The practice of water reuse is a critical component all over the world to provide water for crop irrigation, landscaping, and even for domestic water supply. Born in the Arizona desert in 1933, Carollo has been at the forefront of such efforts, working with communities and farmers to maximize non-potable water reuse.

The Need for Water Reuse
For several years, communities in the U.S. facing severe drought conditions and dwindling water supplies have been turning to municipal wastewater for new potable water through the use of advanced technologies and fail-safe monitoring.

Main Forms of Potable Water Reuse
Potable water reuse takes many shapes, including discharge of effluent into surface water bodies for subsequent intake into water treatment plants, surface spreading of tertiary recycled water for groundwater percolation (soil aquifer treatment), injection of purified water into the groundwater, and purification of reclaimed water for direct consumption by the public.

The two main forms of potable reuse are the following:

- **Indirect Potable Reuse (IPR):** Potable reuse that incorporates an environmental buffer (e.g., groundwater recharge).
- **Direct Potable Reuse (DPR):** Potable reuse that does not include the environmental buffer. Regardless of the type of potable reuse, the industry has clear standards that have been proven to protect public health and provide high quality new water.

Carollo's Experience
Carollo Engineers, Inc. is proud to be a significant part of the industry's successful potable water reuse efforts. Our potable reuse work to date is focused in Arizona, California, Colorado, Florida, Nevada, New Mexico, Oklahoma, Oregon, and Texas, with broader efforts nationally and internationally.

Water Reuse – By The Numbers
Carollo has a long history of supporting water reuse planning and implementation throughout the U.S., helping countless utilities cost-effectively leverage critical water resources.

- **300+** Reuse and Reclamation Projects
- **60+** Potable Reuse Projects Over the Past 10 Years
- **30 Billion** Gallons of Reclaimed Water Each Year
- **5** Key Industry Authorities Carollo has Worked with to Develop State, National, and International Reuse Guidelines and Regulations

Six categories are involved in the successful implementation of potable water reuse projects:

- Regulatory
- Planning
- Design and Construction
- Operations and Maintenance
- Public Outreach and Education
- Research and Development

We have successfully completed projects involving all of these aspects. Examples are provided on the next page.

Carollo's potable reuse experience spans the country.
Regulatory

Regulatory Guidance for Potable Reuse | Nationwide

Carollo’s regulatory work goes far beyond project-specific efforts. Our staff collaborates with other national experts to develop regulations and regulatory guidance for potable reuse. We have worked with several non-profit groups including the National Water Research Institute, the Water Research Foundation, and the World Health Organization on regulatory development efforts in Arizona, California, Colorado, Florida, Nevada, New Mexico, and Texas. Although the guidelines vary from state to state, each has common threads of multiple treatment barriers, pathogen reduction, chemical control, and use of well-trained operations staff. Fundamentally, all the guidelines target a similar high purity water that is protective of public health. Our depth of understanding gives us the confidence to propose potable reuse projects in regions where regulatory paradigms are still in flux.

Planning | Design | Public Outreach and Education

Pure Water San Diego | City of San Diego, California

In April 2018, Carollo delivered the fast-paced, 11-month final design of North City Pure Water Facility (NCPWF), the City of San Diego’s Pure Water Program’s premier project and the first project of its kind in California. Through the implementation of several design refinements, Carollo was able to both improve NCPWF with enhanced safety and operational features and save the City well over $30 million in capital costs. The $367 million NCPWF will purify 34 mgd of tertiary effluent from the North City Water Reclamation Plant (NCWRP) to meet the recently published (July 2017) Title 22 California Code of Regulations for surface water augmentation indirect potable reuse (IPR) to discharge to Miramar Reservoir.

Planning | Design | 330-mgd Tertiary Filtration Facility

Sacramento Regional County Sanitation District, Tertiary Treatment Upgrade | Sacramento, California

This large-scale project involves the construction of over 29,000 square feet of granular media filtration with provision for future ozone. The tertiary treatment plant is designed for treatment of up to 330 mgd. The plant is designed to meet Title 22 regulations for uncontrolled reuse and to satisfy more stringent discharge requirements. The filtration component included assessment of pilot plant data for development of design criteria, options assessments and design for filtration process, development of recycled water quality management control systems and submission of the Title 22 engineering report. Construction cost of the project is estimated at over $330 million.

Master Planning

Water Reuse Feasibility Study | City of Santa Fe, New Mexico

Santa Fe is one of the nation’s most water-efficient communities, with industry-leading conservation programs and a non-potable water reuse system that has been in place for a half-century. Under the Bureau of Reclamation Title XVI funding, Carollo conducted a Water Reuse Feasibility Study that compared a full-range of water exchange, non-potable reuse, and potable reuse alternatives to optimize reclaimed water use in the region. Reuse alternatives included expanding landscape irrigation, aquifer recharge and recovery through surface water augmentation or direct injection, and direct potable reuse. The highest-ranked alternative focused on indirect reuse via a water exchange to the Rio Grande, which would allow Santa Fe to divert more water without acquiring additional water rights or implementing advanced water treatment.