

The background of the entire page is a photograph of a data center aisle with rows of server racks. The image is heavily stylized with a blue color scheme. There are numerous glowing white dots and lines, resembling a network or data flow, overlaid on the server racks. The text "Water Solutions for Data Center Operations" is prominently displayed in the lower half of the image, overlaid on the blue-tinted server racks.

# Water Solutions for Data Center Operations





# Water is all we do. And we do it like no one else.

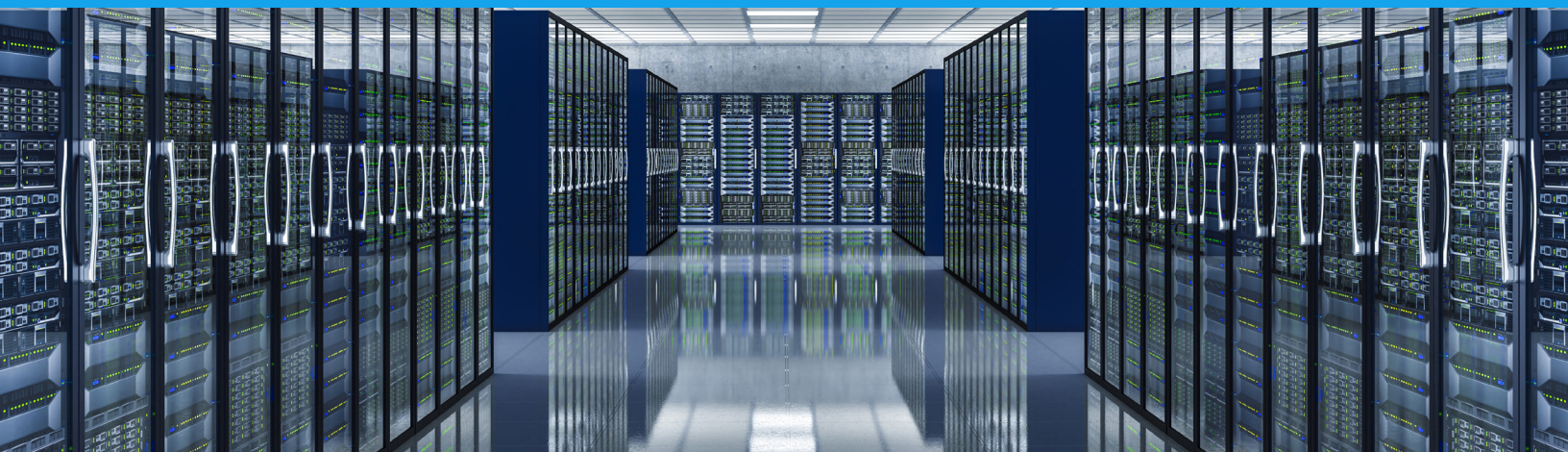
As the largest water-focused engineering firm in the country, Carollo offers engineering services to maximize the value of your water resources, reduce operational risks, meet regulatory requirements, and enhance your bottom line.

Today's complex water challenges require creative solutions. For nearly 90 years, we have dedicated ourselves to advancing the application of water science and technology. With more than 30,000 water and wastewater projects to our name, our engineers and scientists offer integrated, proven solutions to meet your financial operational, resilience, and sustainability objectives. At Carollo, our team:

❖ **Recognizes All Water has Value.** Carollo has been at the forefront of potable and non-potable water reuse, with significant work in research, planning, permitting, and design.

❖ **Provide Holistic Solutions.** We develop water resource and climate mitigation solutions that address our clients' challenges and benefit our customers and their communities.

❖ **Improve and Achieve Resiliency.** Our solutions embed adaptive measures into projects and develop approaches to better manage water now and in the future.



# Effective Water Management

Water is essential to your processes and productivity, yet supplies are scarce, competition is fierce, and public scrutiny over water practices is significant. At Carollo, we work with industrial and hi-tech clients to solve complex water challenges through innovative solutions that drive productivity, facility and system reliability, and overall profitability. Our services include:

- **Water supply planning, water use assessments, and facility master plans** to optimize water resources, achieve maximum water value, and reduce risks that could lead to facility outages/shutdowns and cost impacts.
- **Best value solutions** through holistic design, planning, and construction management offerings.
- **Advanced treatment technologies** that meet your specifications for process, wastewater pretreatment, cooling water treatment and beneficial reuse.
- **Creative public-private partnerships** for joint water management, project funding development and ownership, and operational improvement opportunities.
- **Cost-effective initiatives** for water recycling and gray water reuse to minimize your impact on fresh water supplies, reduce your operational costs, and maximize opportunities for growth.
- **Climate resiliency** to assess the vulnerability and risk mitigation of water supply and assets over the long term.
- **Best management practices and strategies** for reducing water footprints, and managing waste and discharge.
- **Full compliance** with regulatory and safety requirements.
- **Blue Plan-it® Decision Support System** that provides a fully customizable simulation and optimization modeling tool to help you cost-effectively evaluate, optimize, expand, and/or modify your water and wastewater treatment systems and infrastructure.



# Effective Water Management

Carollo can support your Data Center Needs at every Step of the process from site development through the successful operation. Data center technology is evolving every second, maintaining five 9s availability, speed to market being one of the most difficult challenges, and the reduction of harm to the environment are critical components of a successful operation.

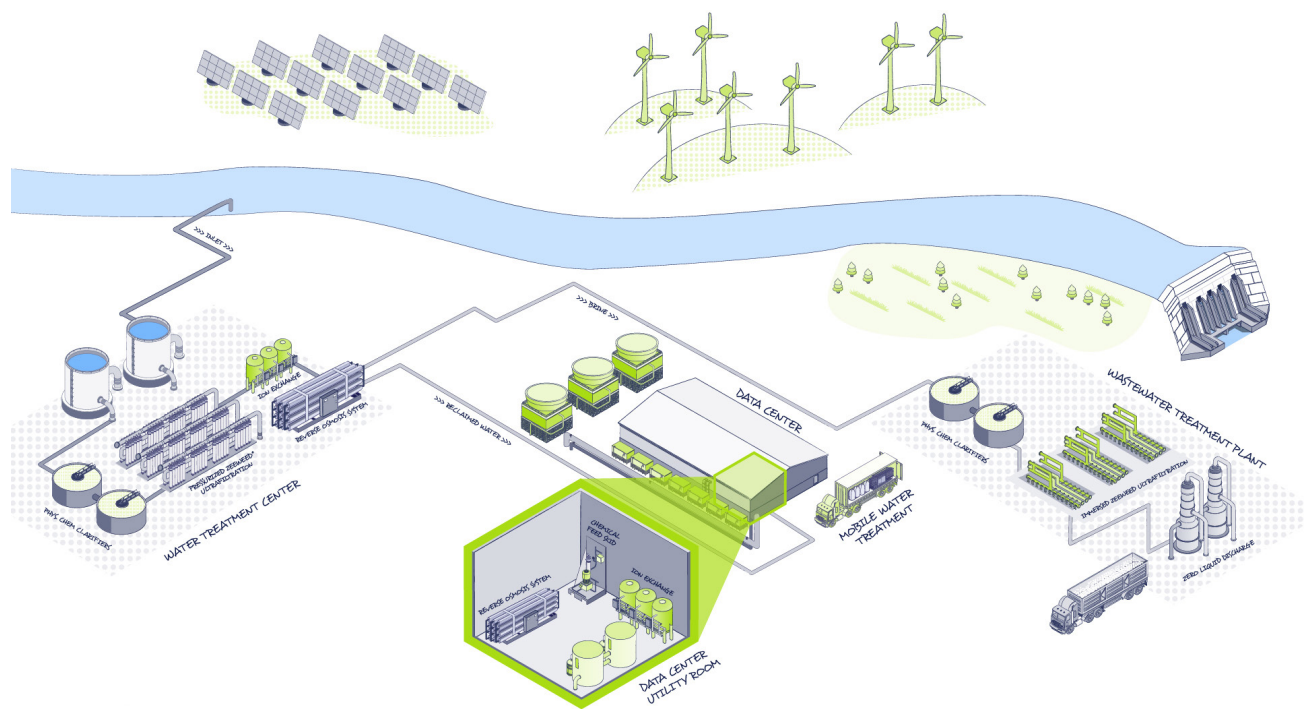
At Carollo our knowledge base and unique combination of chemical water treatment and equipment solutions, we are the right choice to provide guidance from site selection all the way through successful operations. We partner closely with each of our clients to ensure they meet their business compliance, quality, environmental, and customer service needs. At Carollo we can help our clients deliver water management solutions so they can focus on building and operating reliable and sustainable data centers.

Water supply and wastewater discharge are critical factors in siting and operating large data centers. Hyperscale data centers require large cooling infrastructure to remove heat. Evaporative cooling systems can require millions of gallons per day of a reliable water supply, while also continuously producing a concentrated blowdown that requires treatment and discharge, or reuse. Data center water strategies and infrastructure have a significant effect on facility cost, reliability, and vulnerability. Carollo collaborates with our clients on these crucial elements throughout the project lifecycle, from site selection through long-term operations. Early engagement can lead to greater opportunity for the development of water and wastewater management strategies that minimize financial, operational, and reputational risks. This approach empowers clients to be more competitive and better meet their reliability and sustainability commitments to customers. We implement smart water management strategies that minimize the water footprint, reduce total costs of ownership, and reduce the risk profile of your investment and operations.

**Water Management Planning:** Identifying and evaluating supply alternatives, analyzing risks and opportunities, and forecasting short and long-term impacts to improve cost certainty and resilience.

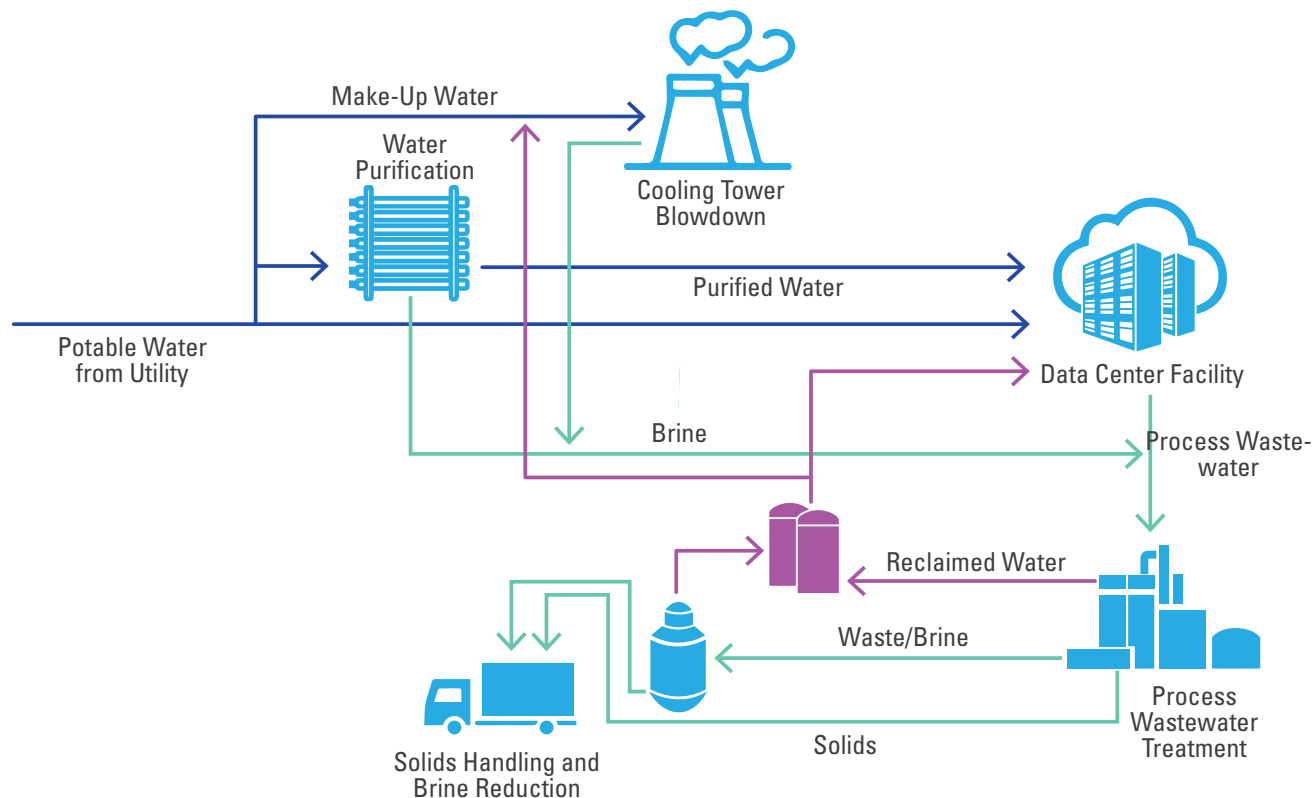
**Design and Design-Build:** Design for design-build, owner advisor, and full-service provider, taking sole responsibility for project delivery from concept through start-up.

**Sustainability:** Creating roadmaps and prioritizing actions to advance water stewardship goals that focus replenishment investment on the greatest impact and measurable progress towards sustainability commitments.





# Process Management



## WATER SYSTEMS PLANNING AND MANAGEMENT

- Pilot and Treatability Studies
- Strategic Planning
- Water Supply and Resource Evaluations
- Area Characteristic Studies
- Water Conservation Alternative Evaluations
- Resource Alternative Studies
- Water Use Assessments and Financial Planning
- Asset Management
- Information Management and Integration
- Electronic Operations and Maintenance Manuals
- Risk Evaluation and Management
- Cooling Tower/System Performance Optimization

## RESEARCH AND DEVELOPMENT

- Water Quality Evaluations
- Treatability Analysis
- Optimization Studies (Blue Plan-it®)
- Pilot and Bench-Scale Testing
- Computational Fluid Dynamics

## TREATMENT TECHNOLOGIES

- Arsenic Treatment
- Biological Treatment
- Brine Management and Brine Reduction
- Softening
- Low-Pressure Membranes
- Heavy Metals Treatment
- Desalination (RO/EDR/FO)
- UV Disinfection
- Specialized Waste Treatment of Industrial Contaminants

## DESIGN

- Full Multi-discipline Design Services
- Balance of Plant Design to Support Vendor-specified Systems
- Redundancy and Resiliency Design Aspects
- Permitting and Compliance

## PROJECT DELIVERY SERVICES

- Construction Procurement and Management
- Construction Administration and Inspection
- SCADA Programming
- Startup and Commissioning
- Facility Operations
- Alternative Delivery Expertise including Design-Bid-Build, Design-Build, and CMAR

# Data Center Services

Providing clean, safe water to support your operations is all we do. That singular focus gives us a unique perspective, creating practical yet innovative solutions born of passion and dedication. Below you will find a list of specific services we offer our data center and hi-tech clients:



## **SITE / FACILITY DUE DILIGENCE**

Comprehensive projects require thorough due diligence and thoughtful comparison of potential alternatives based on overall life-cycle cost-benefit. Typical considerations include capital costs, operations costs, years of planned operations, number of installations, efficiency, ease of operation, safety, permitting, proprietary considerations, and longterm support of the technology or solution.



## **WATER SUPPLY PLANNING**

Water supply planning is an integral component of longer-term regional and local comprehensive planning. Understanding the region's long-term water supply availability and demand, as well as the watershed management and limitations are critical to identifying facility water sources.



## **WATER AND WASTEWATER INFRASTRUCTURE**

Infrastructure is critical to all water, wastewater, and stormwater systems. However, it's also one of the most resource and maintenance intensive investments that clients make. Carollo is committed to working with our clients on planning and designing efficient, sustainable infrastructure, as well as identifying cost-effective maintenance and retrofit options that support the overall health of your operations.



## **WATER REUSE**

Water reuse is the future. With climate change, population growth, limited water supply, and other issues facing our world today, we must look toward recycled water to meet our long-term needs. Carollo has long been a leader in the engineering and design of water reuse systems.



## **WASTEWATER COMPLIANCE**

Wastewater or process water discharge compliance is becoming ever more challenging with the continually increasing regulatory drivers for known and emerging contaminants. Carollo's waste/process water experts have advised numerous clients on improving and meeting effluent discharge requirements through optimization of existing treatment facilities or design of more advanced treatment systems.



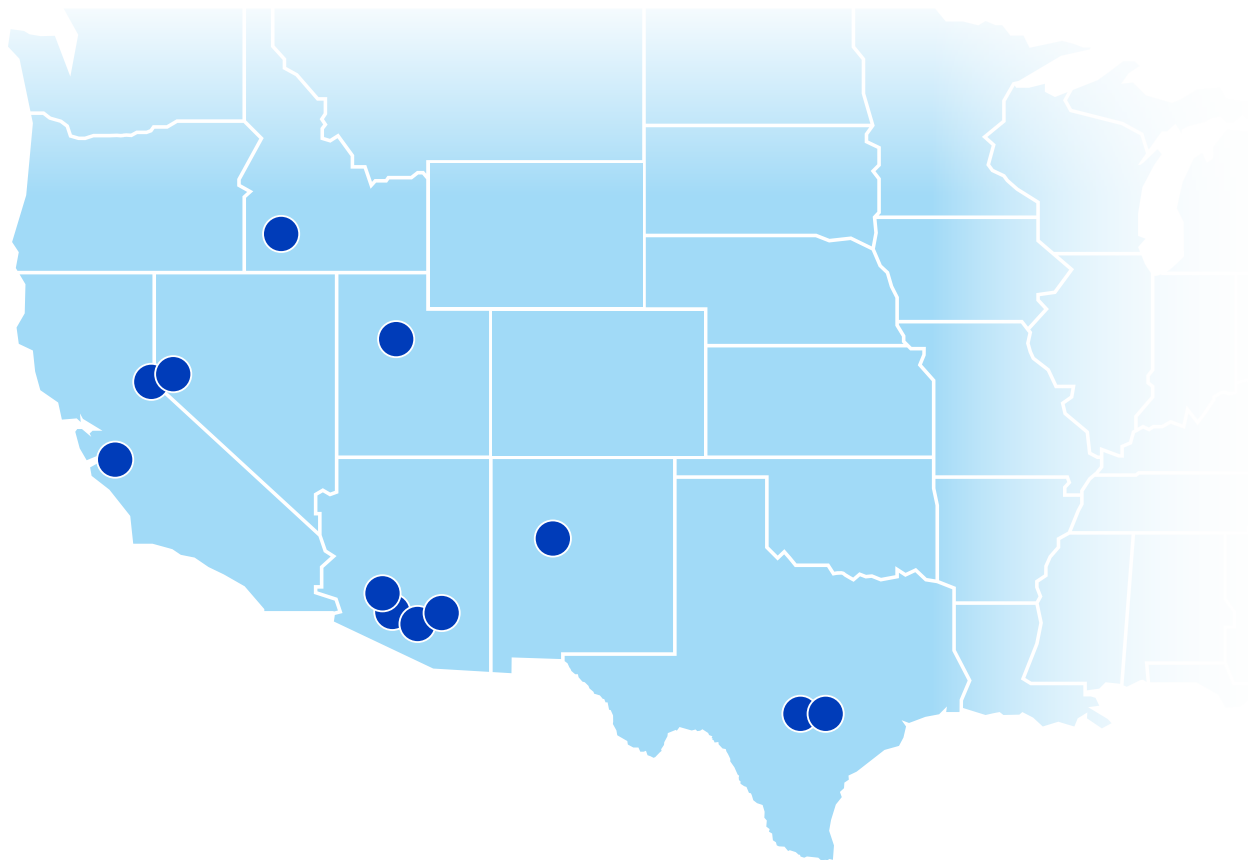
## **BRINE MANAGEMENT**

Brine management must be approached holistically and can often be the most challenging aspect of advanced water treatment, requiring potentially high cost solutions to address. Carollo offers a considerable depth of experience gained through designing desalination and advanced water reuse facilities for a wide range of local and national industrial clients.

# Project Success Stories

At Carollo we take immense pride in our track record of success, having successfully executed 14 data center projects, each uniquely tailored to the distinct needs of our clients. With a diverse portfolio that spans nine different clients, we've earned our reputation as a trusted advisor in the ever-evolving landscape of the data center industry. Our unwavering commitment to precision, efficiency, and the highest standards of quality has made us a go-to partner for some of the most prominent names in the data center world. As you delve into our project experience section on the following pages, you'll discover how our expertise and dedication translate into exceptional solutions that drive the future of data center technology.

You'll see in the map below that the majority of our data center projects have been completed in arid landscapes of the Southwest, where water is a precious and finite resource. Carollo recognizes that here and in other regions, every drop of water counts and being stewards of these limited resources is one of our paramount concerns. Our expertise shows that we meet the complex demands of data center technology but also ensure a greener and more sustainable future for the Southwest and beyond.







## **WATER RESOURCES EVALUATION**

*Confidential Data Center Client | Reno, Nevada*

As part of this study, Carollo evaluated the client's potential water resources from several standpoints - focusing on identifying solutions that maximize available water resources, minimize capital and O&M costs, meet current and proposed regulations, and promote sustainability. Carollo used the dynamic modeling tool Blue Plan-it® to optimize the cooling water quality, quantity, and cycles of concentration based on TDS discharge limits imposed by the utility and the silica, barium, and chloride fouling limits inherent in cooling tower operations. The simulation tool allowed our client to see various water treatment supply and blowdown treatment alternatives side by side.



## **WATER AND WASTEWATER ENGINEERING SUPPORT**

*Confidential Data Center Client | Multiple Campus Locations*

Carollo has been involved in numerous water, wastewater and infrastructure projects for this confidential data center client. Driven by the client's objective of long term sustainability and climate resiliency, we have been engaged in projects to provide advisory services related to facility location due diligence and investigation for the development of new data centers focusing on water reliability and reuse. In addition, Carollo is the Owner's Advisor on the design of a new data center water supply and wastewater treatment system and associated piping and pumping infrastructure for this multiphase facility.



## OFF-SITE WATER AND SEWER PIPELINES

*Confidential Data Center Client | Chandler, Arizona*

As part of a Design-Build team, Carollo provided design and construction services for off-site municipal potable water pipelines and gravity sanitary sewer pipelines to support the initial phases of the data center construction. The project included preparing water and sewer system studies establishing design capacities and sizing for the water, domestic and industrial sewer for the new facilities. The project included 12,500 LF of 16-inch water main and 4,500 LF of 12- and 15-inch sanitary sewer main. In addition, Carollo conducted a detailed evaluation to assist the client in developing water supply and cooling tower blowdown treatment options to support their projected growth. The evaluations resulted in development of a phased implementation approach that supported the financial and operational goals of the client.



## WATER OPTIMIZATION STUDY

*CyrusOne | Chandler, Arizona*

CyrusOne planned to use water-intensive Indirect Direct Evaporative Cooling (IDEC) Units for climate control. While the City's allocated water was sufficient for the first phase of development, the company's future phases called for additional water and/or more efficient water use to sustain operations. Carollo evaluated potential internal and external mechanisms to maximize the utilization of the company's IDEC technology based on available water quantity, water quality and discharge limitations. Services consisted of site/utility planning, water quality analysis, water usage assessment, and the completion of a treatment study with alternatives. CyrusOne used the findings to secure and manage on-site water resources that support near-term and long-term expansions and business objectives.




























### CAMPUS-WIDE WATER REUSE PROJECT

*Confidential Technology Client | Austin, Texas*

To facilitate the rapid growth of this expanding technology company, a new campus has been under development in Austin, Texas. In an effort to improve water use sustainability and resiliency for this campus, the Owner elected to contract for an innovative new wastewater reuse system. Carollo was engaged as the Owner’s Advisor to assist in evaluating the technology planned for the reuse system, reviewing drawings of the system, helping coordinate between manufacturers, vendors, and contractors, and to aid in the construction review process. This work is ongoing and is expected to last for the next two years. The end result of this project will be a system that reuses all campus wastewater and harvests water from the municipal sewer system to minimize the Owner’s impact on both water supply and wastewater discharge. Water will be reused in campus toilet systems, cooling towers, landscaping, and other utilitarian uses.

REPRESENTATIVE PROJECT EXPERIENCE	SITE / FACILITY DUE DILIGENCE	WATER SUPPLY PLANNING	WATER AND WASTEWATER INFRASTRUCTURE	WATER REUSE	WASTEWATER COMPLIANCE	BRINE MGMT.
Water Resources Evaluation - Confidential						
Off-site Water and Sewer Pipelines - Confidential						
Water and Wastewater Engineering Support - Confidential						
Water Optimization Study - CyrusOne						
Campus Wide Water Reuse Project - Confidential						





[carollo.com](http://carollo.com)



Carollo's commitment to the water industry has been a hallmark of the company since our inception in 1933. This single-minded focus allows us to deliver innovative water solutions, a collaborative environment, and exceptional client service. Our passion about ALL water systems means we strive to sustainably maximize the use and benefits of this precious resource.