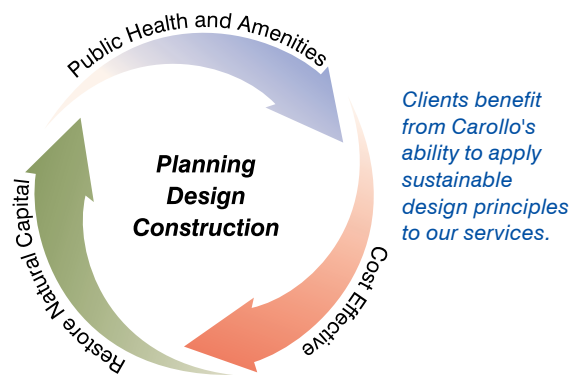


Improving the World's Water Through Sustainable Design

Carollo Engineers provides our clients with solutions in the water, wastewater and water resources industries that incorporate sustainable design principles and employ innovative strategies and technologies. Our solutions promote long-term cost savings, improve community amenities and relations, and restore the environment – the tenets of the “triple bottom line” of sustainability.

We build on more than 75 years of project delivery experience to create successful solutions for our clients. Our services cover all phases of municipal water and wastewater projects, from studies and master plans, through facility and financial planning, design, construction management and operations support. Carollo works with clients to develop optimal water, wastewater and infrastructure systems and facilities. By integrating our client's community values and goals with our knowledge of water resources, science-based research, cutting edge technology, and our business-based decision and stakeholder consensus building techniques, we provide our clients with comprehensive services that integrate sustainability into their projects.

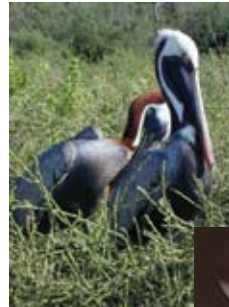


Clients benefit from Carollo's ability to apply sustainable design principles to our services.

We have developed a broad range of sustainable services to provide to our clients. Our services can be tailored to your needs and include:

- ▼ Asset management.
- ▼ Sustainability assessment.
- ▼ Scientific process optimization.
- ▼ Energy efficiency evaluation.
- ▼ Ecological footprint evaluation.
- ▼ Green building (LEED™) design.
- ▼ Financial services.
- ▼ Life-cycle cost and benefit analysis.

- ▼ Integrated water, stormwater and wastewater planning.
- ▼ Water reuse planning/design.
- ▼ Watershed management.
- ▼ Wetlands treatment.
- ▼ Research and pilot testing of innovative technologies for water/wastewater treatment.
- ▼ Public involvement.
- ▼ Decision support analysis.
- ▼ Sustainability policy and program development.
- ▼ Educational workshops.
- ▼ Grant funding research and writing.



"Sustainable human communities meet their current needs without compromising other species and future generations." – International Council for Local Environmental Initiatives



Sustainability in Our Industry

The water/wastewater/reuse industry indirectly supports sustainability through activities that protect public health and restore the environment. Challenges including resource scarcity, increasing costs, and evolving regulations are driving our industry to more directly adopt sustainable practices. Our planning and sustainable design services can help our clients realize a number of benefits including:

- ▼ Cost savings over life of facility - improved efficiencies in energy and other resource usage; reduced capital cost through use of fewer materials.
- ▼ Higher quality and reliability - optimized treatment processes.
- ▼ Improved public perception and regulator relations - “doing the right thing.”
- ▼ Improved community amenities - parks, education, wildlife habitat.
- ▼ Reduced environmental impacts.

"Dedicated to creative, responsive, quality solutions for those we serve."

Carollo follows a whole systems approach to sustainability organized around four central principles:

- ▼ **Efficiency.** Minimize water, energy, and materials use, and undesirable residuals generation.
- ▼ **Reuse.** Regard wastewater, stormwater, and biosolids as valuable resources.
- ▼ **Integration.** Use a watershed perspective as an organizing framework to integrate water/wastewater/stormwater.
- ▼ **Diversity.** One size does NOT fit all. Evaluate a mix of traditional and innovative solutions, including gray and green infrastructure, structural and nonstructural solutions, and centralized and decentralized/distributed treatment. Level of water treatment based on type of use.

Highlighted below are a few key projects that integrated sustainability concepts, either as a core or partial objective.



Building Sustainable Strategies into Planning and Design

City of Petaluma, California, Water Recycling Facility. The City of Petaluma, California, has embarked on a project to replace its 1930s vintage wastewater plant with a new water recycling facility. One of the primary goals of the project is to design and build an ecologically and economically sustainable facility that is widely regarded as a public amenity.

The challenge for our team was to take sustainability principles and concepts and apply them to a wastewater treatment plant planning and design project. The project team used several tools, beginning with the Natural Step Framework to define "sustainability" and establish broad goals related to sustainability. The team then used the Ecological Footprint to evaluate treatment alternatives with respect to sustainability. Finally, the Leadership in Energy and Environmental Design (LEED™) Green Building Rating System™ was used to develop specific, mea-

surable environmental performance goals for buildings and treatment facilities. Based on this approach, a number of sustainable strategies were identified and incorporated:

- ▼ Constructed wetlands for algae removal in place of energy and chemical-intensive Dissolved Air Flotation process.
- ▼ Optimize cement mix design (including fly ash) to reduce greenhouse gas emissions impact of cement production.
- ▼ Passive solar heating, ventilation, and day lighting techniques to reduce energy load of buildings.
- ▼ Optimize mechanical systems design to reduce energy loads.



Energy Efficient Buildings

City of Tempe, Arizona, Environmental Services Building. Carollo's LEED™ Accredited architect designed an energy-efficient building for the City of Tempe for an initial cost comparable to others of its type and construction. Strategies included:

- ▼ Building orientation and deep overhangs over windows on the Southeast and South to minimize direct solar exposure.
- ▼ Low-e glass allowing for good visibility and high insulating value.
- ▼ ENERGY STAR white roof to increase reflectivity and help reduce the urban heat island effect.

Scientific Process Optimization

Clark County Sanitation District, Nevada, Biological Phosphorus Removal Retrofit and Optimization. Carollo implemented process optimization at Clark County to convert their 88-mgd nitrifying activated sludge plant to biological phosphorous removal (BPR), and to convert their solids dewatering operation from lime conditioning to polymer addition.

These changes resulted in increased capacity, improved performance, optimal efficiency, and are saving the following resources *every year*:

- ▼ \$2.2 million annual operating costs.
- ▼ Energy for process blowers reduced by 10 percent.
- ▼ Biosolids to landfill reduced by 50 percent.
- ▼ Eliminated use of lime (23,700 tons per year).