

Purifying Brackish Water

The historic city of St. Augustine, Fla., has relied on a surficial aquifer as the primary source of water for its 12,000 residents. Concerns about the city's future water supply and the impact of aquifer drawdown on wetlands in this coastal community led the city to develop a proactive plan for long-term water resource management. The plan calls for tapping brackish water from the Upper Floridian Aquifer as an alternative source.

St. Augustine commissioned its existing water treatment plant in the 1920s and last modified it in 1987. The plant draws water from 10 shallow aquifer wells and four deep aquifer wells. The raw water is blended and treated in a reactor-clarifier for lime softening, a sedimentation basin for solids settlement and recarbonation, dual-media rapid sand filtration for solids removal, and gravity sludge thickener for sludge treatment.

- ▶ Project overview: St. Augustine LPRO Water Treatment Plant
- ▶ Organisation: Camp Dresser & McKee
- ▶ BE awards category: Plant Multi-Discipline Plant Design

Project objective

Design \$11 mn low-pressure reverse osmosis water treatment facility to process brackish water from aquifer.

The lime-softening process relies on a ready supply of fresh water from the local surficial aquifer. However, the supply is expected to be insufficient to meet the long-term needs of the growing population and tourism industry. The alternative is to draw more water from the deep wells, in which the ample supply is laden with salt and other minerals.

With an aging plant nearing the end of its service life, the city capitalized on an opportunity to implement improvements that would address both the water supply issue and the infrastructure management issue. The city retained Camp Dresser & McKee (CDM) to design a low-pressure reverse osmosis (LPRO) water treatment process that will operate in conjunction with the existing lime-softening water treatment process. The LPRO process will rely exclusively on the high-yield Upper Floridian Aquifer, which can provide a long-term water supply.

Blending water treated with the two processes will increase the plant's operational flexibility. In addition, when the maintenance burden associated with operating the lime softening treatment plant becomes a financial and reliability risk, the city can phase out that process completely. This transition will ultimately conserve fresh water supply in surficial aquifer and minimise environmental impacts to wetlands adjacent to local wells.

CDM began design of the \$11mn LPRO plant in June 2006 and issued permitting drawings in February 2007. The aggressive schedule notwithstanding, CDM developed a cost-effective design with future expansion capabilities while providing an aesthetically pleasing facility that met the requirements of the St. Augustine's Historic Architectural Review Board (HARB).

Efficient workflow enhances design

Using the AutoPLANT suite and the ProjectWise collaboration server system enabled 22 technical staff members across multiple offices to work on the project simultaneously. "For CDM, using Bentley's suite of software - built on providing 3D design and the associated data - is based on the simple principle of providing our clients with a superior and more cost-effective project solution," said CDM Vice President William Nelson. "We're utilising state-of-the-art technology in intelligent plant design."

On past projects with a multidiscipline team the 2D approach to producing deliverables proved ineffective at addressing the continuous design iterations during the detail design phase. Bentley's 3D technology, however, improved CDM's ability to visualize the overall form and function of the plant,

Transition to high-yield alternative water supply preserves fresh-water aquifer.

By Bentley Systems

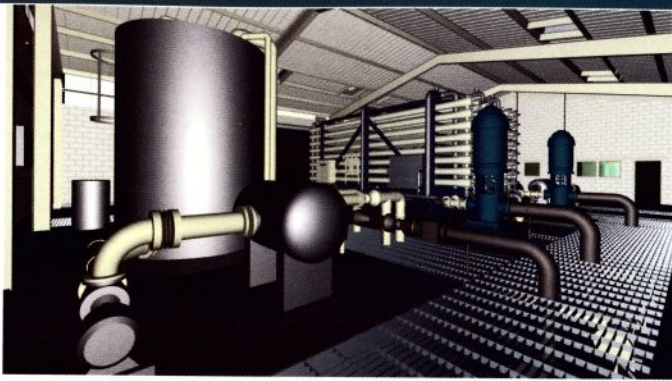


Figure 1A and 1B: Camp Dresser & McKee's master 3D model enabled numerous iterations, multiple design reviews, cross checks from other disciplines, and interference detection.

leading to improvements in the design process and more efficient communication and collaboration among the design team.

CDM used ProjectWise as an enterprise-level electronic document management system, creating a central repository for all related project data. This allowed engineers and designers to work more closely in a secure, managed environment. Applying specific rules and permissions to the project data ensured that a consistent workflow was used, enabling CDM to effectively manage and distribute critical information throughout the design lifecycle. The data-centric nature of ProjectWise allowed all team members to share data in real time, as well as distribute this information to remote locations.

During detail design, the robust and flexible tools provided in AutoPLANT P&ID streamlined the creation of intelligent P&IDs. The software allowed CDM to customise the flow of data and the CADD standards, resulting in faster, more consistent drawings. The P&ID data was then seamlessly integrated with CDM's internal SQL database. With data making the roundtrip from P&ID, datasheets, or 3D model through the SQL database, CDM's engineers were easily able to see changes in real time. The 3D model provided unmatched capabilities in visualization, design review, and interference detection. Errors that

would normally have remained undetected until late in the design phase were caught far earlier, avoiding potentially costly changes downstream. By producing the final 2D construction drawings directly from the 3D model, CDM greatly reduced the overall drafting effort, saving up to 15% of the CADD budget and minimizing user interpretation and inconsistencies due to the inability to visualise sections in relation to the plan drawings.

"By having a master 3D model that has gone through numerous iterations, multiple design reviews, cross checks from other disciplines, and interference detection tools, we showed that final drawings will reflect a far more cohesive, accurate, and superior set of client deliverables," Nelson said. "In addition, we have a process that is simple and effective for providing real-time walkthroughs for our clients."

The building that houses LPRO water treatment equipment is located in St. Augustine's historic entry corridor. Developing the approved design from schematic colored renderings to constructible documents required stringent review and coordination. The development of an integral 3D model supported this process, which allowed multiple disciplines to fully understand how each piece of the design fit together to form a whole consistent with the city's HARB requirements.

The final architectural design blended in with city's distinguished Spanish style while achieving a cost effective combination of historic detailing in highly visible areas and industrial detailing in less sensitive areas. As the "Nation's Oldest City" continues to grow and welcome visitors, the long-term water demand will be met by this seemingly historic facility.



Figure 2: Errors that would normally have remained undetected until late in the design phase were caught far earlier, avoiding potentially costly changes downstream.

About the Contributor

With over 2,800 employees in over 50 offices worldwide and annual revenues surpassing \$450mn, Bentley Systems has invested over \$1bn in research, development and acquisitions since 1993. Nearly 90% of the Engineering News-Record Top 500 Design firms are Bentley subscribers and Daratech has ranked Bentley as the world's No 2 provider of software solutions to the architecture, engineering, construction and owner-operator market as well as No 2 in the GIS/geospatial market.

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