

Annual Review and Update of Strategic Trends and Utility Planning Issues for Fiscal Year 2020

OCTOBER 2020

Orange Water and Sewer Authority

Carrboro, North Carolina



Orange Water and Sewer Authority

OWASA is Carrboro-Chapel Hill's not-for-profit public service agency delivering high quality water, wastewater, and reclaimed water services.

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Purpose and Summary

This report summarizes observed trends for several indicators – such as customer growth and demands, water supply and drinking water treatment, wastewater treatment, use of reclaimed water, and environmental regulations – which are important factors that influence the need for, timing, and scope of our facilities planning and investment decisions. Through the process of regularly reviewing and updating this report, we strive to anticipate and proactively prepare for change so that we are better positioned to provide high quality and reliable water, wastewater, and reclaimed water services for the long-term. Some of the key messages are:

- Our customers have reduced peak day drinking water demands by 31 percent since Fiscal Year (FY) 1999 despite a 32 percent increase in customer accounts over that same period. Similarly, demands on our raw water supply have decreased substantially. These reduced demands result from:
 - Increased water use efficiency and conservation by our customers;
 - Conservation pricing and conservation ordinances including year-round water restrictions; and
 - Implementation of the reclaimed water system in partnership with the University of North Carolina at Chapel Hill (UNC) in 2009, which now meets about 12 percent of the community’s water needs based on water sales.
- These reductions in drinking water demand – and the associated reductions in wastewater flows – help defer the need for costly expansion of the capacities of our raw water supplies, water treatment plant, and wastewater treatment plant. More efficient use of water also helps reduce costs for energy and chemicals for water supply, drinking water treatment and water distribution, and wastewater collection and treatment.
- Based on current demands, we believe we have sufficient raw water supply for the next few decades under most conditions. Our allocation of Jordan Lake water supply, which we can access through our mutual aid agreements with the City of Durham and Town of Cary, serves as an insurance policy to meet demands during extended droughts or operational emergencies. Through the update of our Long-Range Water Supply Plan, we will evaluate options to expand our opportunities to access our allocation of water from Jordan Lake.
- Based on current demands and projections, we do not anticipate needing to expand the hydraulic capacity of the water or wastewater plant for several decades.
- OWASA is committed to providing high quality and reliable services to our customers. We have an asset management program to evaluate our infrastructure and risks and guide our investments in our ongoing maintenance and system renewal programs. The trends listed in this report are one mechanism to evaluate how well we meet our core mission.

Acronyms

AMI	advanced metering infrastructure
AMWA	Association of Metropolitan Water Agencies
AWIA	America’s Water Infrastructure Act
AWWA	American Water Works Association
BG	billion gallons
CIP	Capital Improvements Program
CY	calendar year
DEQ	NC Department of Environmental Quality
EMC	NC Environmental Management Commission
EPA	US Environmental Protection Agency
ERP	Emergency Response Plan
FY	fiscal year (July – June)
GPR	ground penetrating radar
JLP	Jordan Lake Partnership
kWh	kilowatt-hour
KWh/MG	kilowatt-hour per million gallons
lb/yr	pounds per year
LRWSP	Long-Range Water Supply Plan
LT2	Long-Term 2 Enhanced Surface Water Treatment Rule
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
ME	meter equivalent
MG	million gallons
mgd	million gallons per day
NCSU	North Carolina State University
OWASA	Orange Water and Sewer Authority
PFAS	per and poly-fluoroalkyl substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonic Acid
RCW	reclaimed water
RRA	Risk and Resilience Assessment

SCADA	Supervisory Control and Data Acquisition
SWRRP	Source Water Resiliency and Response Plan
TAWSMP	Triangle Area Water Supply Monitoring Project
TN	total nitrogen
TP	total phosphorus
TWP	Triangle Water Supply Partnership
µg/l	micrograms per liter
UCMR3	Unregulated Contaminant Monitoring Rule 3
UCMR4	Unregulated Contaminant Monitoring Rule 4
UCMR5	Unregulated Contaminant Monitoring Rule 5
UNC	University of North Carolina at Chapel Hill
WHO	World Health Organization
WRF	Water Research Foundation
WSMPBA	Water and Sewer Management, Planning and Boundary Agreement
WTP	water treatment plant
WWTP	wastewater treatment plant

Background

Orange Water and Sewer Authority (OWASA) publishes this annual report to evaluate how well we are meeting our mission of providing our customers with high quality and reliable water, wastewater, and reclaimed water services through responsible and creative stewardship of the resources we manage.

This report summarizes observed trends for several indicators – such as customer growth and demands, water supply and drinking water treatment, wastewater treatment, use of reclaimed water, and environmental regulations – which are important factors that influence the need for, timing, and scope of our facilities planning and investment decisions. Thus, the information in this document is one item that shapes our Capital Improvements Program (CIP). Through the process of regularly reviewing, updating, and publishing this report, we strive to anticipate and proactively prepare for change so that we are better positioned to engage the community as we consider and decide on how best to sustainably meet service requirements for the foreseeable future.

The OWASA Board of Directors adopted a Strategic Plan in March 2014 and an update to the [Strategic Plan](#) in June 2016. The Strategic Plan identifies the key initiatives and corresponding actions OWASA will take to address the issues we believe are most important for the customers and community we serve. The June 2016 Strategic Plan stated that this Annual Review and Update of Strategic Trends and Utility Planning Issues (Strategic Trends report) would be modified to serve as a companion document to the Strategic Plan. The information provided in this report may be used to update or add initiatives to future updates of the Strategic Plan.

This Strategic Trends report begins with an overview of OWASA's planning environment which includes a description of those items which may impact the timing and scope of our facilities planning and investment decisions. It then includes a description of OWASA's main management areas beginning with source water protection; then raw water supply and treatment; distribution of drinking water to our customers; wastewater collection, treatment, and recycling or reuse. Each topic includes information on regulations, technology and research, energy management, links to the Strategic Plan, and follow-up actions.

OWASA's Planning Environment

This section describes the items in OWASA's planning environment that would impact the timing and scope of our facilities planning and investment decisions. Understanding these items ensures that we provide our customers with high quality and reliable water, wastewater, and reclaimed water services through responsible and creative stewardship of the resources we manage.

Service Area

The local governments in Orange County have developed several agreements to determine who has jurisdiction over certain areas and what areas are to be served by municipal water and sewer. These agreements help concentrate growth in compact municipal areas, preserve the rural character of the County, and limit urban sprawl. The area that OWASA can provide service to is shown in Figure 1 and is from the [Water and Sewer Management, Planning and Boundary Agreement](#) (WSMPBA) which was adopted in 2001 and amended in 2010 and 2017. The 2017 amendments included minor changes to the boundary along Smith Level Road. If changes are made to OWASA's service area, OWASA will need to ensure its resources and infrastructure will reliably meet the demands of those new areas along with the projected development within our current service area.

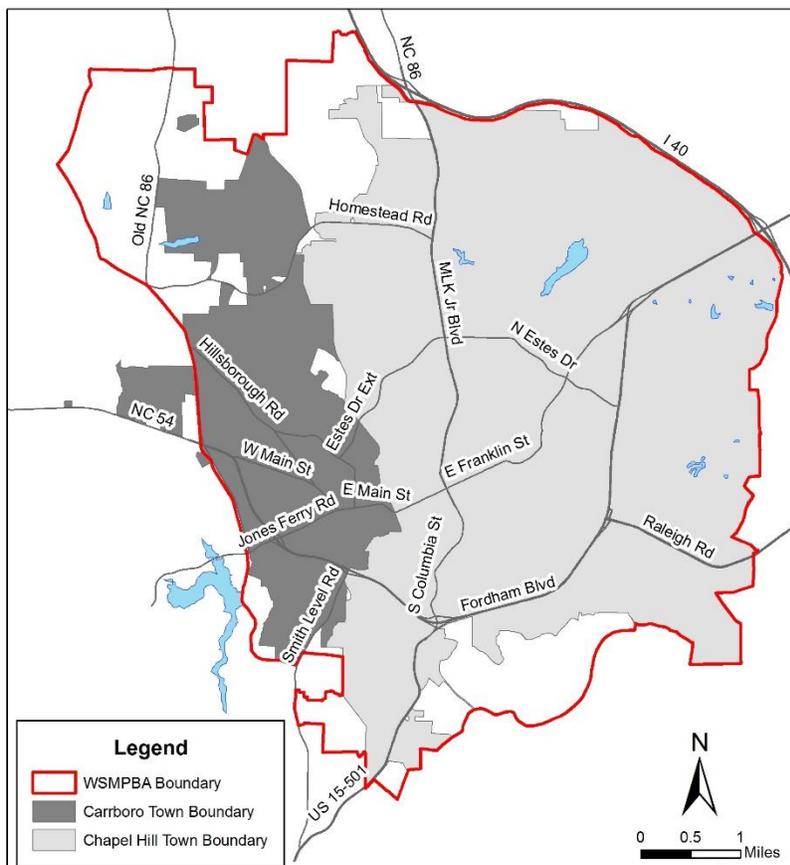


Figure 1. WSM PBA Boundary

Growth and Development

It is important to project when, where, and how much growth will occur, and what the subsequent demands will be on our water, wastewater, and reclaimed water services to ensure we have adequate capacity to meet the community's future needs. Figure 2 illustrates past population numbers for the Towns of Carrboro and Chapel Hill as well as the 2045 projected population based on regional transportation planning and the 2070 projected population as presented in the report titled *Long-Range Water Demand Projections Through 2070 for the Long-Range Water Supply Plan Update* presented to the Board of Directors in March 2019. These projections are similar to those provided during the [State of the Community Report](#) in September 2019; the projected 2050 population in Chapel Hill and Carrboro based on linear models is anticipated to be between 103,564 and 128,755. The projected 2050 population shown by the orange line in Figure 2 is 117,726 and 124,565 shown by the blue dotted line. These projections are all very similar.

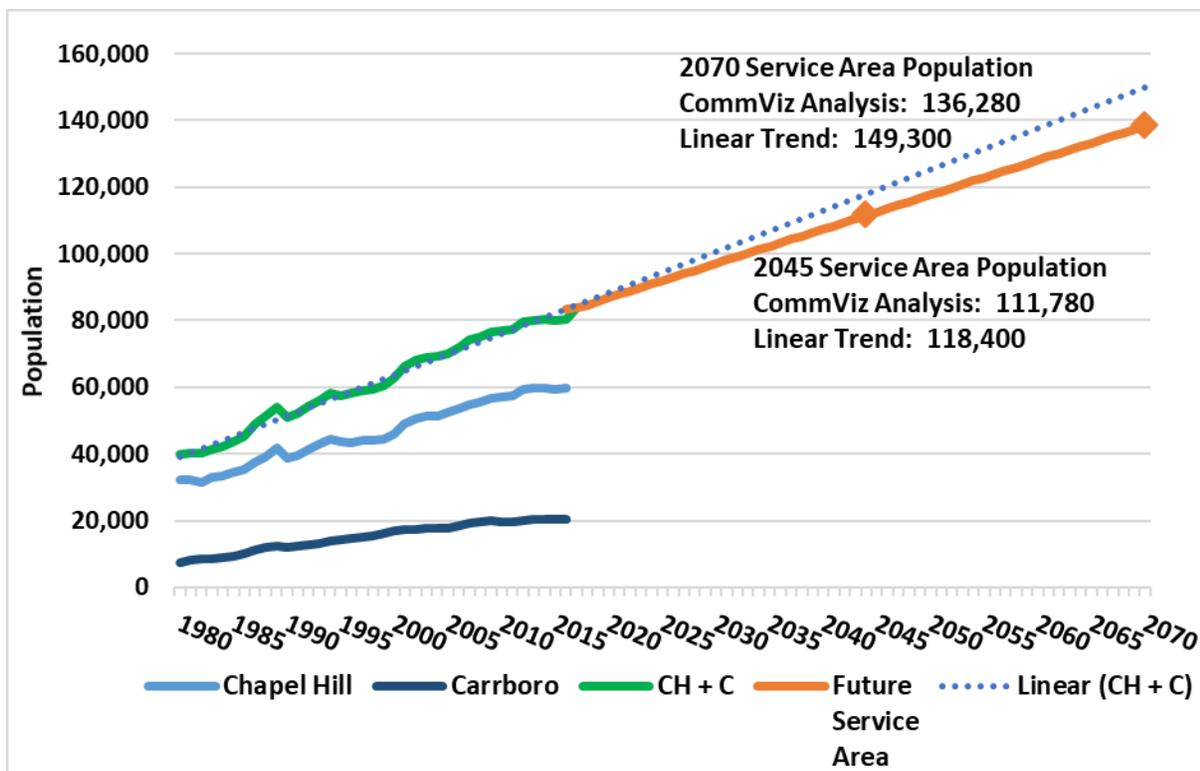


Figure 2. Population Projections - UNC is included in Town of Chapel Hill population projections

We anticipate that growth will continue to be higher density, with redevelopment and infill projects such as the Blue Hill District, East Rosemary Street Parking Deck, South Green, and Shelton Station, and with new development projects such as Carraway Village. Higher density development tends to result in lower per capita demands and may make better use of existing water and wastewater infrastructure. OWASA will use local government future growth information to ensure that the capacity of our water distribution system and wastewater collection system is sized appropriately.

Climate Change

OWASA's operations are intricately linked with the environment and weather, and climate change has the potential to significantly and directly impact various aspects of our business. Additionally, extreme weather events like drought and hurricanes have the potential to indirectly affect the supply of resources that we need to conduct business (i.e. power and chemicals), as well as the demand for our services. OWASA must be prepared to adapt to a changing climate, and we are incorporating climate change adaptation into various aspects of our operations.

While experts believe the southeastern United States will receive about the same or more rainfall on average in the future, that rainfall will likely be provided in more severe storms and flooding events with more severe and prolonged droughts in between. This new pattern of rainfall will impact the yield of OWASA's and the region's reservoirs and the patterns of water demand including the water used for irrigation and cooling. As a result, OWASA and our utility neighbors must address the resiliency of water supply and storage, especially for periods of severe and extended droughts as well as the capacity of our reclaimed water system, which may face higher peak demands.

OWASA worked with our utility neighbors through the [Jordan Lake Partnership](#) (JLP) to develop the Triangle Regional Water Supply Plan to ensure all Partners have sufficient and reliable water supply through 2060. The JLP also contracted a regional interconnection study to evaluate the interconnection capacity of our drinking water systems and to identify needed infrastructure improvements to meet future needs. The JLP has been reorganized as the [Triangle Water Supply Partnership](#) (TWP). The TWP plans to build on the work of the JLP and use the interconnection model to run planning scenarios to identify strategies to improve the region's resiliency to planned and unplanned water supply challenges. OWASA is updating its Long-Range Water Supply Plan (LRWSP) to ensure we have water to meet our needs for the next two generations through 2070.

Our climate change planning to date has focused on drought management planning and natural disaster emergency preparedness. However, high rain events could result in greater flooding of our infrastructure. While our infrastructure has been designed to meet certain flood events, the frequency of those events could increase in the future. Recognizing this change in rainfall, OWASA evaluated the last 30 years of rainfall data to identify a new design storm as part of our wastewater collection system model update in 2019. Prior to the 2019 update, the past 65 years of rainfall data had been used to identify the design storm used for modeling, however this rainfall pattern was no longer accurate for future forecasting of wet weather conditions. As such, OWASA has chosen to run the current gravity sewer hydraulic model with a 10-year design storm based on the last 30 years of rainfall data. The new design storm has a higher 24-hour rainfall volume as compared to the design storm historically used to model the collection system.

In addition to regularly occurring rainfall events, hurricanes and other storms could also damage critical infrastructure. OWASA plans for forecasted events, and coordinates emergency planning with our neighboring communities and other utility partners in North Carolina. Additionally, OWASA has evaluated our risk profile for natural hazards, such as hurricanes, through the America's Water Infrastructure Act (AWIA) requirements. OWASA has evaluated the impact of hurricanes on the

resiliency of the Cane Creek Dam and the University Lake Dam and recommendations and actions to reduce risk and improve resiliency are captured in the risk and resiliency plan that will be certified and sent to the EPA by December 31, 2020.

Climate change also has potential implications on the quality of the water in our reservoirs. With temperature change and impacts on rainfall, we could experience more frequent algal blooms in our reservoirs and potential increases in taste and odor events and cyanotoxin concentrations. (Cyanotoxins are toxins produced by blue-green algae and were responsible for the City of Toledo's "Do Not Use" warning in 2014.)

OWASA continues to monitor climate change science, and we participate in applied research projects with universities, other utilities, and other agencies where applicable, to proactively plan to meet the community's water and wastewater needs in the face of increasing climate variability. Nonetheless, we would benefit as an organization and community to take a strategic approach to the impact of climate change on our overall mission that considers compounding situations and those that might fall just outside of obvious consideration.

Regulations

OWASA monitors the regulatory arena closely so we proactively ensure we can meet all legal requirements applicable to the provision of water, wastewater, and reclaimed water services to our customers. Many of these potential regulations would impact our drinking water supplies and treatment facilities. Potential regulations are included for trends where they are applicable in this Strategic Trends report.

Technology and Research

OWASA stays informed about advancements in technology and research, their capital and operating costs, and ability to better position us to provide services to our customers in a more sustainable manner. OWASA often partners with local university researchers, professional associations, and our consultants to obtain information on how emerging technologies may apply specifically to OWASA. Technologies that OWASA is monitoring are described in applicable sections with this Strategic Trends report. General information on our use of university research, professional associations, and consultants is provided below.

University Partnerships

OWASA often partners with our local universities to evaluate emerging technologies. We have provided water and wastewater samples to local universities to test emerging technologies. We have supported university classes by providing data. One effective use of university research is through our membership in the Urban Water Consortium, a group of twelve of the largest water utilities in the state. Together these twelve utilities pool their funds to bridge our research needs with university expertise. Some of the current research funded through this consortium is included in applicable sections of this report.

Professional Associations

OWASA is a member of various water and wastewater organizations, and our employees review their publications and attend their conferences. Staff regularly meet with other utility staff locally, throughout the southeast region, and nationally through these memberships; these contacts with other utility staff enable us to stay abreast of the latest technologies that work in our region to better meet our water, wastewater, and reclaimed water needs. Some of the industry trends noted by attending these conferences and interacting with staff from other utilities are:

- Renewal and replacement of aging infrastructure
- Asset management
- Conservation and reclaimed water to meet the needs of growing populations with existing water resources
- Public understanding of the value of water
- The need to attract, train, and retain staff and utility management and leadership
- Excellence in customer service and public awareness of water issues
- Cybersecurity
- Climate risk and resiliency
- Energy management
- Compounds of emerging concern

Several of the national organizations develop annual reports that often reiterate these industry trends and that we use to evaluate OWASA's practices:

- [AWWA's State of the Water Industry Report](#) – this report is based on an annual survey of utilities to identify and track challenges facing the water industry, provide data and analysis to support water professionals, and inform decision makers and the public of challenges facing the water industry
- [AWWA's Benchmarking Report](#) – AWWA summarizes performance results provided by water and wastewater utilities in quartiles. OWASA participates in AWWA's benchmarking surveys and has used the results of the Benchmarking Report as goals in several of the trends presented in this report.
- Association of Metropolitan Water Agencies (AMWA) [Annual Report](#) - this report is focused on regulatory issues, but AMWA also supports scientific research, collaboration, and sustainable utility practices.
- The National Association of Clean Water Agencies, Water Environment Federation and Water Environment Research Foundation [Water Resources Utility of the Future](#) – this report was first developed in 2013 to recognize that water and wastewater utilities were identifying themselves as resource managers rather than waste managers. One trend that the latest Utility of the Future (2015) recognizes is that utilities in the United States are beginning to expand their use of technologies used in other countries. This 2015 report also notes how partnerships between utilities, consulting engineers, government, and finance are used to move utilities forward. This

report has been replaced by the Utility of the Future Today Recognition Program. OWASA was recognized by this program for its organizational culture and energy efficiency programs.

The American Water Works Association (AWWA) sponsors the [Partnership for Safe Water](#) and the [Partnership for Clean Water](#). The Partnership for Safe Water is a voluntary effort for water utilities to optimize their treatment and distribution system processes to help ensure the production and delivery of safe water to all users that go beyond regulatory measures. The OWASA Jones Ferry Water Treatment Plant was the ninth plant in the nation and first in North Carolina to achieve the highest level of recognition with the Phase IV Excellence in Water Treatment Award. This level of excellence has been maintained for nine consecutive years. (OWASA has maintained Phase III or higher for 15 years). In 2016, OWASA received the Presidents Award under the Partnership for Safe Water for its distribution system and has continued to maintain this status. The Partnership for Clean Water is a parallel program that focuses on wastewater treatment plant optimization, effluent quality and energy savings. This program was established in 2016. The OWASA Mason Farm Wastewater Treatment Plant completed the initial self-assessment phase, which is currently under review by the Partnership Review Committee.

The Water Research Foundation (WRF) also maintains a [website](#) that summarizes current research on topics important to water utilities including per and poly-fluoroalkyl substances (PFAS), cyanotoxins, fluoride, and taste and odor.

The U.S. Environmental Protection Agency (EPA) and six major water and wastewater associations developed a Primer on [Effective Utility Management](#) which was written to guide utility managers to make effective changes to achieve excellence in meeting their core missions.

The [State Water Infrastructure Authority](#) was created by the North Carolina General Assembly in 2013 to assess and make recommendations about the water and wastewater infrastructure across the state. The Authority finalized the [Infrastructure Master Plan](#) in 2017. The report notes that in order for a water utility to be viable, it must exhibit best practices around infrastructure management, organizational management, and financial management. OWASA employees regularly attend meetings with staff of the State Water Infrastructure Authority to stay updated on their recommendations.

Engineering Consultants

OWASA hires engineering firms to plan, design, and construct our infrastructure. These engineering firms design and construct similar infrastructure throughout the region and nation. We hire them for their expertise; based on our specific requirements and circumstances and their experiences with different technologies, they recommend technologies that will best meet our needs.

Other Important Utility Planning Issues

This section includes a brief overview of other utility planning issues in which OWASA is currently engaged which support our mission and the values included in the Strategic Plan. This section is not intended to be a comprehensive overview of utility planning issues.

Energy Management

Strategic Initiative Number 4 in OWASA's Strategic Plan is to implement an Energy Management Program. OWASA requires significant energy to operate our water, wastewater and reclaimed water facilities, protect the environment, and provide service to about 83,300 residents in the Carrboro-Chapel Hill community. In Calendar Year 2019, our facilities used about 67 billion BTUs of energy – enough to power about 1,800 homes for a year. That energy came at a cost of \$1.15 million.

In a move to improve our environmental impact, reduce a significant operating cost, and increase the resiliency of our organization, the OWASA Board of Directors established the following energy management goals and objectives.

1. Reduce use of purchased electricity by 35 percent by the end of Calendar Year (CY) 2022 compared to CY 2010 baseline;
 - a. Progress: In CY19, OWASA used 29 percent less electricity than in CY 2010.
 - b. In September 2019, the OWASA Board authorized staff to move forward with signing a solar lease agreement with a private partner. In the Fall of 2020, solar photovoltaics will be installed on the OWASA Administration Building, the Operations Center, and a small portion of an OWASA-field used for biosolids land application.
2. Reduce use of purchased natural gas by 5 percent by CY 2020 compared to CY 2010 baseline;
 - a. Progress: In CY19, OWASA used 28 percent less natural gas than in Calendar Year 2010.
3. Beneficially use all wastewater treatment plant (WWTP) biogas, provided the preferred strategy is projected to have a positive payback within the expected useful life of the required equipment, and formally engage local governments and partners in discussion about potential development of a biogas-to-energy project at the Mason Farm WWTP
 - a. Progress: We have determined that there is no cost-effective strategy that we can pursue on our own at this time. We are currently using half of the biogas in a boiler that heats anaerobic digesters (see progress on natural gas goal).

OWASA has an active Energy Management Program designed to systematically identify and evaluate energy management to achieve our objectives. We consider the social cost of carbon in evaluating economic efficiency. Our progress is a result of our investment in energy efficient equipment (blowers, pumps, drives, and motors), lighting, and HVAC units. It is also a result of our community's enhanced commitment to water conservation and efficiency. Less water use equals less energy use.

This Strategic Trends report includes information on electricity and natural gas use for OWASA's operations for trends where it is appropriate. We are not tracking vehicle fuel use by functional area and are not reporting that energy use in this Strategic Trends report.

Safety

Safety is the number one priority of every member of the OWASA team. We are dedicated to reducing injuries, accidents and ensuring compliance. We achieve this by fostering a culture focused on awareness and safe work methods and by providing high-quality training, comprehensive workplace evaluation and emergency response.

Staff continually evaluate methods to improve our processes. We routinely perform after action reviews following small and large events. The after action review process identifies what happened, what we set out to accomplish, what worked well, and where we can improve.

Much of the information contained in this Strategic Trends report helps us ensure we are providing the community with safe drinking water and protecting both public health and the environment through successful wastewater conveyance, treatment, and recycling or reuse.

Source Water Protection

Description

Our community has a long history of taking progressive actions to ensure the health and safety of our drinking water supplies. Since it began operations in 1977, OWASA has understood that to protect the water source, you must protect the watershed, and we have been actively involved in a wide range of watershed protection efforts, such as:

- Limits on the extension of water/sewer service into the Cane Creek Reservoir and University Lake watersheds;
- Support for comprehensive protection through zoning and land use controls;
- Restrictions on in-lake recreational activities;
- Special technical studies and educational activities;
- Land acquisition through the strategic purchase of property or conservation easements in areas determined to be critical for water quality protection; and
- Managing healthy forests.

This section of the report focuses on land acquisition, monitoring and technical studies, and OWASA's forest management program. OWASA spent \$7.8 million on land protection between 1991 and 2006 through purchase and conservation easements and grant funds covered \$3.0 million of these costs. (Note: these costs have not been adjusted for inflation and do not reflect ancillary expenses for legal, survey, appraisals, other site work, or administrative costs of OWASA staff time).

Land acquisition was among the options evaluated in the University Lake watershed management study and plan commissioned in the late 1980s. Water quality modeling indicated that permanently protecting 2,900 acres (approximately 15 percent) of the watershed would have only slight water quality benefits and not justify the multi-million-dollar cost, but that selected land acquisition in critical areas of the watershed may be appropriate. This recommendation was later confirmed in a follow-up analysis, which found that land acquisition would probably not be effective, but a possible exception may apply to undeveloped land very near the lake, and that conservation easements along stream buffers would be particularly valuable near the downstream ends of tributaries as they approach University Lake.

Based on these technical recommendations, OWASA elected not to pursue a widespread program of land or easement acquisition in the University Lake watershed, but to consider land preservation opportunities on a case-by-case basis. In 2006, OWASA purchased a 73-acre property along Morgan Creek immediately upstream of University Lake (with the help of a \$1.2 million NC Clean Water Management Trust Fund grant). This property was placed under a permanent restrictive conservation easement that protects all riparian areas and greatly limits future development; subdivided into two large tracts; and re-sold on the open market in 2011 – with all restrictions in place.

The primary recommendations in a 1996 study of the Cane Creek Reservoir watershed included large lot (5 acres or greater) residential re-zoning and the permanent protection of 1,265 additional acres of

watershed land either through purchase of land or acquisition of conservation easements to limit development and protect critical riparian buffers. OWASA adopted those recommendations as goals for the protection of Cane Creek Reservoir and subsequently protected an estimated 1,075 acres of additional Cane Creek Reservoir watershed land through purchase or acquisition of conservation easements. Since 1997, Orange County’s Land Legacy Program and other groups also acquired protective conservation easements on an additional 360 acres in the Cane Creek Reservoir watershed. Together, OWASA and Orange County’s land protection efforts have exceeded OWASA’s original goal. OWASA and Orange County staff continue to work closely in coordinating the needs of our respective programs as the County protects additional land in the watershed and elsewhere. OWASA also continues to seek cost-effective protection opportunities and is currently working with a neighboring landowner to permanently protect some critical riparian buffer areas.

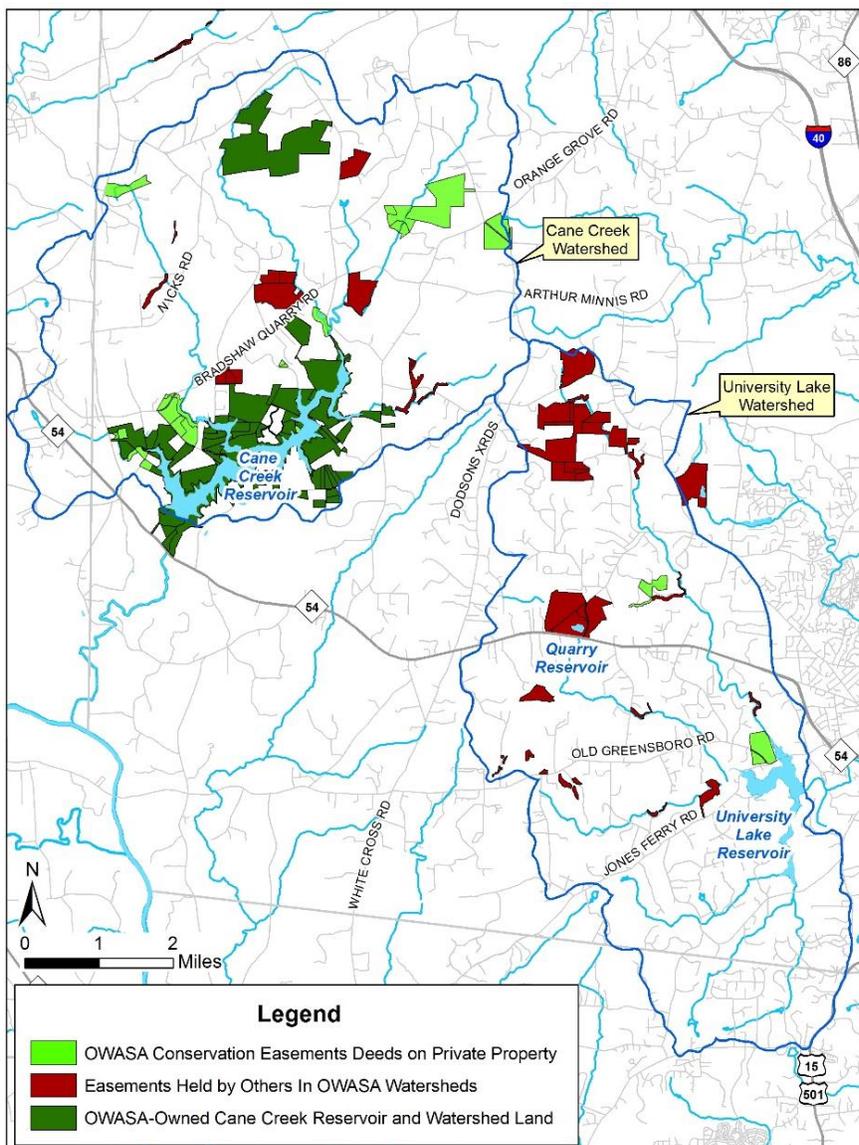


Figure 3. Protected Land in OWASA's Watersheds – Approximately 10 percent of our watershed lands are located outside Orange County, where less stringent controls apply.

Water Quality Monitoring

OWASA is a founding member of and actively participates in the [Triangle Area Water Supply Monitoring Project](#) (TAWSSMP), which is an interlocal water quality monitoring and research project implemented in collaboration with the US Geological Survey (USGS). This Partnership began in 1988. The TAWSSMP samples area water supply reservoirs and some of their key tributaries to monitor water quality and parameters of emerging concern. The robust continuous dataset enables analysis and identification of trends in water quality. TAWSSMP operates in multi-year phases. Scopes of work were developed for each phase of the TAWSSMP which include parameters which remain the same from phase to phase such as nutrients, chlorophyll *a*, major ions, and total suspended solids as well as parameters of interest for that particular phase.

The USGS published [Trends in Water Quality of Selected Streams and Reservoirs Used for Water Supply in the Triangle Area of North Carolina, 1989-2013](#) in July 2018. The USGS evaluated land cover, nutrients, and other parameters for statistical trends over the 25-year period. The results of that trend analysis were summarized in OWASA's 2018 Strategic Trends Report.

An important consideration for long-term watershed protection is how a changing climate may impact water supply water quality and potential treatment needs. Warmer temperatures and changing hydrology will impact the frequency, type and extent of algal blooms in our drinking water reservoirs, but there are several key unanswered questions. Will we need to install advanced treatment technologies in our WTP to reduce public health risk from algal toxins? Are there any effective in-lake management measures (such as mixing) that will reduce the frequency and severity of algal blooms and other water quality problems? What are the costs, effectiveness, and energy requirements of those measures? How are future declines in water quality likely to keep us from maximizing the reliable yield of our water supply reservoirs? Unfortunately, these are not questions that can be addressed by quickly evaluating water quality monitoring data on an annual basis. Staff have been in communication with university researchers who have expertise in characterizing algal blooms, and in particular, cyanobacteria (also sometimes called blue-green algae). These questions are not unique to OWASA, so we are reaching out to other utilities and agencies to explore opportunities to collaborate on targeted research to better understand and address these issues, perhaps through one or more of our existing partnerships, such as the Urban Water Consortium or the Triangle Water Supply Monitoring Program. Due to other priorities and pandemic, little progress has been made on this potential initiative.

Forest Management

OWASA owns approximately 2,400 acres of forested lands, the majority of which is in the Cane Creek Reservoir watershed. Sustainable forest management facilitates protecting our water supply and provides other environmental benefits such as reducing the risk of wildfire and providing wildlife habitat. OWASA has seven guiding principles for its [forest management program](#):

- Protect water quality, OWASA's highest priority;
- Improve ecological health of forested land;
- Reduce the risk of wildfire;

- Improve wildlife habitat and species diversity;
- Sustainably management OWASA’s resources;
- Engage the community and partner agencies; and
- Minimize adverse impacts on neighbors and surrounding community

OWASA has been actively managing its Cane Creek Mitigation tract, an area of approximately 500 acres in the northern portion of Cane Creek Reservoir watershed for about ten years. OWASA recently completed forest stewardship plans for Meadow Crest North and Meadow Crest South located on either side of Teer Road. Implementation on these tracts may begin later this year.

Regulations

- There is ongoing research at the federal and state level regarding per- and poly-fluoroalkyl substances (PFAS) in drinking water. PFAS are present throughout the environment because they are highly persistent and have been widely used for decades, including in industrial applications, household and consumer products, food packaging, and firefighting foams. GenX is one of the PFAS compounds that was found in the City of Wilmington’s water supply. EPA has developed an Action Plan to address PFAS, which includes making a regulatory determination for two PFAS (perfluorooctane sulfonic acid (PFOS) and perfluorooctanoic acid (PFOA)). The North Carolina General Assembly appropriated \$5 million in Summer 2018 to test raw water at public water supplies across the state for PFAS and included air quality sampling because air emissions can transport PFAS in the environment. The universities conducting this monitoring received an extension from the General Assembly, and monitoring is still ongoing. When raw water samples are collected from OWASA’s water supplies, staff also collects paired raw water samples and a treated drinking water sample for analysis by our contract laboratory. OWASA completed special monitoring for PFAS in our raw water, drinking water, Morgan Creek, and in our wastewater treatment plant effluent after researchers from Duke University found some of those substances in our drinking water. Further [information](#) was provided to the Board of Directors on February 22 and March 8, 2018. OWASA’s Natural Resources and Technical Services Committee discussed PFAS and source water protection in November 2018. To better understand the range and variability of PFAS levels present, OWASA collected samples of raw water at Cane Creek Reservoir intake and of the drinking water leaving our Jones Ferry Road WTP quarterly for one year in 2019 and this monitoring has since been continued into 2020.
- The Long Term 2 Enhanced Surface Water Treatment Rule (LT2) builds upon the 1996 amendment to the federal Safe Drinking Water Act to strengthen protection against microbial contaminants, especially *Cryptosporidium*. OWASA completed the first round of monitoring for *Cryptosporidium* and *E. coli* in our source waters in 2009. As a result of this monitoring, OWASA was placed in the lowest treatment category, which requires no additional treatment. Staff completed the second round of two years of monthly monitoring of Cane Creek Reservoir and University Lake in August 2017. Based on the round 2 results, OWASA remains in the lowest treatment category and will not be required to provide additional filtration treatment. Staff completed a round of monthly sampling

of the Quarry Reservoir in January 2020; these results are also within the lowest treatment category range.

- The EPA is requiring monitoring for some cyanotoxins by all large utilities and some small utilities. This monitoring is part of the Unregulated Contaminant Monitoring Rule (UCMR), which is the primary way the EPA gathers occurrence data on compounds it is considering regulating. OWASA conducted this monitoring April-July, 2020. Although this monitoring consisted of sampling the treated drinking water, raw water is the source of these compounds. Since 2016, OWASA has monitored for three cyanotoxins in our raw water, treated drinking water, and within our treatment process. This monitoring serves as an early warning of actual conditions in our lakes.
- OWASA follows developments regarding pharmaceuticals and personal care products in drinking water, wastewater, and reclaimed water. These products enter wastewater systems through excretion, disposal of unused medicine in sinks or toilets, and personal care products washed from skin and hair. They can also be present in runoff from livestock operations and subsurface discharges from-site wastewater systems (septic tanks). Cane Creek Reservoir and University Lake watersheds are highly protected, and no treated municipal or industrial wastewater is discharged within our local water supply watersheds. However, there are livestock operations, private septic systems, and biosolids applications in both watersheds. A [2007 study](#) by the U.S. Geological Survey of local untreated (or raw) water sources including Cane Creek Reservoir and University Lake tested for pharmaceuticals. In this study, one pharmaceutical (acetaminophen) was detected in one sample from Cane Creek Reservoir; all other results from OWASA reservoirs were below the detectable levels. OWASA does participate in EPA monitoring efforts of unregulated contaminants. This tool is used to improve drinking water quality standards by collecting data on compounds that are suspected to be present in drinking water, but do not yet have health-based standards set under the Safe Drinking Water Act. Pharmaceuticals and personal care products have not been included in this program to date, and there are no federal requirements for them.
- In accordance with direction from EPA, the North Carolina Department of Environmental Quality (DEQ) is developing draft nutrient criteria for surface waters in the state. If nutrient levels in one or more of our water supply reservoirs, Morgan Creek, and/or other surface waters in our area exceed future nutrient-related water quality limits, we and/or other parties could be required to reduce the discharge of nutrients into those water bodies. The technical, economic, and environmental feasibility of complying with such requirements can only be determined once proposed criteria are issued.
- The North Carolina General Assembly ratified House Bill 894 in August 2014 to improve Source Water Protection in response to the accidental release of 4-methylcyclohexanemethanol in West Virginia and the coal ash spills in North Carolina. Subsequently, the North Carolina Commission for Public Health adopted rules that require all public water supplies which use surface water to develop a Source Water Resiliency and Response Plan (SWRRP). The regulations state that public water supplies that are required to complete a risk and resilience assessment (RRA) and a subsequent emergency response plan (ERP) under America's Water Infrastructure Act (AWIA) comply with the state's SWRRP requirements (see next bullet on AWIA for more information on those requirements).

- AWIA requires water systems to prepare an RRA and ERP. The RRA is to evaluate risks from natural hazards and malevolent acts, the resilience of source water, treatment, and conveyance facilities, monitoring, and financial infrastructure. The ERP evaluates strategies to improve the resiliency of the system including physical and cyber security, requires procedures to implement to respond to natural hazard or malevolent acts, and practices that can reduce the impact of an event. OWASA is required to prepare its RRA by December 31, 2020 and the ERP must be developed and certified within six months of submitting the RRA certification. OWASA has drafted its RRA and will meet the federal submittal requirements of AWIA.

Technology and Research

- The 2016 General Assembly directed the [UNC Collaboratory](#) to evaluate water quality and nutrient management strategies in the Jordan and Falls Lake watersheds. These studies could result in new management strategies in the Jordan Lake watershed which could impact OWASA operations. The North Carolina Division of Water Resources (DWR) is using the information from the Collaboratory studies to develop a nutrient management strategy through an integrated management approach called One Water. Staff stay updated on the work of the Collaboratory and the [Jordan Lake One Water](#) initiative and have provided data to some of the researchers.

Energy Management

Energy use to manage OWASA's lands is minimal and consists of fuel needed for travel and equipment to manage the land.

Strategic Plan Elements

Strategic Initiative 6 includes a goal that states, "Land assets provide the expected value to fulfill OWASA's mission and the assets are effectively managed". OWASA has started an incremental approach to manage its forests, and the guiding principles are included above; healthy forests help protect long-term water quality in the reservoir.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Since OWASA met its watershed protection goals for land acquisition, we are not actively seeking or funding additional land conservation. However, we will continue to evaluate cost-effective land acquisition opportunities through conservation easements or purchase when available.	Ongoing	X	
2. Consider updating 1996 Cane Creek Reservoir Watershed Study	After completion of LRWSP and as part of next Strategic Plan	X (as part of budget)	
3. Inspect conservation easements on private land to make sure owners are following the terms of the easement	Annually		X
4. Develop AWIA RRA and ERP; these requirements meet DEQ's SWRRP requirements.	Dec 2020 for AWIA and approx. June 2021 for ERP		X
5. Continue quarterly sampling for PFAS at Cane Creek Reservoir intake and in drinking water leaving plant. Evaluate data and identify any next steps.	Ongoing		X

Raw Water Supply and Long-Range Water Supply Plan

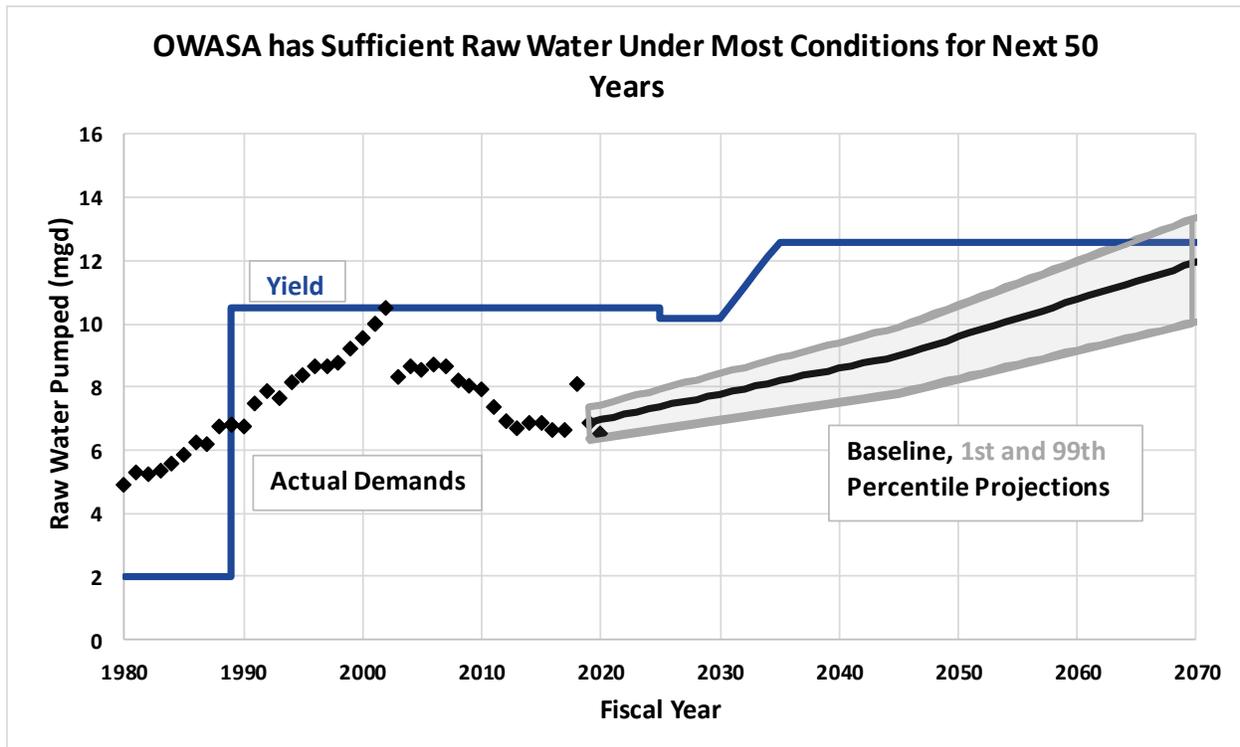


Figure 4. OWASA's Water Supply Yield and Demands

Description: This trend evaluates the supply (reliable yield) of our locally-owned upland water sources – Cane Creek Reservoir, University Lake, and the Quarry Reservoir – and historic raw water demands and estimated future raw water demands. (Since we do not have permanent facilities and/or agreements in place to access Jordan Lake, Figure 4 does not include our Level I Jordan Lake water storage allocation of about 5 million gallons per day (mgd). We can access this allocation through Town of Cary and City of Durham on a limited, emergency basis.)

Key Observations:

- The annual average-day amount of water we pumped from reservoirs has declined substantially since peaking in FY 2002.
- Annual average-day raw water demands are now at the same level they were in the early-1990s, shortly after Cane Creek Reservoir was placed into service. This has occurred despite over a 60 percent increase in the number of customer accounts during that period.
- Key factors in the reduction in water withdrawal rates include:
 - Increased water use efficiency and conservation by our customers;
 - Conservation pricing and conservation ordinances, including year-round restrictions;
 - Implementation of a process water recycling system at the drinking water treatment plant (2002), which reduced annual average-day raw water withdrawals by about seven percent;

- Implementation of the reclaimed water system in partnership with UNC (2009), which now meets about twelve percent of the community’s annual average-day water needs (see Drinking Water and Reclaimed Water Sales trend).
- Higher density development which typically results in lower per capita demands.
- Raw water demand was lower than anticipated in FY 20, but the pandemic resulted in reduced water demands of approximately 12 percent from March until the end of the FY.
- Raw water demand was higher than expected in FY 18, because we provided water to the City of Durham while they were working on their WTPs. If we had not transferred this water, our average raw water demand would have been approximately 6.9 mgd, the same level it was in FY 15 and FY 19.
- OWASA is updating its Long-Range Water Supply Plan (LRWSP), and Figure 4 shows the updated raw water demand projections developed as part of that project. Because we know that there is significant uncertainty when projecting growth and water demands 50 years, we developed a range of projections as shown by the grey lines in Figure 4; these represent the 1st and 99th percentile projections that resulted when we varied assumptions and ran the model 5000 times. Further information on the methodology is in this [report](#).
- As part of the LRWSP update, a sensitivity analysis was performed on the yield; depending on the parameter changed, our estimated yield after the Quarry Reservoir expansion is completed and full in approximately 2035 will range from 11.5 to 15 mgd.
- We anticipate that OWASA’s current and planned locally-controlled water supply sources will meet most customer demands through the next thirty to forty years and under most circumstances over the next 50 years.
- We anticipate that Jordan Lake or an alternative source are expected to be needed to reduce risk to acceptable levels. Demand management measures will not meet long-term needs on their own, but will be an important component of OWASA’s water conservation program.

Regulations

Regulations concerning our raw water supply are described in the Source Water Protection section.

Technology and Research

Information on technology and research concerning our raw water supply is included in the Source Water Protection section of this report.

Energy Management

As shown in Figure 5, total kilowatt-hours (kWh) of electricity used to pump our raw water to the treatment plant was 33 percent less in 2019 than in 2010. Energy use in 2017 and 2018 was higher than prior years since we provided drinking water to the City of Durham while they were upgrading their water treatment plants. In 2019, energy used to pump raw water dropped to normal levels overall. The University Lake Pump Station underwent construction in 2019, which resulted in a significant drop in use and, subsequently, electricity use. As a result, our use of the Cane Creek Pump Station increased.

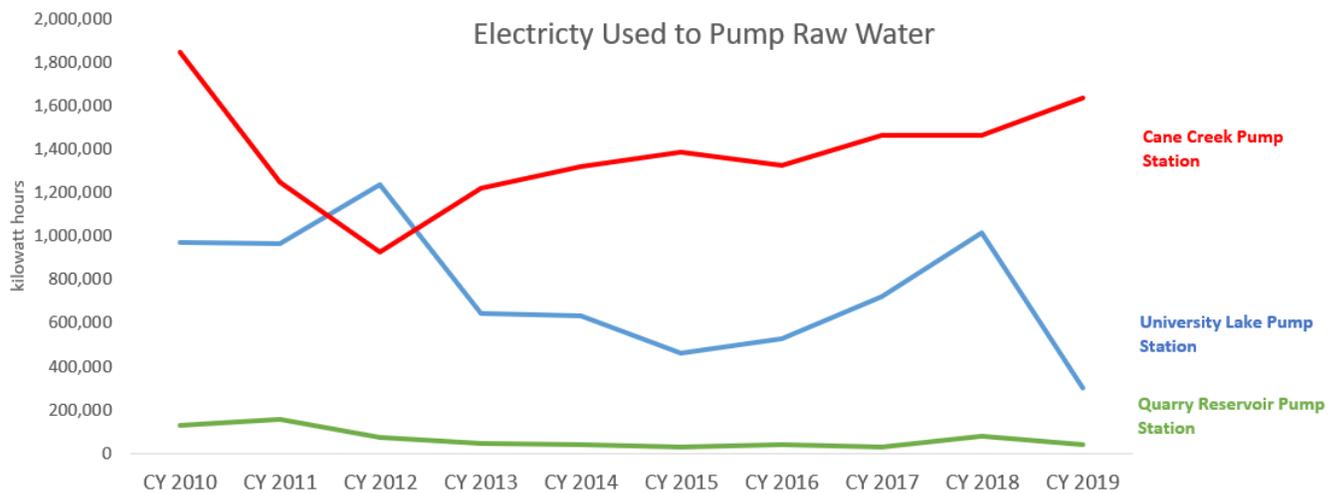


Figure 5. Electricity Used to Pump Raw Water

The 2019 Energy Management Plan Update identified three upcoming Capital Improvement Projects that have potential to further decrease the amount of energy used for raw water pumping: University Lake Pump Station Improvement project (270-11), the Cane Creek Raw Water Transmission Main study (271-05), and the Cane Creek Pump Station Improvement project (270-16).

Strategic Plan Elements

This trend is directly related to updating the LRWSP, Strategic Initiative 1. Updating the LRWSP will also engage the community (Strategic Initiative 2), and the technology of advanced metering infrastructure (AMI, Strategic Initiative 5) may help detect and address leaks sooner which would reduce raw water demand. It also is related to Strategic Initiative 3 in that we want to invest in any new water supply at the right time to sustain the community’s drinking water supply.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. In future years, update calculations to estimate yield and estimate raw water demand projections when warranted (e.g., when new drought of record occurs [impacts yield], service area boundaries change, local governments or UNC revise growth projections).	Review when warranted – likely every 5 to 10 years	X	
2. Continue to proactively plan and account for uncertainty, including increasing climate variability, through a diversified water supply and demand management portfolio.	Ongoing –as part of LRWSP update	X (as part of LRWSP update)	
3. Continue to partner with neighboring utilities to evaluate a potential new intake and WTP on the west side of Jordan Lake, evaluate new agreement options which guarantee access to Jordan Lake, and continue with mutual aid agreements as part of update of LRWSP.	Ongoing (Participated in Jordan Lake West Facilities Feasibility Study in 2015 and Economic Feasibility Study in 2018)	X	
4. Develop Water Conservation Plan.	Now through spring/summer 2021	X	
5. Identify potential energy savings opportunities for raw water pumping in Energy Management Program.	Ongoing	X (as part of Energy Mgmt Plan)	

Quarry Reservoir Storage Volume

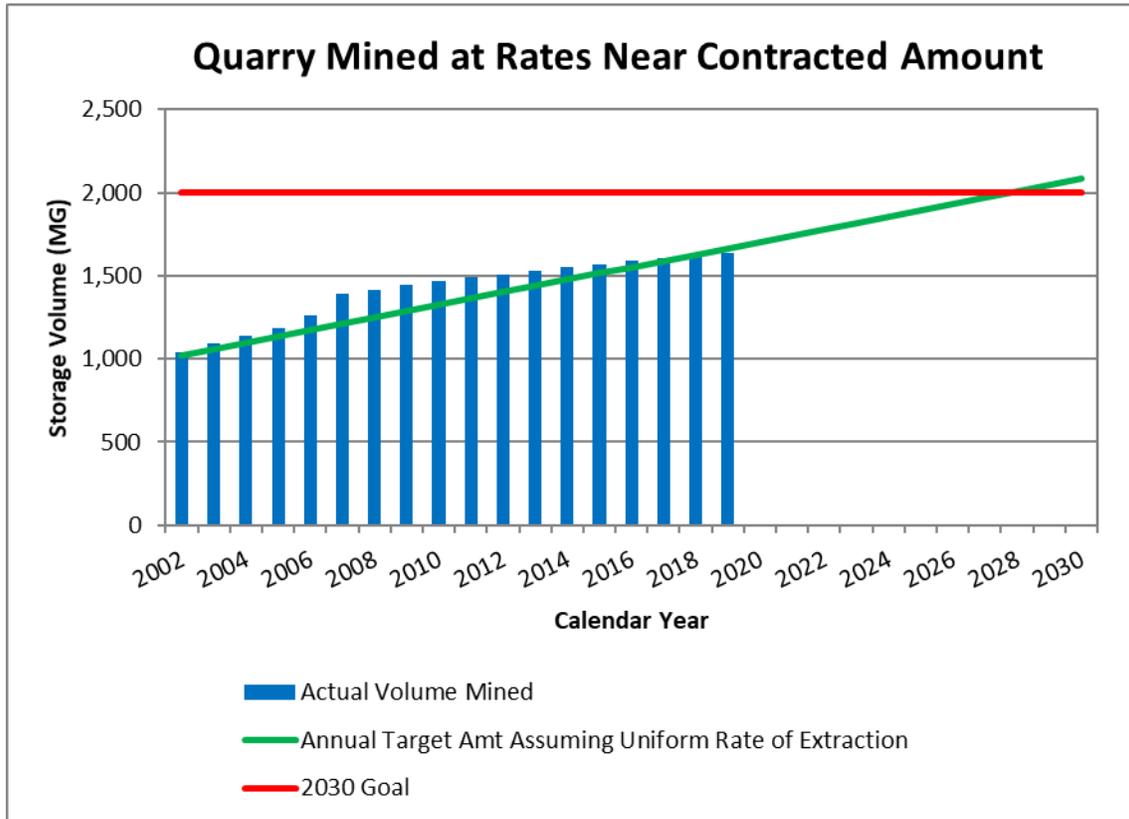


Figure 6. Quarry Mining Rates

Description: In accordance with an agreement with OWASA, Martin Marietta (formerly American Stone Company) is mining rock from OWASA-owned land adjacent to our Quarry Reservoir. Per that agreement and the requirements of Orange County’s Special Use Permit that authorized expansion of the quarry, mining operations must cease by 2030, after which OWASA will begin to fill the expanded quarry with water from Cane Creek Reservoir. Martin Marietta is required to remove enough stone to ensure the expanded quarry (including OWASA’s existing Quarry Reservoir at 0.2 billion gallons (BG)) will store at least 2.2 BG of water. This trend evaluates whether the quarry is being mined at rates which will meet that minimum water storage capacity requirement.

Key Observations:

- The quarry is being mined at rates which meet the contractual requirements.

Regulations

There are no regulations to report for the quarry. However, OWASA will perform microbial monitoring on the expanded Quarry Reservoir as soon as it is put into service, and DEQ may need to approve it as a water supply source. Adding a new, permanent water supply source may impact frequency of

monitoring for compounds which OWASA was previously granted reduced monitoring status based on results trends (e.g., lead and copper monitoring). Staff has completed LT2 monitoring of the Quarry Reservoir, and results are included in the Source Water Protection section.

Technology and Research

There are no updates in technology to report for the quarry.

Energy Management

The existing Quarry Reservoir is used only during extreme droughts or other emergencies. We periodically test the pumps to ensure they are ready in time of need. As a result, our energy use at the Quarry Reservoir is negligible (see Raw Water Supply and Long-Range Water Supply Plan trend).

Strategic Plan Elements

The Quarry Reservoir is an essential part of OWASA’s water supply portfolio and is tied to Strategic Initiative 1, “Provide reliable and high quality supply of water for the next 50 years”.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to monitor the annual rate of rock excavation at the quarry to ensure contractual requirements are met.	Annual		X
2. Maintain and follow the Quarry Reservoir implementation checklist in order to ensure timely implementation of the Quarry Reservoir water storage project once mining ceases in 2030.	Ongoing		X
3. Begin draining existing Quarry Reservoir to enable Martin Marietta to connect the current mine site with the existing Quarry Reservoir.	CY 2025		X

Water Treatment Plant: Peak Day Drinking Water Demands

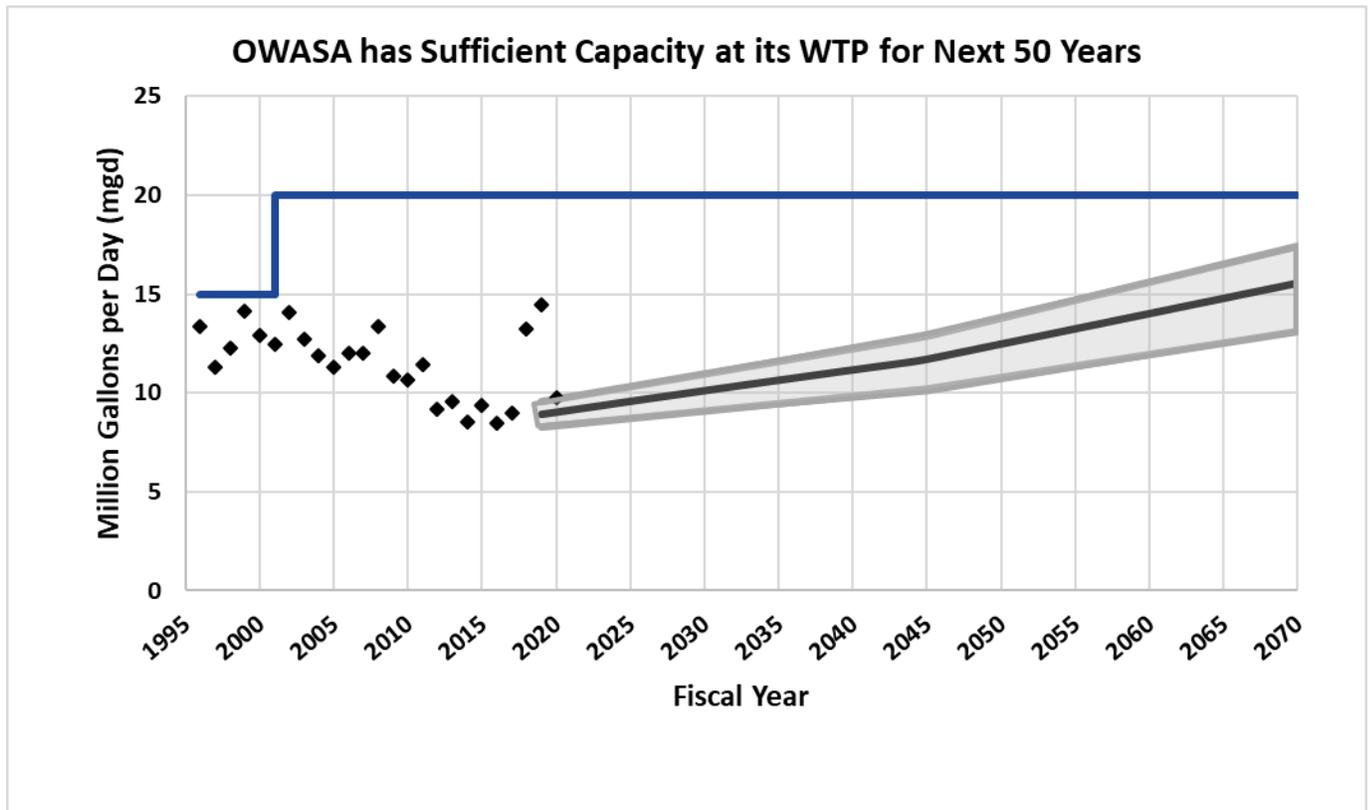


Figure 7. WTP Capacity and Peak Day Drinking Water Demands

Description: This trend evaluates peak day drinking water demands and compares those demands to the 20 mgd rated capacity of the Jones Ferry Road Water Treatment Plant (WTP).

Key Observations:

- Since FY 1999, the year with the highest peak day demand under normal operations, peak day drinking water demands have declined by 31 percent despite a 32 percent increase in customer accounts over that same period. (See comments regarding peak demands in FY 2018 and FY 2019 in bullet below).
- This decline has resulted from the following primary factors: (1) our customers are using water more efficiently, (2) we have adopted conservation pricing and conservation ordinances including year-round water use restrictions, and (3) since March 2009, reclaimed water has been used instead of drinking water to meet certain non-drinking water needs at several UNC facilities that have high summer season demands (cooling towers and irrigation).
- The peak day drinking water demands indicate that we have adequate capacity in our WTP for the next 50 years even when accounting for uncertainty in our demand projections.
- There was a significant increase in peak day drinking water demands in FY 2018 and FY 2019 compared to the recent past. OWASA provided drinking water to Durham while they had one WTP

offline in FY 2018 and were making improvements at their second WTP; we provided some water to Durham in FY 2019 as well. The reason for the increased peak day in FY 2019 was the water main break on November 5, 2018. If OWASA had not had the main break, our peak day demand would have been 8.6 mgd, comparable to earlier years.

(NOTE: The observations presented above assume that the reclaimed water system is in service throughout the peak day demand season. Peak day drinking water demands would be considerably greater if the reclaimed water system is out-of-service.)

Regulations

- The 1996 amendments to the federal Safe Drinking Water Act require that monitoring be completed for a list of unregulated contaminants every five years. EPA uses the data collected to determine if any of these contaminants should be regulated. As part of the third round of monitoring, called UCMR3, OWASA participated in the Assessment Monitoring of 21 contaminants from November 2013 through August 2014. [OWASA monitoring](#) consistently detected the following three unregulated contaminants: chromium-6, strontium, and chlorate (see next bullets). As part of the 4th round of this monitoring (UCMR4) OWASA participated in required monitoring for 30 parameters including cyanotoxins, pesticides, and disinfection by-products from August 2019 through July 2020. UCMR4 monitoring nationwide is occurring between 2017 and 2021. OWASA monitoring detected manganese in half of the samples and consistently detected unregulated disinfection byproducts (see next bullets).
- EPA has set the maximum contaminant level (MCL) of total chromium (i.e., all forms of chromium) at 100 µg/L but has not yet published a drinking water standard for chromium-6. Before issuing any regulation of chromium-6, EPA must issue a final human health assessment for chromium-6 which has not yet occurred. The state of California adopted a chromium-6 MCL of 10 µg/L, which became effective on July 1, 2014; but on May 31, 2017 the Superior Court of Sacramento County issued a judgment invalidating the MCL; as of August 2020, no new MCL has been adopted. However, it is worth noting that the California MCL for total chromium is half the federal level (50 µg/L). During UCMR3 monitoring for chromium-6, levels between < 0.03 - 0.06 µg/L were detected in OWASA's treated drinking water. These levels are well below the now invalid California standard. OWASA and other members of the TAWSMP identified chromium-6 as a focus area for the current phase of water supply monitoring (see Source Water Protection section for a brief overview of the TAWSMP). As such, the US Geological Survey collected bi-monthly samples in our raw water supply sources beginning in August 2017. This monitoring was discontinued in August 2019 due to the very low number of detects and decision of the group that the resources could be better allocated. Analysis of data are ongoing.
- EPA has not yet published a drinking water standard for strontium, but has established a health advisory level of 1,500 µg/L. A health advisory level is a non-enforceable, non-regulatory federal guidance which describes the concentration which can be consumed with little or no risk to health. OWASA's monitoring for strontium detected levels between 53 - 75 µg/L, well under the health advisory level. On March 10, 2020, the EPA provided an update on strontium in the Federal Register: "the Agency continues to consider additional data, consult existing assessments ..., and evaluate

whether there is a meaningful opportunity for health risk reduction by regulating strontium in drinking water. Additionally, the EPA understands that strontium may co-occur with beneficial calcium in some drinking water systems and treatment technologies that remove strontium may also remove calcium. The agency is evaluating the effectiveness of treatment technologies under different water conditions, including calcium concentrations.”

- EPA has not yet published a drinking water standard for chlorate. The health reference level for chlorate is 210 µg/L. OWASA’s monitoring for chlorate during UCMR3 detected levels between 160 – 650 µg/L. California has not set an MCL for chlorate but has set a notification level of 800 µg/L. The World Health Organization (WHO) guideline for chlorate is 700 µg/L. Chlorate is known to occur in drinking water because of the disinfection process and sodium hypochlorite (bleach) degradation. Concentration, long storage times, and temperature all contribute to the degradation of sodium hypochlorite. Following UCMR3, OWASA changed the concentration and reduced storage times of our bulk sodium hypochlorite. OWASA completed a two-year study to test the chlorate levels of our treated drinking water leaving the WTP and in the distribution system quarterly after implementing these changes and found an average decrease of 64 percent compared to levels measured as part of UCMR3. However, OWASA continues to measure chlorate levels both in the treated drinking water and in the distribution system quarterly to monitor levels. It is not uncommon for levels of chlorate in the summer to exceed the 210 µg/L health reference level despite changing our practices. OWASA will continue to follow this issue.
- EPA issued a final decision in June 2020 to not regulate perchlorate because it does not occur with a frequency and at levels of public health concern. The EPA health advisory for perchlorate is 15 µg/L, effective October 2008. California and Massachusetts adopted standards of 6 and 2 µg/L, respectively. OWASA has tested perchlorate levels in the treated drinking water several times and all results have been undetected or well below the health advisory level and California and Massachusetts standards. Perchlorate was not detected in samples collected in 2001 and 2002 as part of UCMR1, but the detection limit was 4 µg/L. Perchlorate was detected in a sample collected in 2011 at a level of 0.33 µg/L. In anticipation of the final rule making, a sample was collected in 2019 and the level was below the detectable level of 0.05 µg/L.
- PFAS are a family of man-made compounds containing fluorine and carbon. In 2016, EPA published an updated lifetime health advisory for two of these compounds, perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS), of 0.07 µg/L for a combined concentration of PFOA and PFOS in drinking water. This level of 0.07 µg/L was set to protect the most sensitive populations over a lifetime of exposure to the two contaminants. OWASA monitored for these substances in our treated drinking water as part of UCMR3; PFOA concentrations ranged from <0.02 µg/L to 0.03 µg/L, and PFOS was not detected. OWASA subsequently tested all our water supplies and our treated drinking water for a suite of PFAS in 2018 with lower detection limits. In light of these results, OWASA is continuing to sample our treated drinking water and raw water from Cane Creek Reservoir quarterly. Our use of powdered activated carbon in our treatment process remains effective at removing some but not all of these compounds. Levels of PFOS and PFOA remain well below the health advisory level. In February 2020, the EPA made a preliminary determination to regulate both PFOS and PFOA in drinking water. The comment period on these preliminary

determinations closed on June 10, 2020 and the agency is reviewing and considering the over 11,000 comments received. The EPA is also asking for information and data on other PFAS and comments on potential monitoring requirements and regulatory approaches for PFAS. The EPA has committed to including PFAS in UCMR5.

- OWASA has historically met all disinfection by-product criteria applicable to our treated drinking water. Monitoring data indicates that we should continue to meet any criteria developed for disinfection by-products. Two groups of currently unregulated disinfection by-products are included in UCMR4 and OWASA consistently detected some but not all the compounds in these groups. Disinfection byproducts are produced from the reaction of disinfectants (chlorine or chloramines) with organic compounds that remain in the water after treatment. OWASA regularly achieves 80-95% removal of these organics compared to the 50-55% required removal. This high level of removal helps us achieve low levels of disinfection byproducts by limiting the level of one of the reactants.
- Cyanotoxins are toxins produced by cyanobacteria (also sometimes called blue-green algae) under certain conditions. These toxins can be harmful to the environment, animals, and human health; one was responsible for the City of Toledo's "Do Not Use" warning in summer 2014. In June 2015, EPA issued health advisories for two cyanotoxins: microcystin (1.6 µg/L for children 6 and up and adults and 0.3 µg/L for children less than 6 years old) and cylindrospermopsin (3.0 µg/L for children 6 and up and adults and 0.7 µg/L for children less than 6 years old). Establishing a monitoring program and benchmarks for when source and/or finished water should be analyzed for toxins provides a solid foundation for a cyanotoxin management approach. OWASA has proactively been monitoring algal cyanotoxins since 2007 in our finished drinking water using a contract laboratory when our cyanobacteria counts rise above 100,000 units/mL in the blend of University Lake and Cane Creek Reservoir water being treated. Additionally, beginning in the summer of 2016 staff began monitoring cyanotoxin levels at the intakes and through the treatment process on a weekly basis to gather baseline data on occurrence and removal. To date, OWASA has not exceeded the health advisory levels in our finished drinking water. In addition to microcystin and cylindrospermopsin, OWASA also monitors for anatoxin-a. Staff will continue to evaluate algal toxins (additional information provided in Treatment Technology section). OWASA monitored for some cyanotoxins as part of UCMR4 in our treated drinking water and no samples had detectable levels.
- Manganese is being monitored as part of UCMR4 and may be regulated in the future. Monitoring as part of UCMR4 detected manganese in two of four treated drinking water samples; results ranged from <0.400 to 0.998 µg/L. At this time, there is a secondary MCL, which is based on aesthetic concerns such as taste and discoloration not health effects, of 0.05 mg/L (or 50 µg/L). Additionally, there is a non-regulatory 10-day health advisory limit (based on short-term exposure for infants) for manganese of 300 µg/L. OWASA tests annually for manganese and results are consistently below the detection limit of 10 µg/L. Manganese occurs naturally in our reservoirs and the levels can be quite high. Because there are high levels in our source water, it would be possible for our treated water to exceed regulations. However, our treatment process is effective at removing this metal. Manganese is insoluble in its oxidized form. Both permanganate and chlorine are strong oxidants that help remove manganese from our water during the treatment process.

Technology and Research

- In 2017, there were several incidents where OWASA’s drinking water had taste and odor issues. While taste and odor compounds in the drinking water are not harmful, they are not pleasant and can affect customer confidence. OWASA purchased and started using a gas chromatograph/mass spectrometer in March 2019 which enables staff to test for the compounds in-house and receive results the same day or next morning. This has enabled us to swiftly adjust our treatment in response to higher levels of taste and odor compounds in our reservoirs thereby assuring aesthetically pleasing drinking water for our customers. This equipment will also be useful for screening for other compounds of emerging concern in the future.
- OWASA evaluates the treatment technologies at our WTP to ensure we can meet any potential upcoming standards with current treatment technologies. OWASA can meet most of the potential standards discussed in the Regulations section. Staff continues to follow on-going research on this topic to ensure safe drinking water for our customers.
- Staff periodically evaluate the chemicals we use at the plant to ensure we are using the best available to meet our treatment goals in the most sustainable manner and to ensure that we do not foresee shortages in chemicals we use which could impact treatment or their price. At this time, staff believe we are using the correct blend of chemicals and no shortages are foreseen in their supply.

Energy Management

In 2019, we used fourteen percent less electricity at the Jones Ferry Road Water Treatment Plant (WTP) than we did in 2010. As with the energy use for raw water pumping, we used more electricity in 2017 and 2018 than we would have because we treated and pumped an additional 375 million gallons of drinking water for the City of Durham. Natural gas is used at the WTP to heat buildings, and our use of natural gas is largely driven by weather. The use of natural gas (therms) was about thirteen percent lower in 2019 than it was in 2010, largely attributable to weather and minor operational changes.

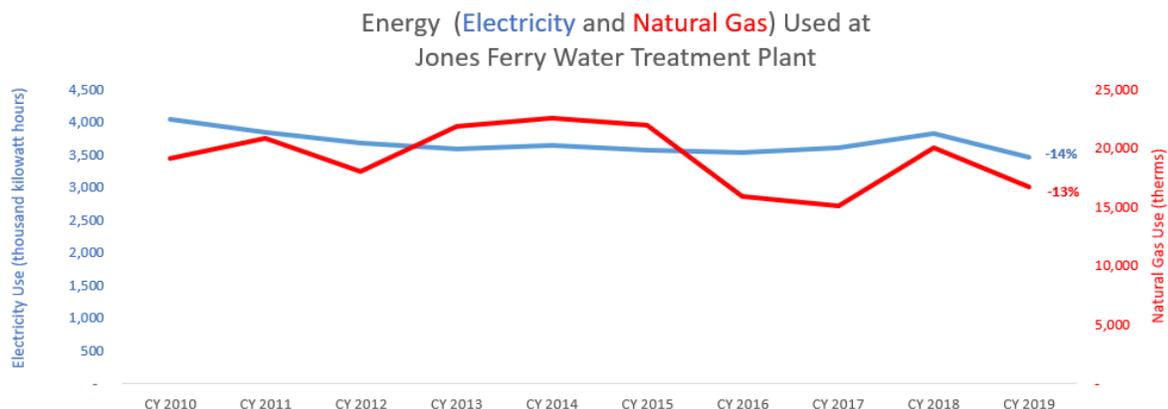


Figure 8. Energy Use at the Jones Ferry Road WTP

Strategic Plan Elements

Strategic Initiative 1 includes preparing a Water Conservation Plan. Conserving water will help reduce peak day and average day demands. Ultimately, the Water Conservation Plan will serve as a compilation of water conservation strategies identified in three separate OWASA plans:

- Strategies that effectively and efficiently delay or prevent the need for supply side expansion in order to meet the demands of a growing community (None were identified in the development of the forthcoming Long-Range Water Supply Plan)
- Strategies that extend limited water supplies in times of drought or operational emergency (as identified in the Water Shortage Response Plan)
- Strategies that promote a community-wide water conservation ethos (as identified in the Strategic Communications Plan)

In addition, Strategic Initiative 3 includes a goal to invest at the right time in our community’s water assets. Understanding the capacity of our WTP, the demands placed on it, and the potential implications of future treatment requirements will inform our CIP.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to monitor peak day demands at the Jones Ferry Road WTP.	Annually		X
2. Continue to identify and pursue cost-effective opportunities for additional conservation or reclaimed water use, which help reduce peak demands.	As opportunities arise		X
3. Continue to monitor potential growth in our service area by working closely with Carrboro, Chapel Hill, and UNC to ensure we have sufficient drinking water treatment, pumping and storage capacity.	Ongoing		X
4. Continue to monitor our water and stay current with the potential new drinking water standards to ensure we can meet future requirements. Identify any studies or technologies needed to ensure we provide safe, high quality drinking water to our customers.	Ongoing		X
5. Continue to monitor treatment technologies and chemical use for potential to improve our level of service.	Ongoing		X
6. Identify potential energy savings opportunities for water treatment and pumping in Energy Management Program.	Ongoing	X (as part of Energy Mgmt Plan)	
7. Maintain performance goals within Partnership for Safe Water (see chapter on “OWASA’s Planning Environment”) for Phase IV Excellence in Water Treatment	Ongoing		X

Cumulative Number of Water Meter Equivalents (MEs)

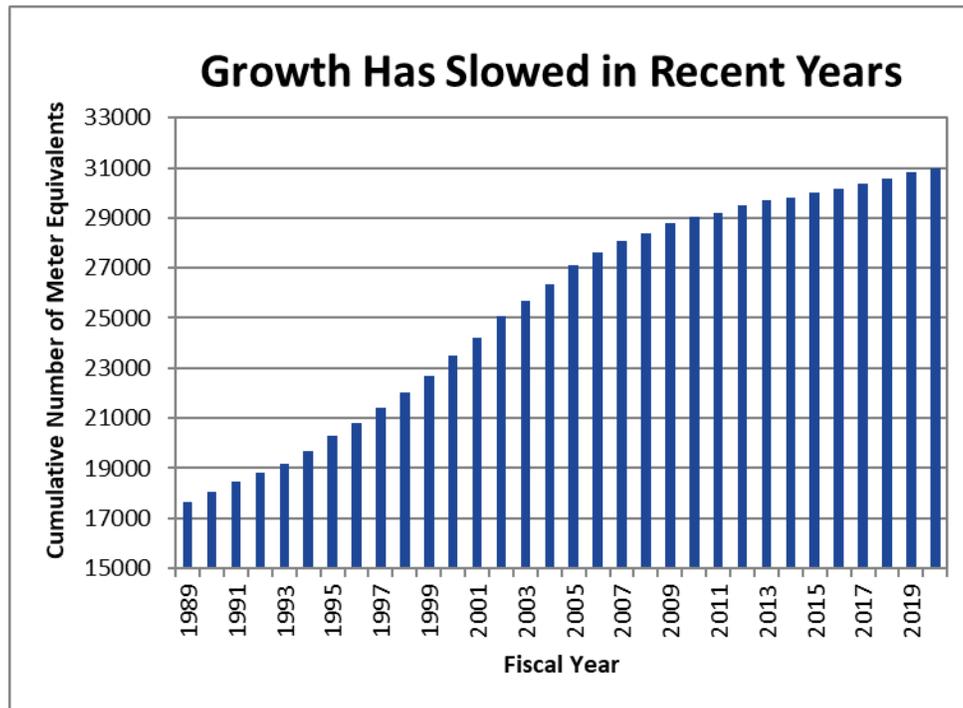


Figure 9. Number of Meter Equivalents Served by OWASA

Description: This trend evaluates the number of meter equivalents (MEs) served by OWASA. The smallest meters (5/8-inch) serve single family homes and small non-residential customers, while larger meters are used to serve locations with larger water demands. The capacities of larger meters are expressed in hydraulic capacity proportional equivalents of a 5/8-inch meter, or “meter equivalent”. (For example, a 2-inch meter has a meter hydraulic capacity ratio of 8 MEs, and a 6-inch meter has an equivalency of 50 MEs.) The number of meter equivalents is an indicator of the rate of growth in customer demands in the service area.

Key Observations

- Growth in the service area is slower in recent years than in past.
- The number of meter equivalents has grown 37 percent since FY 1999, the year with our highest peak day drinking water demands (see Peak Day Drinking Water Demands Trend).

Regulations

There are no regulations to report for meter equivalents.

Technology and Research

There are no updates in technology to report for meter equivalents.

Energy Management

There is no energy use to report for meter equivalents.

Strategic Plan Elements

Understanding how growth is occurring in our service area allows us to plan for our water supply needs and treatment and conveyance capacity needs (as well as our wastewater collection and treatment capacity needs). These are related to Strategic Initiatives 1 (provide reliable and high quality supply of water for next 50 years) and 3 (adopt budget decision processes to ensure affordable services).

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to monitor growth in service area by tracking new meter equivalents.	Monthly (for Dashboard report)		X

Drinking Water and Reclaimed Water Sales

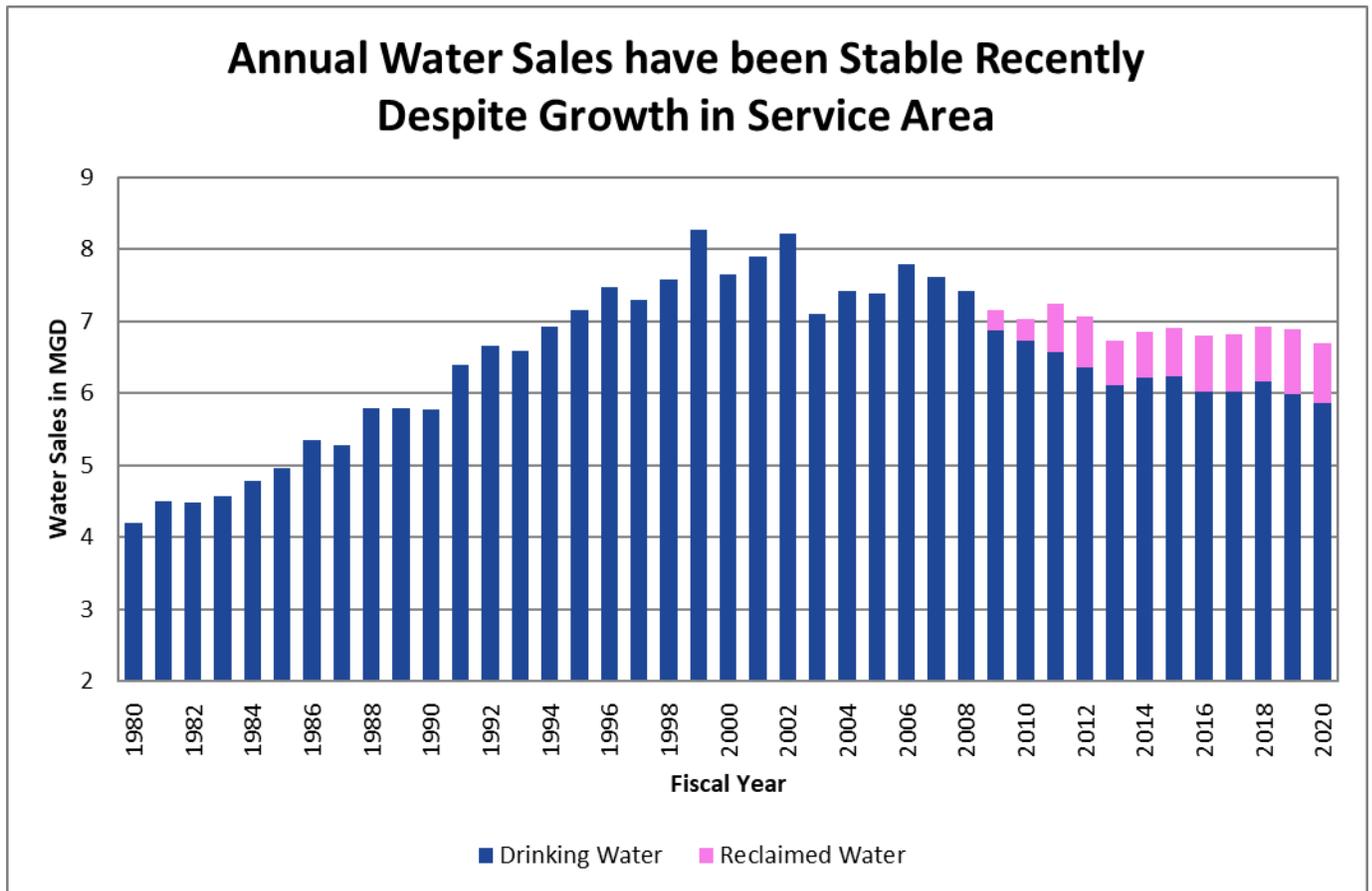


Figure 10. Annual Water Sales

Description: This trend evaluates average-day sales of drinking water and reclaimed water (in mgd) since 1980. (The reclaimed water system began operating in March 2009.)

Key Observations:

- OWASA’s annual average drinking water sales volume has declined despite growth in the service area as shown in the Meter Equivalents trend. Drinking water sales volume is currently at about the same level it was 30 years ago.
- Total annual water sales volume (including reclaimed water) is 19 percent less from the peak in FY 1999, despite a 32 percent increase in customer accounts during that same time period. Drinking water sales volume declined 29 percent over that same period.
- Reclaimed water met about 12 percent of the community’s water needs in FY 2020 based on sales volume.
- Water sales volume was lower in FY 2020 than predicted, partially due to COVID, which resulted in water demand approximately 12 percent lower than forecasted from mid-March through the end of the fiscal year.

Regulations

There are no regulations to report for drinking water volume sales. For regulations on reclaimed water, see Reclaimed Water section.

Technology and Research

In accordance with Strategic Initiative 5, OWASA installed advanced metering infrastructure (AMI) with early leak detection. During FY 2020, the Agua Vista Web Portal has provided alerts to 5,458 customers. Of those notifications, customers confirmed leaks in 5,347 instances. In these cases, leaks were repaired within 175 hours of starting (note: typically leak lasts for approximately 72 hours before alert provided). The average leak was 132 gpd. If allowed to continue for 35 days until a customer received a bill, each one of these leaks would have wasted close to 4,000 gallons more of water than occurred with AMI. If these trends continue, the early leak notification services provided by AMI will help avoid a measurable, but modest amount of wasted water use.

Energy Management

Energy used to pump drinking water is shown in the Peak Day Drinking Water Demands section.

Strategic Plan Elements

The Water Conservation Plan or demand management strategies evaluated in the update to the LRWSP (Strategic Initiative 1) may result in reduced drinking water demand. This in turn would impact revenue, which would be addressed through the financial management policies included in Strategic Initiative 3. Financial reserves help OWASA meet its financial obligations during times of reduced water demand such as may occur during drought conditions.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to identify cost-effective opportunities to expand the reclaimed water system which will help reduce our community's risk to drought, extend the capacity of the WTP, and optimize the use of our locally-controlled water supplies.	As opportunities arise		X
2. Continue to identify cost-effective and customer-accepted opportunities for additional conservation.	Ongoing	X (as part of Conservation Plan)	
3. Continue to monitor potential growth in our service area by working closely with Carrboro, Chapel Hill, and UNC to ensure we have adequate water treatment capacity for the future.	Annual with ongoing communication		X

Average Monthly Water Use and Billed Amount

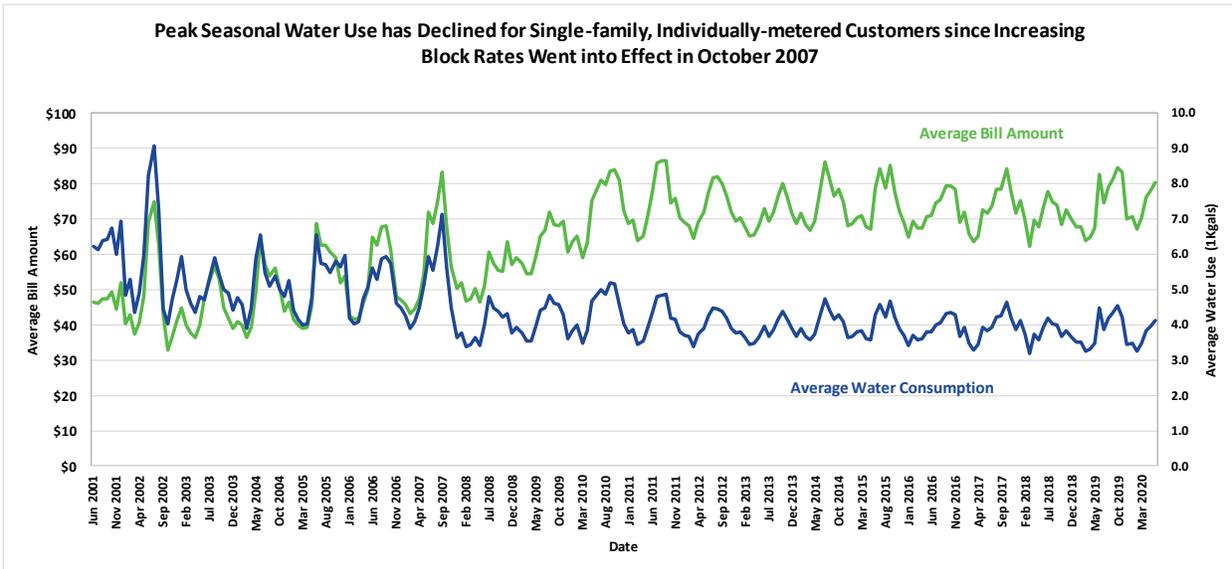


Figure 11. Single Family Residential Water Use

Description: This trend evaluates average monthly water use and the average monthly water and sewer charges for single-family, individually-metered residential customers.

Key Observations:

- Peak seasonal water use by this group of customers has declined, particularly after OWASA’s increasing block rates went into effect in October 2007. This indicates that outdoor water use for single-family, individually-metered residential customers has diminished and implies a relationship with the change in our water rate structure.

Regulations

There are no regulations to report for water use.

Technology and Research

In accordance with Strategic Initiative 5, OWASA installed advanced metering infrastructure (AMI) throughout our service area. AMI allows OWASA and our customers to detect leaks earlier and is likely to have a measurable, but modest impact on overall system demand.

Energy Management

Energy used to pump drinking water is shown in the Peak Day Drinking Water Demands section.

Strategic Plan Elements

The Water Conservation Plan and demand management strategies evaluated as part of the LRWSP (Strategic Initiative 1) may result in reduced drinking water demand. This in turn would impact revenue, which would be addressed through the financial management policies included in Strategic Initiative 3. Financial reserves help OWASA meet its obligations during times of reduced water demand such as may occur during drought conditions.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to track this trend to determine whether water use is increasing.	Annual		X

Physical Interconnection Capacity and Average Annual WTP Demands

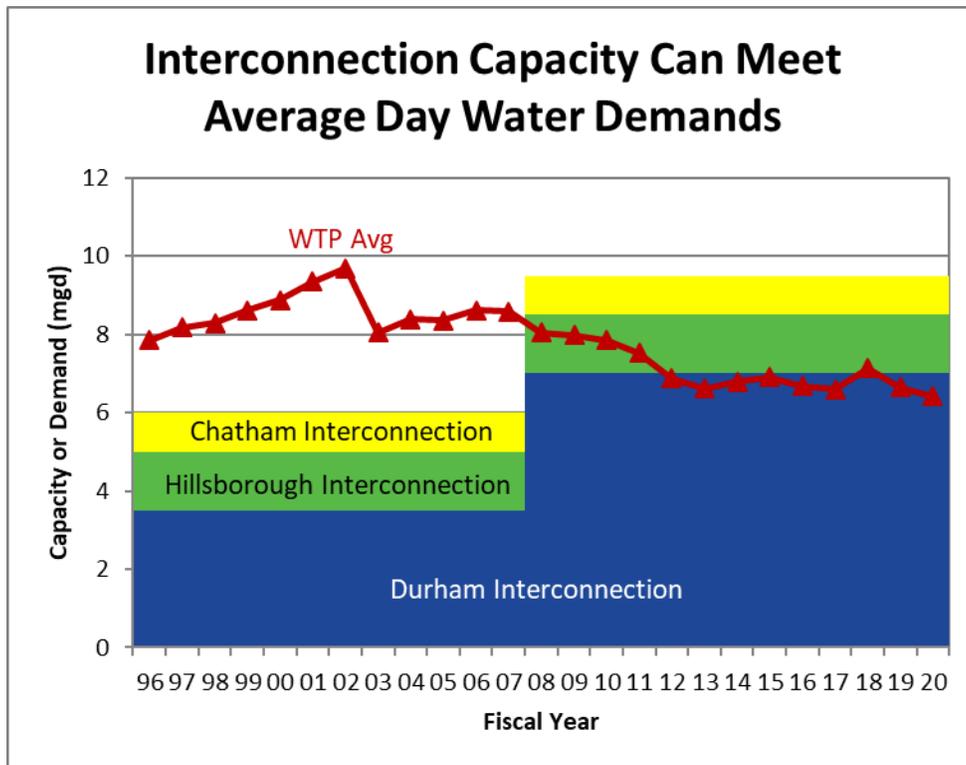


Figure 12. OWASA's Interconnection Capacity

Description: This trend evaluates the ability of OWASA's drinking water system interconnections with neighboring communities to meet average-day drinking water demands during planned or unplanned events that could affect our ability to treat and deliver water to our customers.

Key Observations:

- OWASA's existing physical interconnections are of sufficient capacity to meet average-day drinking water demands.
- Our drinking water system interconnections with the City of Durham have a combined capacity of about 7 mgd.
- We can receive about 1.5 mgd through our interconnection with the Town of Hillsborough, which was confirmed during recent testing.
- OWASA also has an interconnection with Chatham County. OWASA can receive approximately 1 mgd through this connection based on modeling analyses; during the November 2018 water emergency we received approximately 1.3 mgd from Chatham County.

- The combined capacity of our interconnections is about 9.5 mgd, which is about 143 percent of our FY 2020 average-day drinking water demands and about 131 percent of our FY 2020 water demands including reclaimed water.

Regulations

There are no regulations to report for interconnections.

Technology and Research

There are no updates in technology to report for interconnections.

Energy Management

Energy used to pump water at our interconnections is negligible under most conditions; however, it would increase considerably when we are obtaining drinking water from a neighboring utility depending on the amount of water needed and the length of time it is needed.

Strategic Plan Elements

While Strategic Initiative 1 does not directly include operational emergencies, our interconnections help us meet our water supply needs for short periods if something happened to our raw water supply, treatment plant or distribution system.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. OWASA should continue to monitor this trend to ensure that average-day drinking water demands could be met through water system interconnections with our neighboring utilities.	Annual		X
2. Re-evaluate the capacity of system interconnections to ensure changes in system facilities and demands have not adversely affected our ability to import an adequate supply of drinking water to meet average-day demands during an emergency.	Periodically as needed		X
3. Perform field tests on all interconnections to ensure proper operation, train staff, and confirm capacity.	Routinely, in coordination with utility neighbors		X
4. Continue to work with Triangle Water Supply Partnership to update and use regional interconnections model for planning purposes to improve regional reliability and resiliency.	Ongoing		X

Drinking Water Distribution System Integrity

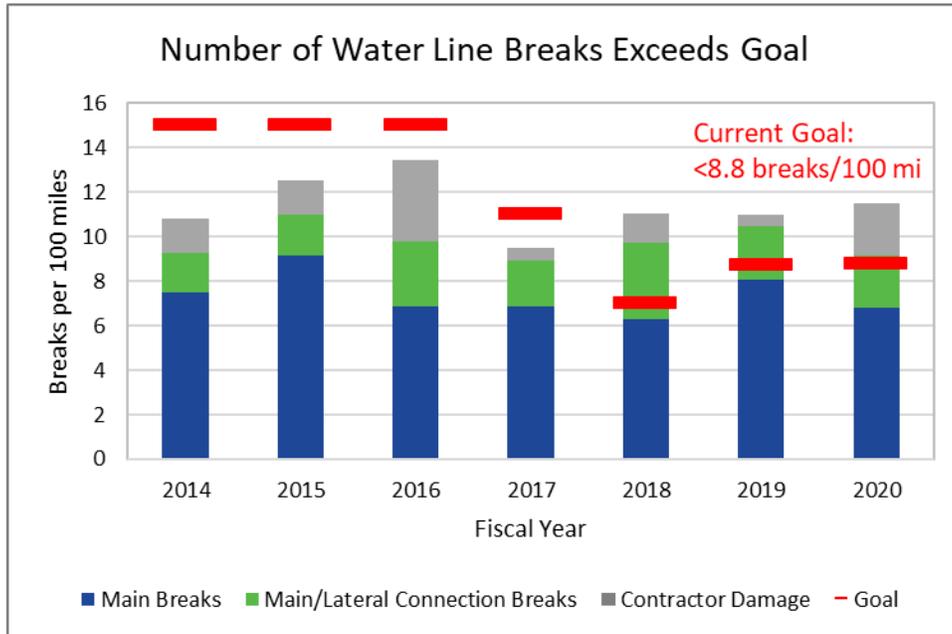


Figure 13. Historic Water Line Breaks

Description: This trend evaluates the number of water main breaks per 100 miles of water mains and connections with service lateral lines. These are important indicators of the integrity of our drinking water distribution system. It also includes information on lines damaged by contractors; while that metric does not impact the integrity of our water distribution system, there is an impact on our customers and thus we include contractor damage in this trend.

Key Observations:

- We have had more water main breaks than our goal of 8.8 main breaks or less per 100 miles of pipeline, which is based on median of value included in the 2020 (based on FY19) American Water Works Association Benchmarking report. (Note: In prior reports we used goals of 15, 11, 7, and 8.7 main breaks or less per 100 miles of pipeline based on earlier Benchmarking reports).
- OWASA experienced a water main break outside its Jones Ferry Road WTP on November 5, 2018 resulting in a system-wide boil water advisory. To improve the reliability and resiliency of our water system, OWASA has completed a major update of our risk-based water main prioritization model; is collaborating with UNC and UNC Hospitals on resiliency solutions; inspecting all valves; and investing in rehabilitation and replacement projects through the capital improvements program.

Regulations

Federal and state testing requirements require public water systems such as OWASA to test for lead in drinking water collected from customers' homes as part of the Lead and Copper Rule. Samples must be

collected from homes that meet criteria set by the EPA; these criteria identify “high priority” homes that are most likely to have elevated lead levels. OWASA tests for lead in drinking water in 30 homes built from 1983 to 1985 that have copper pipes with lead solder every three years. The most recent round of monitoring will end September 30, 2020; however, we have already completed this effort. In advance of the expected Lead and Copper Rule Revisions we requested that our contract lab analyze all samples with lower reporting limits and all 30 samples had no detectable lead (<0.001 mg/L). In the previous round of monitoring, completed September 30, 2017, only one sample had a measurable level of lead. The EPA will be publishing the finalized Lead and Copper Rule Revisions this fall; staff is monitoring the proposed changes to ensure we will meet any new requirements. OWASA also provides testing of our drinking water for lead at no charge when requested by a customer.

Technology and Research

Technologies exist to assess the condition of pipe, monitor system pressure and detect leaks. The recently completed Water Main Prioritization Study, in conjunction with the updated risk framework for distribution system pipes, evaluated the applicability of currently available technology and recommended a programmatic strategy for the optimal use of condition assessment technologies and procedures, system monitoring (pressure monitoring), and leak detection to help refine our understanding of system integrity and ultimately inform investment decisions about pipe replacement and other actions.

Due to the cost and complexity of performing assessments on in-service pressurized pipes, water main condition assessment is typically focused on pipes identified as high risk by a prioritization model. However, OWASA’s options are limited due to the prevalence of asbestos cement (AC) pipe, which does not lend itself to non-destructive condition assessment technologies. The condition of AC pipe can only be assessed by removing sections of pipe and having those analyzed. Done as a standalone activity, this assessment process can be very costly, can disrupt service to customers, and runs the risk of degrading the integrity of the pipe. Therefore, we have been implementing an opportunistic condition assessment program that capitalizes on events where our pipes have been exposed during construction activities or while repairing breaks and leaks. Pipe samples, soil samples, and corrosion potential measurements are taken during these events and inform a database of information staff uses to assess the general condition of adjacent pipes. To date, 5 different AC pipe samples (both from breaks and from taps) have been analyzed. As more pipe and soil samples are collected, we plan to develop a baseline for pipe that will illustrate the characteristics of pipe that still have service life available and those who are nearing replacement.

For metallic pipes, insertion of a camera is the simplest method; however, the resulting assessment is qualitative (i.e. good, fair, poor). Typically, a visual inspection does not provide sufficient information on pipe condition because it does not provide information on the strength of the pipe or on external conditions which may lead to pipe failure (e.g. external corrosion, bedding condition, or utility crossings). This method of assessment tends to cost more per linear foot and has a lower accuracy than other assessment methods.

Pressure monitoring for overall system monitoring is often an overlooked technology that can assist with the management of the distribution system. High pressures and pressure surges may be indicators of issues that can increase the likelihood of failure of water mains. Early detection of pressure events can reduce the consequence of the event by reducing response time and identifying potentially affected customers. OWASA currently has no formal pressure monitoring or leak detection program, but we do monitor the distribution system pressure at nine locations in addition to the WTP. The current locations include three storage tanks, three booster pump stations and three other locations throughout the distribution system. OWASA is currently evaluating the possibility of expanding our current pressure monitoring network through the installation of temporary devices or permanent devices.

Detecting leaks can help identify conditions that may cause breaks; however, not every leak will cause a break (i.e. complete structural failure) and not every break is caused by a leak. Furthermore, water loss is not a significant issue in our system, so identifying and repairing leaks will not appreciably reduce unaccounted for water. Leak detection tends to have a moderate cost and accuracy, relative to other technologies. Recent studies have recommended that leak detection be a part of OWASA's distribution system monitoring plan. Staff will continue to evaluate this technology as methods evolve and budgets allow.

Energy Management

As reported in the Peak Day Drinking Water Demands section, over half of the energy used at the WTP is actually for pumping drinking water into the distribution system and for maintaining system storage levels to maintain pressure and meet peak demands. In addition, we use energy to pump finished drinking water into a higher pressure zone. Combined, these two uses of energy account for approximately 12.5% (2.0 million kWh) of the energy we used in 2019. Other energy is fuel for vehicles and equipment used to maintain our drinking water distribution system.

Strategic Plan Elements

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Maintaining and replacing our infrastructure when needed enables us to maintain high levels of service to our customers over the long-term.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Use OWASA's water main prioritization model and risk framework to inform investment decisions for the condition assessment and replacement of the drinking water distribution system.	Annual		X
2. Continue the programmatic replacement of aging galvanized water mains throughout the distribution system.	Through FY 2024		X
3. Update the prioritization model's risk framework to account for current data sources and statistical trends in main break history.	Ongoing		X
4. OWASA inspected all critical and previously uninspected valves in CY 2019. Staff has a goal of inspecting all valves every four years and inspecting all critical valves annually.	Ongoing		X
5. Continue to fund our water main renewal/replacement program to ensure system sustainability.	Annual	X	
6. Develop risk mitigation and emergency response procedures with key customers such as UNC, UNC Hospitals for water supply resiliency.	Ongoing		X
7. Maintain Presidents Award status by the Partnership for Safe Water (see chapter on "OWASA's Planning Environment") for Distribution System Operation.	Ongoing		X

Water System Audit

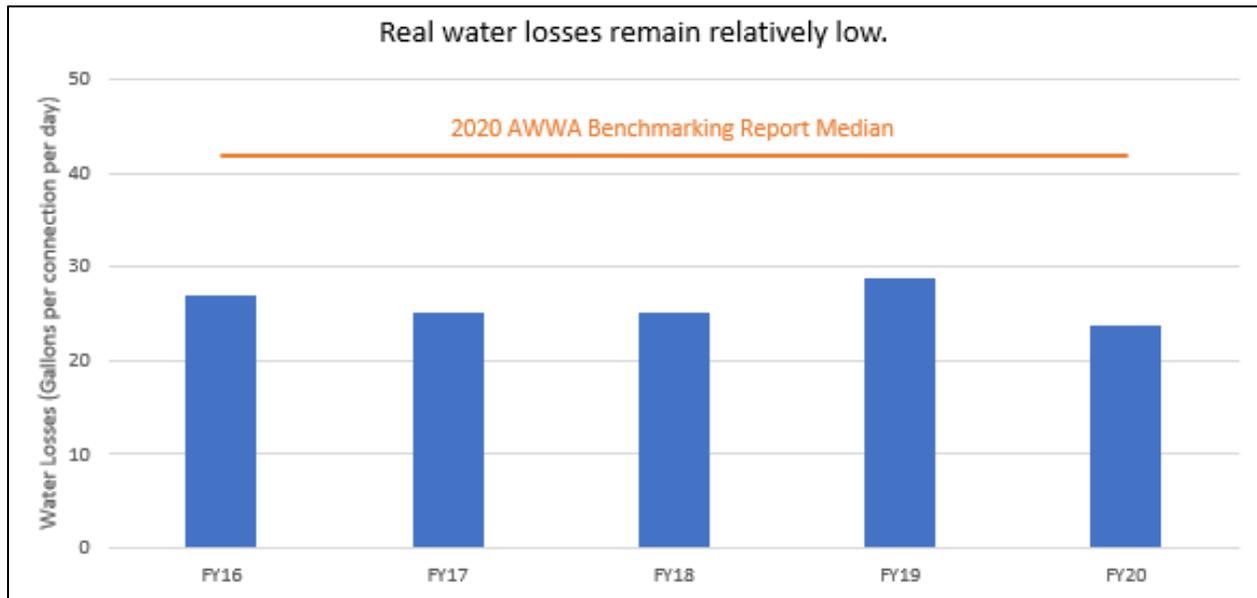


Figure 14. Historic Real Water Loss

Description: This trend evaluates the annual volume of water lost through leaks in the distribution system. Real loss is the difference between water supplied and authorized consumption; utilities also subtract out apparent losses associated with inaccuracies in metering, data errors, and estimated water theft.

Key Observations:

- OWASA’s water loss remains less than other utilities. In years past, the median water loss for water utilities in Georgia (a state where all water providers that serve a population of 3,300 or more conduct annual, validated water system audits) averaged over 40 gallons per connection per day. The median water loss reported in this year’s AWWA Benchmarking survey was 42 gallons per connection.

Regulations

There are no regulations to report for real water loss.

Technology and Research

The Drinking Water Distribution System Integrity trend includes information on acoustic leak detection.

Energy Management

Energy used to pump drinking water is shown in the Peak Day Drinking Water Demands section.

Strategic Plan Elements

Strategic Initiative 1 includes the development of a Water Conservation Plan, an important element of our updated Long-Range Water Supply Plan. Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Understanding the amount of water loss in our system helps make investment decisions. Maintaining and replacing our infrastructure when needed enables us to maintain high levels of service to our customers over the long-term.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Update water audit information	Annual		X

Wastewater Collection System Integrity

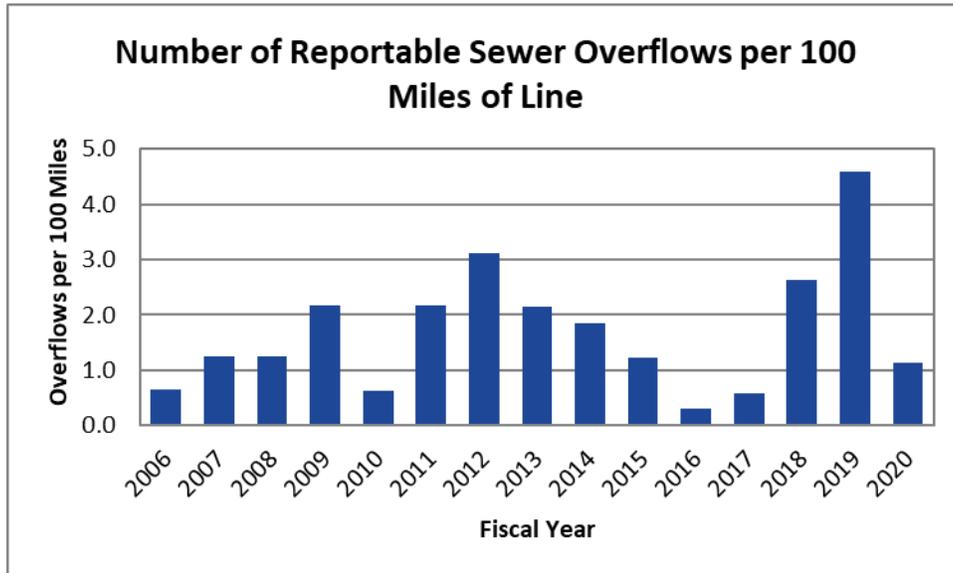


Figure 15. Historic Reportable Sanitary Sewer Overflows

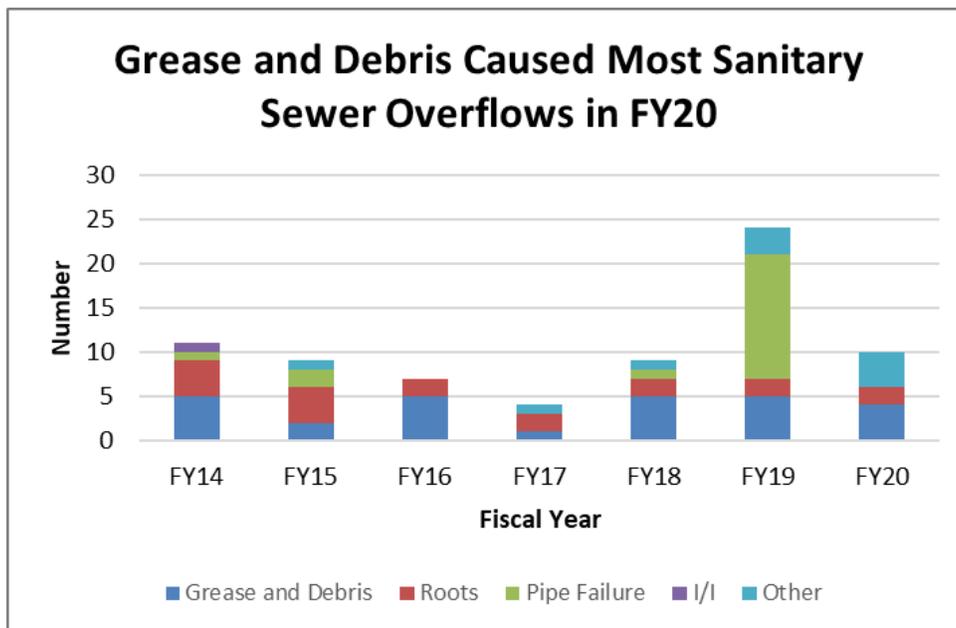


Figure 16. Historic Causes of All Sanitary Sewer Overflows

Description: This trend evaluates the number of reportable sewer overflows, which is an important indicator of the integrity of our wastewater collection system. It also evaluates the causes of all sewer overflows.

Key Observations:

- The number of reportable overflows is less than 1.6 per 100 miles of pipeline, which is the national median per the American Water Works Association 2020 Benchmarking report. The 25th percentile in that report was 3.7 overflows per 100 miles of pipeline. Per DEQ guidance, OWASA strives to have no overflows.
- In FY 2020, grease and debris was the primary cause of overflows. Grease, debris, and roots are typically the primary causes of overflows. Reducing grease will require proactive, recurring education of our customers – especially those in the food service sector. Customers can also help minimize potential root intrusion by not planting trees near our sewer lines.

Regulations

There are no upcoming regulations to report for our wastewater collection system.

Technology and Research

- Advanced, automated flow measurement technologies are available for real-time monitoring of wastewater collection systems. These flow monitors may be connected to our SCADA system. When monitors indicate that water levels inside a pipe increase, it may be an indication that the line is blocked downstream or there is substantial inflow and infiltration (I&I) during rain events. Recent work with consultants on our hydraulic model has indicated that a permanent flow monitoring system may have merit in identifying areas susceptible to I&I. We intend to more thoroughly investigate the feasibility of such a system in the near future. Additionally, to better understand the I&I throughout the collection system an I&I dashboard has been developed. This dashboard utilizes currently installed flow meters at the Rogerson Drive Pump Station and the Wastewater Treatment Plant along with rain fall data. We plan to use this dashboard to track progress of various activities in the collection system on removing I&I from the system over time. Furthermore, a cross-departmental collection system group is being formed from staff from the Engineering and Planning, Distribution and Collection, Wastewater Treatment, and Administration (communications) Departments to better prioritize and plan for collection system improvements and projects. These projects may include, smoke testing high priority neighborhoods, improving customer communication about private side sewer laterals, and targeted rehabilitation based on improved sewer CCTV activities, among others.
- Acoustic monitoring to detect sewer line blockages is available. A device sends a sound down a line to help find obstructions. A pilot test of this type of technology indicated that it was not yet reliable and cost-effective.
- Robotic Pipeline Monitoring and Maintenance Systems which can complete robotic inspections of pipelines are also being developed. This method is still in its early stages and still not cost effective to deploy throughout the collection system. Historically, this technique has been used by other utilities to assess the wastewater constituents rather than the pipeline condition.

Energy Management

Wastewater is primarily conveyed through the force of gravity; however, wastewater pumping stations are necessary to transport wastewater when gravity flow is not possible. All of our wastewater pumping stations are powered by electricity, with diesel fuel or natural gas being used to power emergency standby generators when electrical service is unavailable. Electricity use by OWASA's wastewater pumping stations has been relatively consistent over the last six years, with the Rogerson Drive Pump Station accounting for about 65 to 70 percent of the electricity used for collection system pumping.

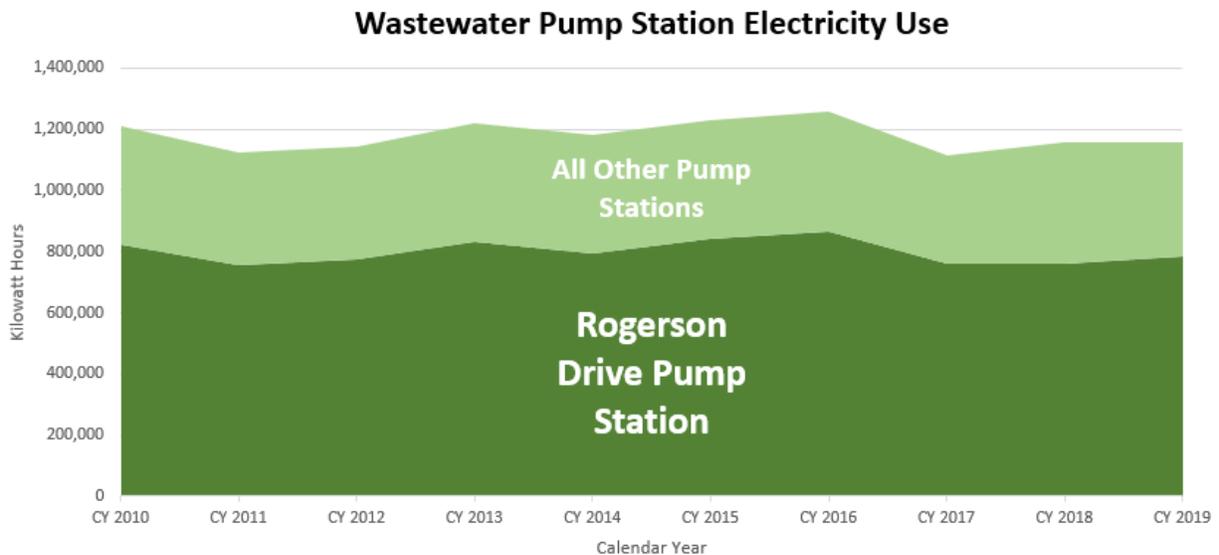


Figure 17. Wastewater Pump Station Electricity Use

Strategic Plan Elements

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Maintaining and replacing our infrastructure when needed helps us meet the community's wastewater needs.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to use the findings and recommendations from the 2020 Sewer System Master Plan and subsequent Sewer Evaluation Reports as a guide for prioritizing funding for sewer system evaluation, rehabilitation and replacement. Update the Master Plan's modeling efforts periodically as flow demand patterns change. The goal of these actions is to reduce inflow and infiltration.	Ongoing		X
2. Integrate the results of the sewer system modeling and field condition assessment work into the comprehensive asset management program so that the trade-offs of different capital improvements investment decisions can be consistently evaluated and prioritized.	Annual		X
3. Investigate the feasibility of installing flow monitoring equipment in the collection system to identify areas susceptible to I&I.	TBD depending on other priorities		X
4. Continue to inspect, clean, and rehabilitate our sewer lines and wastewater pumping stations as needed to prevent overflows, reduce infiltration and inflow, and ensure adequate capacity.	Ongoing		X
5. Continue to monitor and maintain sewer easements to ensure our equipment and personnel can access the sewer system for maintenance and repair work, and to ensure tree root intrusion into sewers is minimized and corrected.	Ongoing		X
6. Continue to educate the public on the importance of not pouring fats, oils and grease, medications, etc. down the drain and not flushing items other than toilet paper.	Ongoing		X
7. Continue to fund the sewer system renewal/replacement program and operations and maintenance activities to ensure system sustainability.	Annual	X	
8. Identify potential energy savings opportunities for wastewater collection in Energy Management Program	Ongoing	X (as part of Energy Mgmt Plan)	

Mason Farm Wastewater Treatment Plant Maximum Month Flows

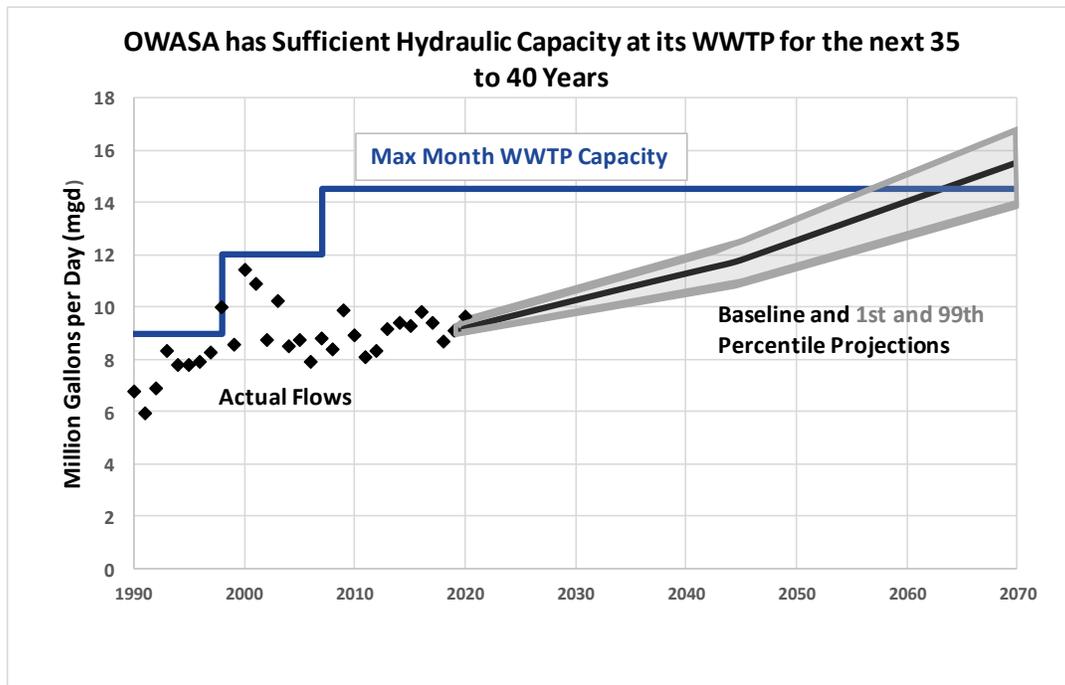


Figure 18. Mason Farm WWTP Capacity and Demands

Description: The Mason Farm Wastewater Treatment Plant (WWTP) has a permitted capacity of 14.5 mgd, which is the maximum average daily flow which can be treated in any given month. This trend tracks historical annual maximum month of flow and compares those against the permitted capacity of the WWTP.

Key Observations:

- OWASA’s maximum month wastewater flows have declined from a peak of 11.5 mgd in FY 2000. This corresponds to reduced drinking water demands by our customers, as well as our continuing investments in the rehabilitation and replacement of sewer lines and manholes.
- In FY 2020, the maximum month flow was 9.7 mgd, which is about 67 percent of the WWTP’s permitted flow capacity.
- The projected maximum month flows indicate that we have adequate hydraulic capacity in our treatment plant for the next 35 to 40 years assuming inflow and infiltration rates do not increase.

Regulations

- Important regulations pertaining to wastewater treatment are related to nutrient removal at the WWTP, which is described in the Mason Farm WWTP Nutrient Capacity section of this report.

- As mentioned previously in this report, PFAS are emerging compounds of concern. Drinking water and wastewater are not sources of PFAS. PFAS are present throughout the environment because they are highly persistent and have been widely used for decades, including in industrial applications, household and consumer products, food packaging, and firefighting foams. The DWR is implementing several projects associated with emerging compounds. Studies were done in 2018 to characterize the presence of these compounds in various water supply reservoirs. The results from these studies indicated that the Cape Fear River Basin was of concern in the occurrence of these emerging compounds. An effort is underway to develop an overall management strategy to reduce the levels of these compounds in the Cape Fear River Basin. As part of this strategy, DWR required utilities in the Cape Fear River Basin with significant industrial dischargers to begin investigative monitoring of their wastewater influent for PFAS. Depending on those results, utilities may be required to perform further monitoring to identify the potential sources of PFAS in their system. Once these sources are identified, the utility would be required to work with the dischargers to reduce/eliminate the PFAS compounds. While OWASA does not have any significant industrial dischargers and therefore not required to participate, we do believe it is important for us to know what is in our wastewater. In June 2019, OWASA began proactively monitoring the influent into our wastewater treatment plant and its effluent for PFAS compounds. The total PFOS/PFOA have been consistently lower than 70 ppt, the health advisory level for drinking water described earlier in this report. In conjunction with our PFAS monitoring of our treated drinking water and raw water from Cane Creek Reservoir, we will continue to monitor our wastewater influent and effluent quarterly.

Technology and Research

- A CIP project is in the final stages of construction to replace our gravity belt thickeners with rotary drum thickeners which thicken solids prior to anaerobic digestion. The rotary drum thickeners have two advantages: (1) better odor control which also extends the life of equipment in the solids thickening building and (2) better control of the solids concentration and reduced operating costs.
- Staff at the WWTP periodically evaluate the chemicals used at the plant to ensure we are using the best available to meet our treatment goals in the most sustainable manner and to ensure that we do not foresee shortages in chemicals we use which could impact treatment or their price. At this time, staff believe we are using the correct blend of chemicals, and no shortages are foreseen in their supply.
- Staff is closely following advancements in technology and actual industry experience for resource recovery at the WWTP. This includes energy generation such as the biogas to energy alternatives being evaluated as part of the Energy Management Program, nutrient recovery for beneficial reuse, and direct and indirect potable reuse. Biogas recovery strategies are being evaluated as part of the Energy Management Plan, and opportunities for greater reuse will be evaluated as part of the Long-Range Water Supply Plan.

Energy Management

The Mason Farm WWTP uses the most energy of any of our facilities. Since 2010, our electricity use at the WWTP has decreased by about 39 percent. This is largely attributable to a \$10.4 million capital improvement project that reduced electricity use, further reduced off-site odor releases, improved plant performance, and prepared us to meet future standards for treated wastewater quality. In 2018, our use of natural gas declined significantly because we restored our biogas-to-boiler system. Our use of biogas continued in 2019. Natural gas is used primarily as a supplemental fuel for running the two boilers that heat anaerobic digesters for solids treatment. Methane – or biogas – is produced as a by-product of the digestion process, and under normal operations, is used as the primary fuel in our boilers at the plant. However, from 2015 through March 2018, we had to rely almost exclusively on natural gas to heat the boilers while two digesters and our gas storage unit were undergoing major rehabilitation.

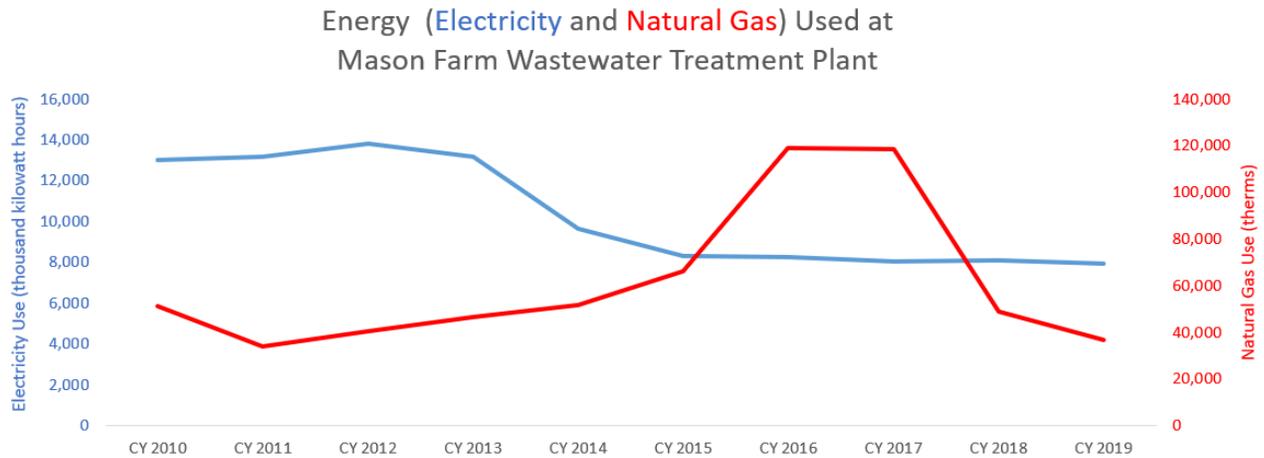


Figure 19. Energy Use at the Mason Farm WWTP

Strategic Plan Elements

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Ensuring that our wastewater treatment capacity is adequate, and timing expansions properly, helps us meet the community's wastewater needs.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to monitor growth and development activity and projections in our service area by working closely with the Towns of Carrboro, Chapel Hill, and UNC to ensure we have adequate wastewater treatment capacity for the future.	Annually with ongoing communication		X
2. Continue to inspect, rehabilitate, and replace our sewer lines when necessary to reduce infiltration and inflow.	Ongoing		X
3. Identify potential energy savings opportunities for wastewater treatment and pumping in Energy Management Program.	Ongoing	X (as part of Energy Mgmt Plan)	
4. The Partnership for Clean Water (see chapter on “OWASA’s Planning Environment”) Phase III self-assessment has been completed and is under review. We are awaiting the news on whether we received the Directors Award status. Next steps are to get to work on the identified action items.	Ongoing		X

Mason Farm WWTP Nutrient Capacity

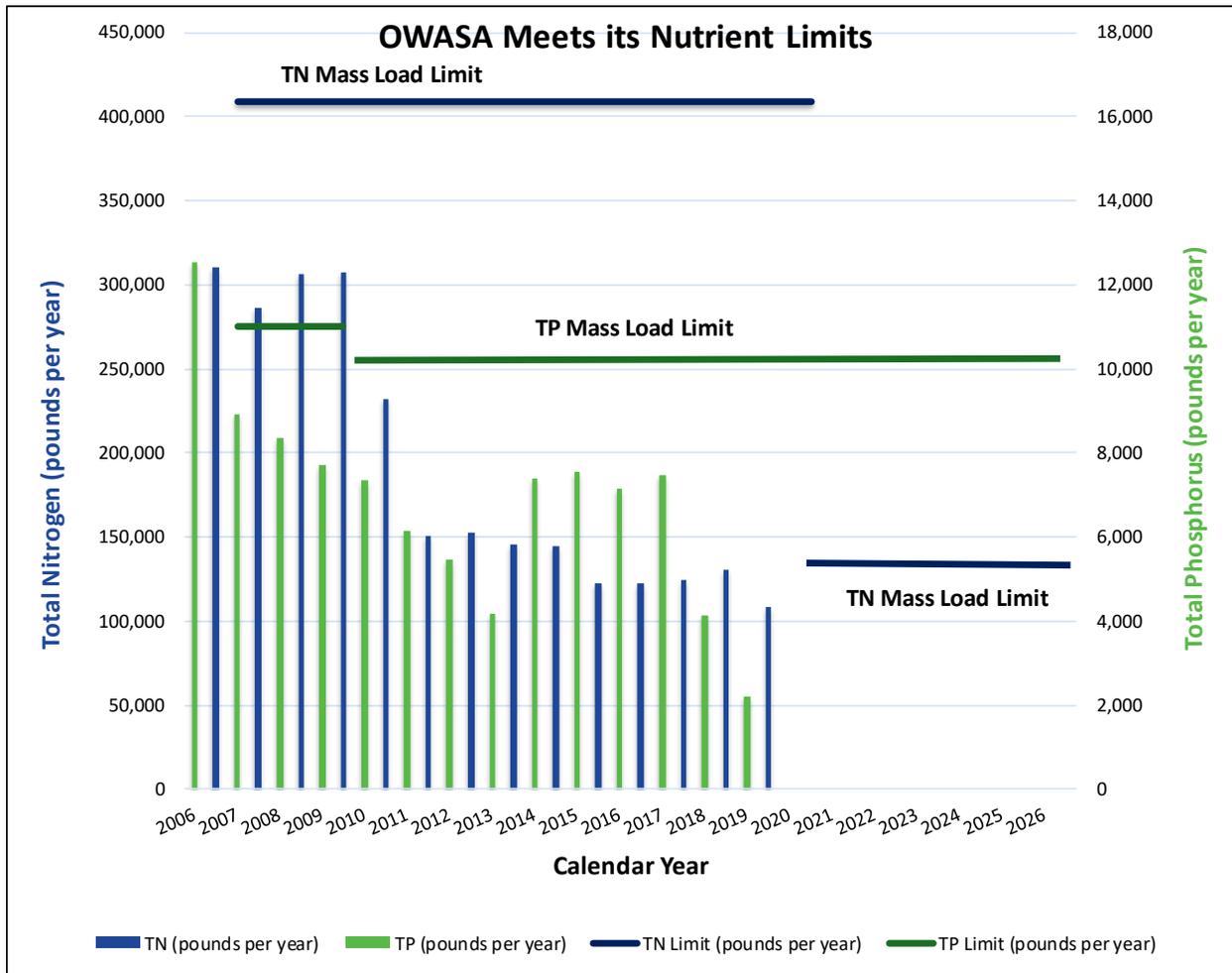


Figure 20. Mason Farm WWTP Annual Nutrient Loading

Description: The state’s Jordan Lake nutrient management rules require point sources to reduce their discharge of Total Phosphorus (TP) and Total Nitrogen (TN). OWASA’s new TN limit will apply in 2021. We report nutrient loading on a calendar year basis rather than a fiscal year basis since our permit limits for TN and TP are on a calendar year.

Key Observations:

- OWASA has met its TP limit since the annual mass load limit was first incorporated into our permit in 2007. We expect to continue to meet the limit within the 20-year planning horizon without the need for additional major capital improvements for TP removal.
- OWASA better optimized its biological phosphorus removal process which is reflected in the decrease in TP in 2018 and 2019.

- OWASA has consistently met its current TN limit, but may need to operate our filters in denitrification mode and incur considerably greater energy and chemical costs to meet the more stringent limits taking effect in 2021.

Regulations

As part of OWASA's participation in the Partnership for Clean Water, OWASA will be trying to meet 95 percent of the TN and TP limits described in this section.

Technology and Research

- OWASA evaluates the treatment technologies we have at our WWTP to ensure we can meet upcoming standards with current treatment technologies. OWASA can meet all applicable permit limits but may need to operate our filters in denitrification mode to remove nitrogen when revised limits become effective. Carbon must be added to achieve denitrification in the WWTP filters, and there are different operational, safety, financial, and environmental considerations associated with different carbon sources. We will evaluate the advantages and disadvantages of alternative carbon sources and conduct pilot and plant-scale testing as needed to inform our decisions regarding the preferred source.
- Sidestream flow is process water from the solids treatment process that flows back into the main treatment process. This sidestream flow is often high in nutrients. Sidestream treatment includes processes that capture and treat this water to reduce nutrients before returning it to the main treatment process. Sidestream treatment for greater nutrient removal is a process that may be considered for the Mason Farm WWTP if we decide to dewater a greater portion of our biosolids. Sidestream treatment would help to reduce nitrogen loading in the liquid treatment process. Modeling studies indicate that if we dewater all of our biosolids, sidestream treatment could provide annual chemical and energy cost savings of approximately \$200,000 and have a payback of less than ten years. Sidestream treatment could also provide additional process flexibility in meeting TN limits; it may also allow a rerating of the plant to a higher treatment capacity, thereby providing substantial cost savings for our customers. The City of Durham uses side stream treatment at one of its WWTPs.

Energy Management

See the section titled Mason Farm Wastewater Treatment Plant Maximum Month Flow Projections for energy use information at the WWTP. As noted above, certain advanced nutrient recovery technologies may have the potential to further reduce energy use for the liquid wastewater treatment process.

Strategic Plan Elements

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Ensuring that our wastewater treatment technology can meet permit requirements and incorporating changes in operations to meet limits helps us meet the community's wastewater needs.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Continue to monitor nutrient loadings at the plant.	Monthly		X
2. Continue to optimize denitrification performance in the aeration basins.	Ongoing		X
3. Evaluate ability of existing filters (and advantages and disadvantages of alternative carbon sources) to meet TN permit limits.	2020-2021		X
4. Evaluate benefits and costs of different nutrient removal strategies as part of Mason Farm WWTP Master Plan update.	FY 2022		X

Reclaimed Water

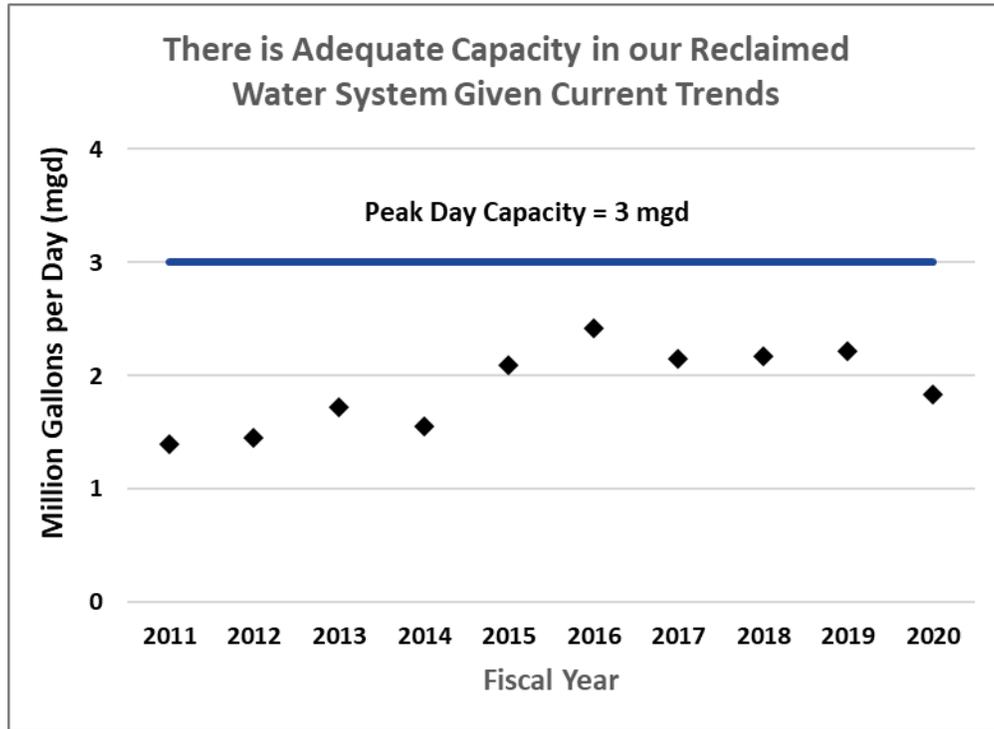


Figure 21. Reclaimed Water System Capacity and Demands

Description: This trend tracks historical annual peak day reclaimed water (RCW) demands and compares those against the peak day capacity of the Mason Farm WWTP’s RCW system.

Key Observations:

- The majority of RCW is used for chilled water and irrigation of landscaping and athletic fields and these demands peak during warm months (April-October). Demands are typically lower during cold months (November-March).
- Peak daily demand of 2.4 mgd occurred in August 2016 when it was very hot and humid. The RCW system is currently configured to meet a total peak day demand of 3 MGD (average daily demand of 1.2 MGD); however, the system is designed and constructed to allow cost-effective expansion to 5.2 MGD by adding only an additional transfer pump and additional chemical feed system capacity (if that feed system is deemed necessary).
- There is no anticipated significant change in demand for the next 15 years, and therefore the RCW system can meet projected RCW demand for the foreseeable future.

Regulations

There are no upcoming regulations to report for our RCW system.

Technology and Research

One aspect of reuse is recycling water within a building, which has been done in other parts of the country. One example (Solaire) is a high rise building in New York City which uses various filtration (membranes) and disinfection (ultraviolet light) technologies to produce reclaimed water that is beneficially recycled within the building and used for flushing toilets, cooling tower make-up water, and irrigating the green roof. The WaterHub at Emory University is an onsite wastewater reclamation system which uses ecological processes and stormwater capture to meet the campus's nonpotable water demands. A similar stormwater capture and treatment system is being planned for Chatham Park in Chatham County. These types of facilities were evaluated as part of the update to the Long-Range Water Supply Plan, but are not cost-effective at this time.

Energy Management

In February 2015, we began sub-metering and monitoring the energy uses of a few specific processes at the WWTP, including the RCW system. The RCW system is not just important for its impact on our use of raw water resources, but it is a more energy-efficient way to meet demands. The energy required to treat and deliver reclaimed water is about 20 percent less than that is required to treat and deliver raw water to the community.

Strategic Plan Elements

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Ensuring that our RCW system capacity is adequate will help meet the community's water needs. This also ties to Strategic Initiative 1; the use of RCW reduces the demand on our drinking water supplies which will help meet our community's long-term water supply needs. Finally, the use of RCW uses less energy than treating and delivering raw water, which ties to Energy Management Program in Strategic Initiative 4.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Verify RCW meters are properly calibrated and recording flows accurately.	Annual		X
2. Closely monitor RCW demands in order to ensure RCW system capacity expansion is planned, designed, and funded in time to meet future demands.	Ongoing		X
3. Pursue cost-effective opportunities to expand the RCW system to serve non-drinking water demands of non-UNC customers as new growth and development/redevelopment occurs.	Ongoing – evaluated some options as part of LRWSP update	X	
4. Begin work to add corrosion inhibitor and investigate conductivity levels to ensure water meets UNC needs.	FY 2021		X

Biosolids

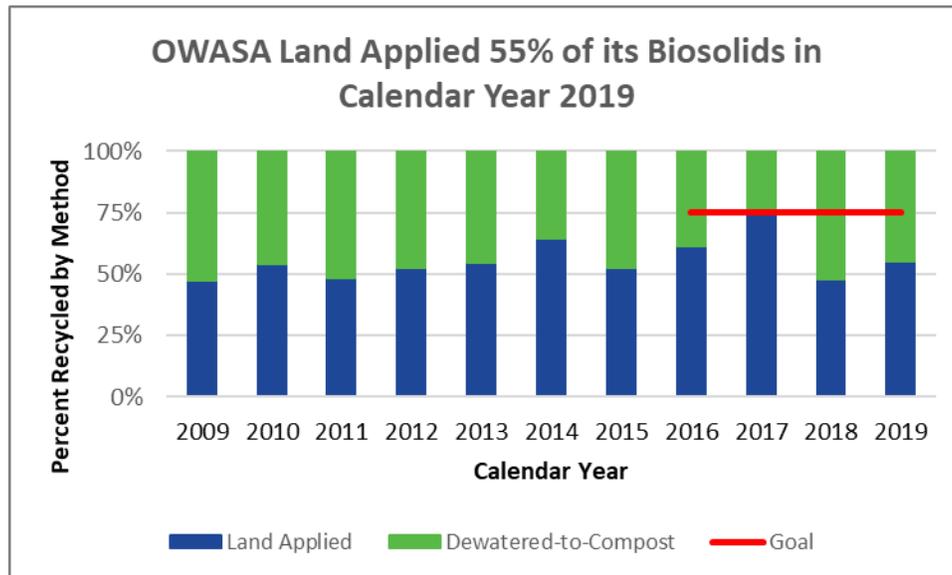


Figure 22. Historic Biosolids Application

Description: This trend evaluates the amount of biosolids which OWASA applies to land and the amount it dewateres for composting. The WWTP produces about four dry tons of biosolids each day. Most of this is applied in liquid form to agricultural land and a portion is dewatered to the texture and consistency of moist soil and transported to a private composting facility in Chatham County. For the liquid form, OWASA has 1,336 acres of farm land in Orange, Chatham and Alamance counties available for its Class A land application program (see Figure 23). 89 percent (1183 acres) is privately owned. The remaining 153 acres are owned by OWASA as part of a 700-acre tract west of Orange Grove Road in Orange County. At its October 8, 2015 work session, the Board of Directors agreed that OWASA’s goal is to apply 75 percent of our biosolids in liquid form, and to dewater 25 percent of our biosolids. The Board of Directors understands that there are factors including weather conditions which may keep staff from meeting the goal.

Key Observations:

- From CY 2009 to CY 2014, OWASA consistently land applied about half of its biosolids and dewatered and composted the remaining half.
- In CY 2019, OWASA land applied 55 percent of its biosolids and did not meet the goal. Our ability to meet this goal is dependent in part on weather and staffing. Our opportunities to land apply biosolids were limited in 2019 due to wet conditions and short-staffing. Instead, we dewatered higher amounts of biosolids while meeting all applicable regulatory requirements for our biosolids treatment and recycling program.

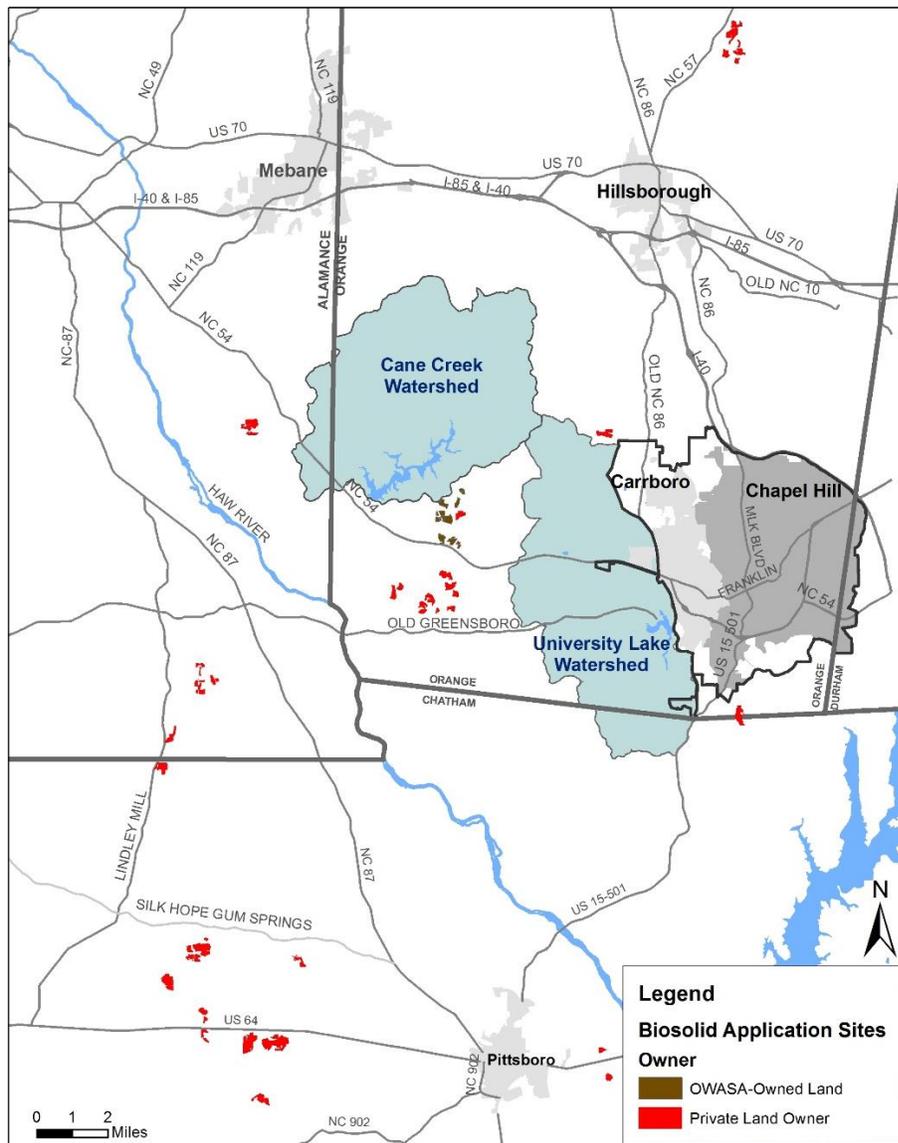


Figure 23. OWASA Biosolids Application Sites

Regulations

Federal and state regulations specify the agronomic rates at which biosolids may be land applied for designated crops (the maximum amount of biosolids that can be applied to a given field is currently determined by the nitrogen content of the biosolids and is limited to the nitrogen requirements of the particular crop to which it is being applied). OWASA closely monitors the application rates on each individual field and historically has applied at rates well below the maximum allowed by regulation. Some states also limit land application of biosolids based on the phosphorus content of the biosolids and the soil; however, North Carolina does not have such a loading limit. If North Carolina adopts this

approach, the amount of land needed to support our land application program would increase considerably.

The NC Department of Environmental Quality (DEQ) modified its regulations concerning biosolids in September 2018. The modifications reduced the set back from streams for Class B biosolids from 100 feet to 32.8 feet, and Class A setbacks remained at 100 feet. The state indicated that General Statute 150B-19.3(a) prohibits agencies from adopting a rule that imposes a more restrictive standard, limitation, or requirements than those imposed by federal law or rule. There is no federal setback requirement for Class A residuals and hence the existing 100-foot state requirement remains.

EPA is developing a risk assessment to evaluate the potential public health impacts of PFAS in biosolids. As described in other sections, staff follows ongoing work regarding PFAS.

Technology and Research

Information on technology concerning our solids thickening process is provided in the Mason Farm WWTP section.

Energy Management

The primary energy uses of OWASA’s biosolids management program are for vehicle fuel, biosolids loading, running the rotary press for dewatering, treating the nutrient-rich dewatering filtrate loads returned to the aeration process, and mixing the biosolids holding tanks.

Strategic Plan Elements

Strategic Initiative 3 includes a goal to make the right investments at the right time, and to base this information on our asset management program. Ensuring that our biosolids program meets federal and state requirements and protects public health, helps us meet the community’s wastewater needs.

Actions Needed

Action Items	Timing	Board Action?	
		Yes	No
1. Evaluate the 75 percent liquid land application goal and report our performance to the Board	Annually as part of this report		X
2. Evaluate the amount of land in our biosolids program to ensure it is adequate to meet liquid land application goal	As needed (if farmers drop out of program)		X