WATER SOLUTIONS
for Hi-Tech Operations

Engineering services to maximize the value of your water resources, reduce operational risks, meet regulatory requirements, and enhance your bottom line.
For more than 85 years, we have dedicated ourselves to advancing the application of water science and technology. With more than 25,000 water and wastewater projects to our name, our engineers and scientists offer integrated, proven solutions to meet your financial and operational objectives, including:

- **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** end-to-end through holistic design, planning, and construction management offerings.
- **Advanced treatment technologies** that meet your specifications for process, wastewater pretreatment, reuse, and cooling water treatment.
- **Creative public-private partnerships** for joint water management opportunities.
- **Cost-effective initiatives** for water recycling and gray water use to minimize your impact on fresh water supplies, reduce your operational costs, and maximize opportunities for growth.
- **Best management practices and strategies** for reducing water footprints, waste, and discharge.
- **Full compliance** with regulatory and safety requirements.
- **Blue Plan-It® Decision Support System** provides a fully customizable simulation and optimization modeling tool to help you cost-effectively evaluate, optimize, expand, and/or modify your water and wastewater systems.

Effective Water Management... Your Success Depends on it.

Water is essential to your processes and productivity, yet supplies are scarce, competition is fierce, and public scrutiny over water practices is severe. 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.
Trusted Water Experts for Reliable Solutions

Water is our focus, our business, and our passion. Since all of our work focuses on water, we lead the way in offering technically sound, reliable planning, design, and construction related services that maximize value for all of your water related challenges. Carollo provides an experienced and skilled planning, design, construction support, start-up, and commissioning team. In addition, we can provide turnkey design-build-operate-finance solutions for any size project. As your trusted partner, we will manage your water so you can manage your core business.

UNPARALLELED EXPERTISE

Projects with complex water challenges require experts who know water. While other engineering firms cater to multiple markets, water is all we do. This singular focus means you will collaborate with the best and brightest water professionals who share your goals for optimizing your water and wastewater systems, while minimizing your capital and operational costs. Our staff includes civil, structural, electrical, mechanical, and I&C engineers along with planners, architects, CAD designers, programmers, and construction managers. With our technical expertise and institutional knowledge, we put our clients ahead of the curve.

INNOVATIVE, VALUE ADDED SOLUTIONS

At Carollo, we combine creativity, applied research, and technology with sound engineering to deliver cost-effective and valuable solutions. Carollo’s Research Group supports projects with cutting-edge treatment technologies, improved operations practices, and insights on major trends in the water and wastewater industry. Our in-house research capabilities and team of industry-leading engineers allow us to evaluate your unique water requirements and provide answers that maximize productivity, minimize your water footprint, and help avoid costly issues. Our Sustainability Group rounds out our services with strategies that integrate sustainable principles into all that we do.

SUPERIOR SERVICE AND PERFORMANCE

Engineering News Record consistently ranks Carollo among the nation’s top design firms for water and wastewater engineering design services. We achieve this status through our consistent commitment to quality service and our track-record of delivering tailored, high-performing water management systems. We take tremendous pride in helping some of the top municipal, hi-tech and industrial clients in the world solve their most important water challenges.
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 Performance Optimization

Design
- Full Multidiscipline Design Services
- Balance of Plant Design to Support Vendor-specified Systems
- Permitting and Compliance

Treatment Technologies
- Arsenic Treatment
- Biological Treatment
- Brine Management and Brine Reduction

- Softening
- Low-Pressure Membranes
- Heavy Metals Treatment
- Desalination (RO/EDR/FO)
- Perchlorate Treatment
- Selenium Treatment
- UV Disinfection
- Specialized waste treatment of industrial contaminants

Research and Development
- Water Quality Evaluations
- Treatability Analysis
- Optimization Studies
- Pilot and Bench-Scale Testing
- Computational Fluid Dynamics

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
Our Industrial/Hi-Tech Services Group provides comprehensive services for managing potable water, process water, cooling tower blowdown, wastewater, and reuse water. As one of the largest water-focused engineering firms in the U.S., we deliver innovative, quality solutions customized to meet your water management needs.

**Diversified and Focused Services**

**INDUSTRIES SERVED**

AEROSPACE  
BIOTECHNOLOGY AND PHARMACEUTICALS  
FOOD AND BEVERAGE  
PAPER AND PULP MANUFACTURING  
SEMICONDUCTOR MANUFACTURING  
DATA CENTERS  
GENERAL MANUFACTURING  
APPAREL AND TEXTILE MANUFACTURING
REDUCING COST BY TREATING AND REUSING INDUSTRIAL WASTEWATER
Confidential Pharmaceutical Client | California

Currently, the facility uses City water in several manufacturing processes and the resultant waste streams are discharged to the sewer. The primary water demands include the manufacturing and clean-in-place operation, cooling towers, and steam boilers. The client hired Carollo to complete a critical study to identify and then evaluate potential opportunities to conserve city water and reduce discharges to the sewer.

Two treatment configurations were considered. The first was a membrane bioreactor (MBR) to aerobically treat the COD concentration of the wastewater stream and produce a filtered water that could be reused in the process. The second approach included the use of physical membrane barriers to separate the solids and organic matter from the water. In the latter concept, an initial microfiltration (MF) step removes most of the suspended material, and a downstream reverse osmosis (RO) step removes the organic material and most of the remaining inorganic salts.

Carollo prepared capital and operating cost estimates for the two treatment configurations. The physical membrane treatment approach was estimated to be more cost effective and had the added benefit of producing RO quality water, allowing for further recycle and resulting in a 3-year payback period. As a result of this study, the client again engaged Carollo to embark on bench scale testing to confirm the proof of concept treatment configuration and is proceeding with pilot testing of the MF/RO combination.

BRINE MANAGEMENT DESIGN PROVIDES COST-EFFECTIVE, FLEXIBLE SOLUTION
Confidential Semi-Conductor Client | Arizona

Carollo provided design and construction management services for a new brine management system featuring pretreatment, high efficiency reverse osmosis, and thermal concentration technologies. The primary treatment train includes conventional lime softening using high-rate clarifiers, granular media filters, ion exchange, RO with energy recovery, a re-purposed brine concentrator, and brine evaporation ponds. The solids stream treatment features backwash equalization, thickened sludge storage, and solids dewatering using belt filter presses. The system also includes various chemical storage and feed systems, including lime silos and associated batching systems, caustic soda, carbon dioxide, polymer, magnesium chloride, ferric chloride, and hydrochloric acid.

The project team’s innovative design resulted in a solution that eliminates sewer discharge, produces high-quality permeate for reuse on-site and at the facility’s adjacent industrial campus, and provides long-term opportunities to discontinue or significantly minimize use of off-site brine ponds. It also offers the client and the City of Chandler operational flexibility for managing variable water quality and reducing O&M costs associated with chemical usage and solids handling.
HOLISTIC WATER RESOURCES EVALUATION OPTIMIZES WATER MANAGEMENT AND PROMOTES COST SAVINGS

Confidential Data Center Client | Nevada

To support construction of a 500-acre colocation data center campus that will require water for cooling systems and domestic purposes, the client requested Carollo complete a master plan of the water resources to coordinate with the construction of seven facilities over a period of two decades. The process and domestic water will be provided from various sources, each with varying water quality. These water sources could be treated and/or blended to meet quantity and quality requirements to support operational and growth objectives. Carollo worked with the client, the utilities, and water providers to determine the optimum water source and associated treatment for each phase, based on capital and O&M costs, as well as other non-cost factors, including reliability and sustainability. To ensure the data center would remain available for customers, Carollo performed a water reliability analysis to recommend improvements to the infrastructure currently in place. The analysis included evaluating the water resources from several standpoints: identifying solutions that maximize available water resources, minimizing capital and O&M costs, meeting current and proposed regulations, and promoting sustainability.

Carollo used the dynamic modeling tool Blue Plan-it® to optimize the site’s projected 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 the client to see various water treatment supply and blowdown treatment alternatives side by side. Options were evaluated relative to cost and non-cost factors, including evaporation pond size, water resource savings, and ease of operations. Carollo provided specific recommendations critical to planning, such as an implementation timeline, the size of evaporation ponds to install, and a budgetary lifecycle cost estimate, with the recommended approach expected to result in significant water resource savings and associated capital and O&M savings. The Water Resources Evaluation provided a holistic view of the near- and long-term solutions to best address this complex, interconnected water issues.

WATER OPTIMIZATION STUDY GUIDES DATA CENTER EXPANSION

CyrusOne | Chandler, Arizona

CyrusOne, a global provider of enterprise data colocation services, broke ground in 2012 with the first phase of its slated 1-million-square-foot data center. As part of its expansion planning, CyrusOne retained Carollo for a Water Optimization Conceptual Alternatives Study.

CyrusOne was planning to utilize 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 call 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 is using the findings to secure and manage on-site water resources that support near-term and long-term expansions and business objectives.