Carollo Engineer’s Dallas office is continuing to move forward with a $120 million dollar project awarded by the City of San Angelo, Texas (City) in 2008. This project is the direct result of an extended drought faced by the State of Texas, which caused the City to explore its best available water supply option: the Hickory Aquifer well field. However, there were some challenges to overcome: the well field is approximately 60 miles away from the City’s treatment plant, and the water contains significant amounts of radium and iron. The scope and details of this project has allowed Carollo to showcase the full range of our capabilities, including financial planning and assistance, applied research, design, construction management, and start-up services.

One of the first steps in the project was to identify funding alternatives and Carollo worked with the City to identify potential funding and lower interest loan options. The team determined that the Texas Water Development Board (TWDB) Water Infrastructure Fund Program was the City’s best funding option, and Carollo assisted the City in applying for and receiving approval of the $120 million dollar loan for project design and construction.

One of the next steps was figuring out how to treat the high levels of radium and iron in the Hickory Aquifer well field. There is limited experience and information available on how to deal with radium in terms of treatment, conveyance, and distribution, so Carollo undertook several studies to help identify options and guide the final design and construction phases of the project. Some of the major studies included:

- Conveyance and Treatment Alternatives Evaluation
- Ion Exchange Pilot Plant Investigation
- Reverse Osmosis Pilot Plant Investigation
- Pipe Loop Study to determine impact of radium on pipe scale deposition and disposal
- Blending Study (Ground Water + Surface Water)
- Surface Water Treatment Plant Assessment
- Pipeline Materials Evaluation

The Conveyance and Treatment Alternatives evaluation compared different alignment strategies and ranked the most favorable pipeline alignment. In addition, and as part of the evaluation, Carollo conducted a desktop evaluation of water treatment and residual disposal technologies and options to determine the best treatment and disposal options, as well as sequencing for phasing and project budgets.

Following the Conveyance and Treatment Alternatives Evaluation, Carollo conducted pilot plant testing for three ion exchange resins. Two of the resins were viable options. The City wanted to evaluate other treatment technologies, and Carollo led a second pilot plant investigation that tested three RO membrane systems. Both technologies worked well, but the City decided to select the single use ion exchange technology to remove radium because it offered better waste disposal alternatives.

Since the groundwater from the Hickory will be blended with the City’s high TDS surface waters, it was necessary to investigate the effect of blending both waters on the distribution system. Results of the blending study showed that the surface and ground waters blend well and that the chloramines stability improved with increased groundwater in the blend. Further testing of the Pipe Loop Study demonstrated that there was no valid concern about significant levels of radium depositing on the pipe wall. The results of the Pipe Loop Study helped cultivate the decision of locating the groundwater treatment facility within the City, next to the surface water treatment plant site.

The project also included a Surface Water Treatment Plant Assessment task to help identify synergies and challenges with locating the ground and surface water plants next to one another. As part of the study, existing treatment and chemical feed facilities were evaluated for adequacy, capacity, conformance with applicable regulations, and other factors. The assessment further reviewed capacities as well as the mechanical, structural, electrical and instrumentation components of the existing surface water plant, and included a prioritized list of recommendations to optimize and improve the plant.

Because the transmission main presented a significant portion of the cost of the project, it was necessary to optimize pipe selection for different pressure zones and soil conditions. For this reason, Carollo conducted a pipeline material evaluation to determine the types of pipes that could be used for the different soil corrosiveness and operating pressure conditions. The evaluation led to identifying four pressure zones and specific pipe materials for each of the zones.

Final design activities started in February 2011 and were divided into three phases: the 63-mile transmission main, the booster pump station and well field expansion project, and the groundwater treatment facility.

The 63-mile transmission final design was completed in August 2011, and construction should be complete by September 2013. Carollo provided design, construction engineering services, and services of resident project representatives.

The booster pump station and well field portion of the project includes the following key elements:
- Four vertical turbine booster pumps with variable frequency drives (VFD) and a firm capacity of 6 mgd; glass fused to steel well field stand pipe tank; glass fused to steel ground storage tank; nine submersible deep well pumps with VFDs; rehabilitation of nine existing groundwater wells; nine well field electrical buildings; a booster pump station electrical building; a 900 MHz radio communication system including towers, antennas, and radios; and a long-haul microwave system including three towers, antennas, radios, and a PLC based control system. The design of the booster pump station was completed on an expedited schedule of nine months from kickoff to advertisement. These project elements are also under construction and scheduled for final completion in September 2013.

The groundwater treatment facility and miscellaneous improvements includes a master-planned groundwater facility that can treat up to 12 mgd of groundwater, as well as a disinfection facility capable of disinfecting up to 52 mgd of surface and groundwater. Other design components included new access roads, a chemical trench, a retaining wall, and improvements to the existing backwash pond. The design was completed in May 2013 and construction is anticipated to start in the end of August.

Due to the exceptionally low bids observed in earlier stages of the project, there was enough money was left in the original budget for the City to expand the capacity of the existing well field and booster pump station. The well field expansion portion of the project includes the design services for drilling up to seven additional wells, extending the well field access road and collector piping to serve the new well sites, as well as the expansion of the booster pump station from a firm capacity of 6 mgd to a firm capacity of 9 mgd. Due to the need to protect habitats for endangered species, Carollo worked closely with a contractor already on site to clear the sites for the new wells as well as the access road right of way prior to the restricted season, which prevents habitat disturbance between March 15 and September 15. This will allow the City to bid and begin construction of the wells as quickly as the design documents can be completed and regulatory approval obtained. To further expedite the expansion of the well field, the design was divided into two packages. Package 1 includes only the drilling and casing of the new wells, and Package 2 includes the expansion of the booster pump station and all of the piping, access roads, drainage, electrical, instrumentation, and controls. As with the other phases of the project, the well field expansion has an aggressive schedule, which includes approximately six months for design of packages 1 and 2.