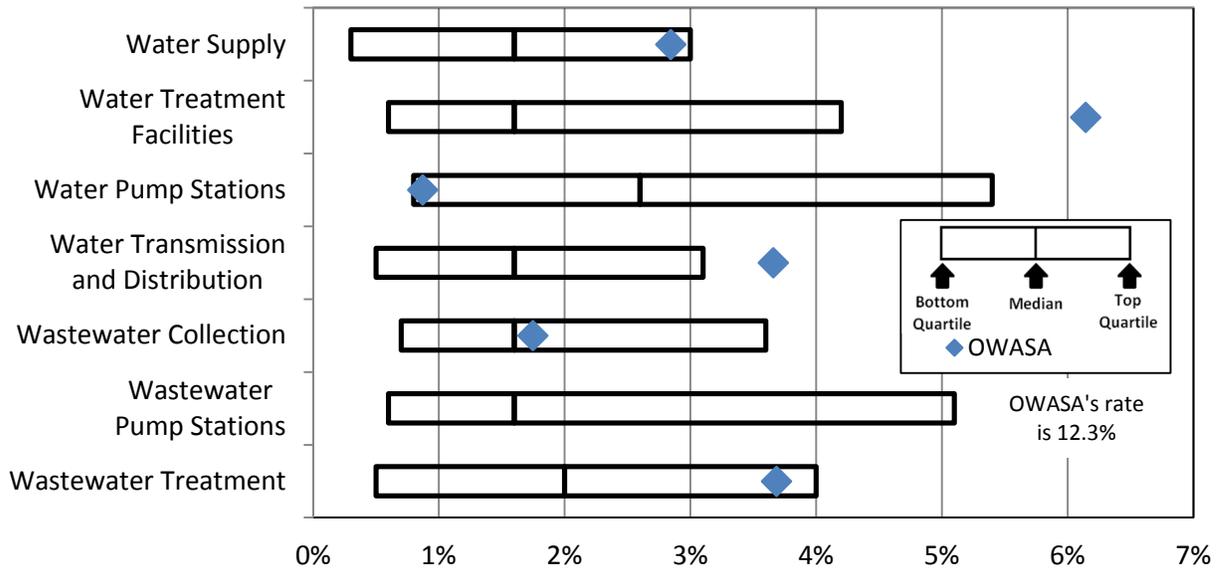
- water supply
- water treatment facilities
- water pump stations
- water transmission and distribution
- wastewater collection
- wastewater pump stations
- wastewater treatment

The performance indicator is calculated by dividing the amount of funds reserved for renewal and replacement of an asset group by the total present worth of renewal and replacement needs for that asset group.

Figure 20 compares OWASA's FY 2018-2020 CIP average renewal and replacement rate against the quartile results from the 2016 AWWA benchmark survey. Quartiles divide a data set into four equal parts or quarters using three points referred to as the bottom quartile, median and top quartile. For instance, the bottom quartile separates the lower quarter from the upper three-quarters of data.

OWASA's renewal and replacement rate is above the top quartile for three of the asset groups, which indicates that our future renewal and replacement funding for these categories is higher than the historical funding of other utilities included in AWWA's benchmarking survey. This higher rate is primarily due to significant upcoming capital improvement projects. For example, 8 of 21 wastewater pump station are scheduled for renewal or replacement in FY18-20. We are confident that our funding levels are reasonable because we have verified that these specific assets are in poor condition and require renewal or replacement in the near future. Our renewal and replacement rate for the other four asset groups is between the top and bottom quartile.

Figure 20. Comparison of OWASA FY 2018-2020 System Renewal and Replacement Rate with AWWA 2016 Benchmarking Performance Indicators



Using performance indicators to compare utilities can be challenging due to utility-specific factors such as water sources, treatment requirements, system age/materials, regulations, etc. The AWWA report notes that several large-scale phenomena including economies of scale, economies of scope and economies of density can influence observed levels of performance and make utility-to-utility comparison difficult. Additionally, the renewal and replacement needs are calculated using age, estimated replacement value and an assumed useful life for each asset. This calculation does not account for the condition of assets, which is what our asset management program typically uses to develop renewal and replacement projects.

SECTION 6 FINANCIAL PLANNING

The final asset management question is “*What is my best long-term funding strategy?*” to maintain our assets at the defined level of service?

In order to sustainably manage our infrastructure, OWASA must have the financial resources and capacity to operate, maintain, repair and replace assets when needed. OWASA has a formal Financial Management Policy that ensures a comprehensive and systematic approach to strategic financial planning and related policy decisions. The Policy includes performance measures and targets that collectively guide ongoing efforts to provide customers with high quality water, wastewater and reclaimed water services through responsible, sustainable and creative stewardship of the resources and assets that OWASA manages. Table 6 summarizes the primary financial performance measurements and objectives specified in the Financial Management Policy. Performance against these metrics is reported quarterly in a Financial Report to the Board of Directors.

Table 6. Financial Performance Objectives

Measurement	Objective
Working Capital Reserves	The greater of 4 months of O&M budget or 20% of the succeeding 3 years of CIP budget
Capital Improvements Reserve Fund	Minimum fund balance target of 2% of annual depreciated capital costs
Debt Service Coverage Ratio	≥ 2.0
Debt Burden to Asset Value	$\leq 50\%$
Sufficiency of Revenues Above Debt Requirements	Annual Debt service shall not exceed 35% of annual gross revenues
Credit Ratings	Aa2 – Moody’s; AA+ - Standard & Poor’s; AA+ - Fitch
Cash Financing of Capital	Annual revenues and cash reserves shall provide not less than 30% of CIP funding
Rate/Revenue Stabilization Fund	Minimum fund balance target of 5% of projected water and sewer revenue
Service Affordability	Average annual residential bill divided by real median household income shall be $\leq 1.5\%$

OWASA maintains a comprehensive 15-year financial plan to evaluate projected revenues, operating and capital expenditures, debt service, future borrowing needs and rate adjustment scenarios in order to ensure it can meet the financial goals and objectives over the long-term. Adequate and sustained funding of operating and capital expenses ensures that OWASA will continue to meet service level targets. The plan is updated annually, and annual rate adjustments are made as needed to ensure financial performance.

We update the plan’s assumptions regarding projected water sales, growth trends, increases in number of customers, projected operating and maintenance costs (including trends in energy, chemical, personnel and other expense categories), projected capital equipment and capital

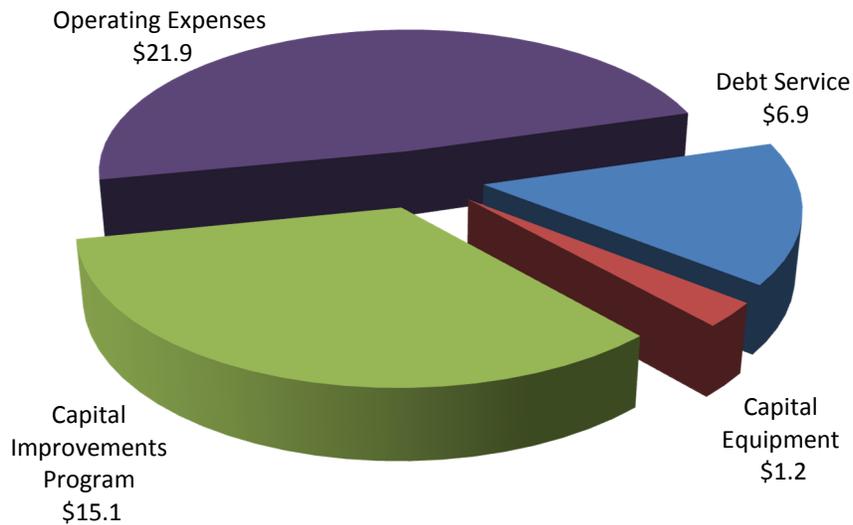
improvements needs, desired ratio of net income to debt service, cost of borrowing and other factors. Based on the input assumptions, the plan is used to determine the level of rates required to achieve OWASA's financial goals and objectives.

Fees we collect from delivering services to customers are our primary source of revenue to pay for operating expenses, capital improvement projects and to make debt payments. OWASA's rates and fees are based on comprehensive cost-of-service rate studies that are prepared about once every five years by expert rate consultants.

The FY 2018 budget consists of projected revenues and other receipts of \$37.3 million, capital project costs of \$14.6 million, operating expenses of \$21.9 million, debt service payments of \$6.9 million and capital equipment purchases of \$1.2 million. Figure 21 provides a breakdown of FY 2018 budget expenditures.

Figure 21. FY 2018 Expenditures

Total Expenditures = \$45.1M



SECTION 7 NEXT STEPS

OWASA has a complex set of assets that provide essential water, wastewater and reclaimed water services to the Carrboro-Chapel Hill community. The asset management program tools and practices are aligned with industry best practices and ensure the sustainable long-term operation, maintenance, replacement and expansion of OWASA's assets. OWASA's asset management program is a continuous improvement process and the associated tools and practices are frequently refined and improved.

Ongoing and upcoming near-term improvements to our asset management program include:

- Collection system field verification. Project is underway with completion in 2021.
- Mason Farm WWTP process pipe inventory. Project is underway with completion in 2018.
- Evaluation of OWASA's *Water Main Rehabilitation and Replacement Prioritization Model*. This will include discussing prioritization methodology, condition assessment feedback into the risk framework, rate of replacement, levels of service performance and determining project extents. The evaluation will be completed in 2017. However, the potential project to update the model will not begin until 2018.
- Jones Ferry Road WTP process pipe inventory. Projected to start in 2018.
- Perform a Risk Assessment on the water, wastewater, and reclaimed water systems. Project will begin in 2018 and be completed in 2019.
- Update of the collection system hydraulic model. A consultant was selected in April 2017. The project schedule will be determined when the final scope of services is negotiated.
- Implement new collection system CCTV software. Project is underway with completion in 2017.

The Board of Directors approved OWASA's first Energy Management Plan on April 13, 2017. The plan describes OWASA's use of energy in our facilities and what we've done and plan to do to use energy more efficiently, use renewable energy sources and reduce our greenhouse gas emissions. Energy management strategies identified in this plan will inform our asset management program. Additionally, all CIP projects will be evaluated for energy management opportunities to help achieve objectives established by the Board and included in the plan.

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