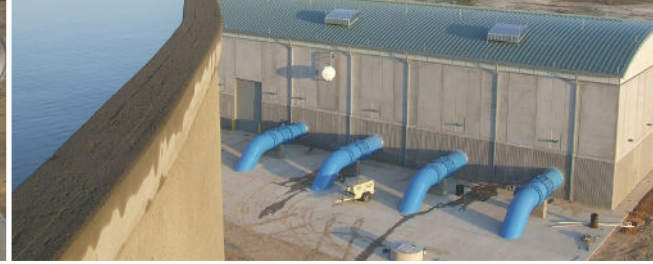




WATER  
CONVEYANCE  
SERVICES



## ABOUT FREESE AND NICHOLS, INC.

Freese and Nichols is a client-focused, regionally based firm with national expertise. We meet client needs with responsiveness and flexibility. Dating back to our firm's founding in 1894, we have put relationships first – clients, teaming partners and staff – and seek long-term relationships, many of which are counted in decades, not years. Freese and Nichols provides a broad range of services to plan, design and manage public infrastructure projects.

We help our clients through every stage of the project life cycle: planning, design, program management, funding procurement, regulatory compliance, construction management, and operations and maintenance. Our project teams are known for exceeding client expectations through innovative concepts and high-performing designs.

In our quest to bring innovation to our clients and projects, FNI uses the Institute for Sustainable Infrastructure's (ISI) Envision™ rating system to apply sustainable principles to infrastructure projects. As a charter member, FNI has been recognized as a forward-thinking firm and has embraced the collaborative approaches embodied within the Envision™ program.

### IN THE PAST 5 YEARS, WE HAVE:

- Designed more than \$1.5 billion in water conveyance projects

### IN THE PAST 10 YEARS, WE HAVE:

- Designed 730 miles of conveyance pipeline, more than enough to span the width of Texas
- Designed 50+ pump stations with the ability to collectively pump more than 3.9 billion gallons per day



## OUR SERVICES

FNI provides the following services as part of our integrated approach:

- Architecture
- Construction Services
- Program Management
- Electrical Transmission/Substation Engineering
- Environmental Assessments and Remediation
- Funding/Grant Applications
- Geotechnical Engineering
- Levee and Dam Evaluations and Design
- Mechanical, Electrical and Plumbing Engineering
- Oil and Gas Engineering
- Stormwater Master Planning and Design
- Structural Engineering
- Transportation/Infrastructure Planning and Design
- Urban Planning and Design
- Water and Wastewater Master Planning and Design
- Water and Wastewater Treatment
- Water Resources Planning and Facility Design
- Water Conveyance Design
  - Intakes
  - Pipelines
  - Pump Stations
  - Rehabilitation
  - Reservoirs
  - Tanks
  - Tunnels
- Water Conveyance Studies
  - Condition Assessment
  - Energy Studies
  - Hydraulic Analysis
  - Operations Studies
  - Planning
  - Route Studies
  - Surge Modeling
  - Value Engineering
  - 3D Modeling





# CONSTRUCTION MANAGEMENT

# TECHNICAL EXCELLENCE

## SERVICE SPOTLIGHT

FNI has a team of employees dedicated to construction management and inspection of FNI-designed and third-party-designed projects. We are experienced in alternate project delivery systems such as Design-Build and Construction Manager-at-Risk (CMAR) and offer an array of online tools for bid phase and construction project management.

Our construction management staff can provide the following:

- Bid and construction phase services
- Code compliance services
- Constructability reviews
- Program management
- Resident representation
- Third-party construction contract administration



## HISTORY OF RECOGNITION

FNI has achieved engineering excellence on water conveyance projects, including the following:

- O.H. Ivie Project - Outstanding Civil Engineering Achievement Award, Texas ASCE (1996)
- Benbrook Connection Project - Outstanding Civil Engineering Achievement Award, Texas ASCE (1999)
- Eagle Mountain Connection Project - Engineering Excellence Gold Award, ACEC Texas (2008)
- Ward County Transmission System - Engineering Excellence Gold Award, ACEC Texas (2014)
- Lee B. Freese - ASCE National Bechtel Award for Pipeline Engineering, ASCE (2001)



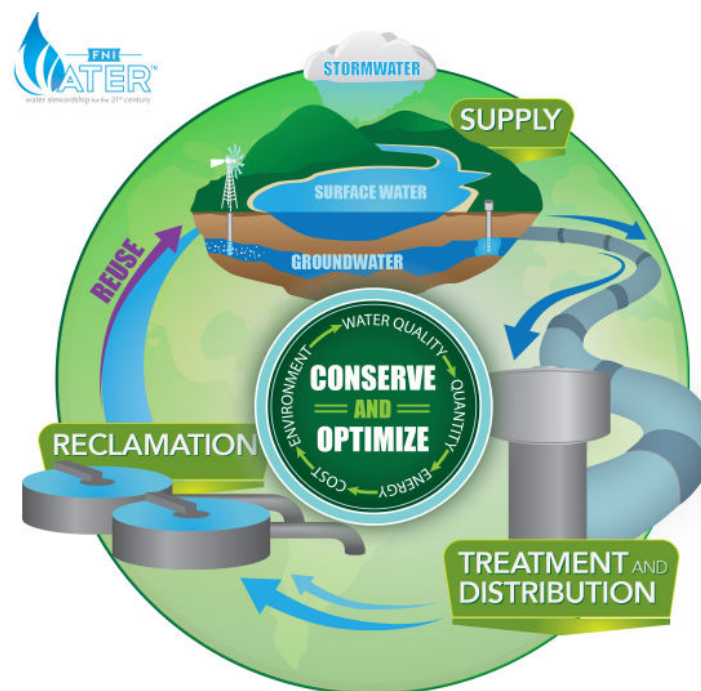


## SUSTAINABILITY

### FNI WATER™

A key tenet of the FNI philosophy is stewardship of our clients' assets and public resources. FNI Water™ is the framework for a process that helps our staff explore alternatives for sustainable water resources in the 21st century. FNI Water™ is a Freese and Nichols initiative that incorporates sustainability, the water/energy nexus, water efficiency, water conservation, conjunctive use of groundwater and surface water, brackish water, and water reuse. FNI Water™ is also a way to demonstrate to our clients that resource sustainability and stewardship are important to us and will be considered in any endeavor we undertake.

FNI Water™ focuses primarily on two aspects of sustainability: the natural environment (water and energy) and life cycle costs. The idea is to take a holistic, environmentally responsible approach and implement best practices through every step of a water supply project, from planning to operations, to maximize the quantity and quality of water, protect ecosystem functions, minimize energy use, and minimize costs.



## COST SAVINGS / ADDED VALUE

### REPRESENTING OUR CLIENTS' BEST INTERESTS

FNI's client-focused approach is evident in the results we deliver to clients, typified by the minimal 0.04-percent change orders on the \$71.5-million Lake Alan Henry Water Supply Project or the \$10 million under-budget results on the Ward County Water Supply Project.

We use an approach that saves money and adds value to design, bid and construction phase services. Our cost-saving techniques amount to millions of dollars saved on conveyance projects, including pipe material competition and unique contract bidding structures. In addition, we apply a number of added-value techniques that contribute to the design, operations and life cycle of the conveyance system, such as optimizing alignments to reduce costly bends and incorporating surge control into normal operations to add reliability.

Combined, these techniques deliver a highly reliable system with a lower total cost. In addition, owners benefit from flexibility, expandability and ease of operations.





## CASE STUDY—Eagle Mountain Connection

### FAST FACTS

- Client: Tarrant Regional Water District
- Optimal route selection
- 0.12 percent change orders
- Cost-saving pipe material specifications
- 2008 Engineering Excellence Gold Award, Texas Council of Engineering Companies

The \$148-million Eagle Mountain Connection Project allows the Tarrant Regional Water District (TRWD) to pump water from its East Texas reservoirs (Richland Chambers Lake and Cedar Creek) to Eagle Mountain Lake north of Fort Worth. It provides TRWD with the water supply to meet increasing demands in the West Fork service area and improves the reliability of the TRWD system. The project includes the following major components:

- 20 miles of 96-inch and 84-inch pipeline
- 430-MGD Rolling Hills booster pump station
- 230-MGD Benbrook booster pump station
- 118-MG RCC-lined balancing reservoir
- 280-MGD lake outlet and flow control structure
- 78-inch subaqueous pipe and 114-inch aerial pipe
- 14-MG and 7-MG ground storage tanks
- SCADA and communications systems

With the pipeline crossing urban and semi-urban areas in Fort Worth and Benbrook, route selection included a screening process in which seven routes were studied before the final route was selected. FNI used GIS files to evaluate topographic, aerial, property, land use, environmental, utility and soils mapping.

FNI provided life cycle cost studies for each alternate route to compare capital costs, power costs, yearly maintenance costs and debt service. The studies also compared pumping and electrical equipment options.

One measure to promote cost savings included extensive studies of the steel pipe coatings, pipe performance and construction techniques. Extensive research was conducted to develop a design that would promote price competition and long-term performance. Special design issues included polyurethane and side-extruded polyethylene coating options, weld-after-backfill techniques, joint coating systems, cathodic protection systems, coating testing requirements, pipe deflection control requirements, and special field leak testing requirements.

The greatest hurdle overcome was planning the system to meet many different operating scenarios and future expansion alternatives.

The Eagle Mountain Connection earned the Texas Council of Engineering Companies' Gold Award for the top water resources project in Texas in 2008.





## CASE STUDY — Ward County Transmission System —

### FAST FACTS

- Client: Colorado River Municipal Water District
- 18-month design and construction schedule
- CMAR delivery method
- Completed two weeks early
- Innovative solutions saved client \$10 million
- 2014 Engineering Excellence Award, American Council of Engineering Companies of Texas

FNI designed the \$125-million Ward County Transmission System in seven months and managed the 11-month construction phase to help the Colorado River Municipal Water District (CRMWD) respond to 10 years of drought conditions that had lowered the storage volume of its three reservoirs to 5.5 percent of capacity. The system was pumping water to West Texas cities two weeks ahead of schedule and was completed \$10 million under budget.

The system included:

- 41.6 miles of 42- and 48-inch transmission pipeline
- 22 miles of 10- to 36-inch well collection lines
- 30-MGD well field booster pump station with a 2-MG ground storage tank
- 30-MGD transmission pump station with a 2-MG ground storage tank
- 25-MGD Odessa booster pump station to move water backward through the system
- 6-MGD Big Spring booster pump station to move water backward through the system
- Multiple connections to existing water transmission facilities

To fast-track the project, the construction was split into three pipeline contracts, one pump station contract and one well contract. The Competitive Sealed

Proposal (CSP) process was used to select a CMAR to deliver all pump stations in the pump stations contract. The CSP process was also used to select contractors for all the other construction contracts.

To further expedite the project, several equipment pre-purchase bid packages were included. The design also incorporated use of pre-packaged pump skids to shorten the construction phase schedule. The project required seven pipe production plants, seven pipe-laying crews and four construction contractors to meet the challenging schedule.

Although initial capacity is 30 MGD, the pipelines are designed for the future demand of 50 MGD. The transmission pump station is expandable to 50 MGD. One of the sustainable features of the project was the use of native materials to embed portions of the pipeline. Additionally, native soils were used to make Controlled Low-Strength Material (CLSM) for portions of the pipeline and other facilities. Using these trench-excavated materials also sped up the project and saved CRMWD an estimated \$3 million.

The Ward County Transmission System earned a Gold Award in Water Resources in the American Council of Engineering Companies of Texas' 2014 Engineering Excellence Awards. The project was also featured on the cover of ASCE's *Civil Engineering* magazine in January 2014.





## CASE STUDY — Integrated Pipeline Project

### FAST FACTS

- Clients: Tarrant Regional Water District and Dallas Water Utilities
- Integrates Envision™ sustainable design aspects
- Program-wide route study, environmental services, hydraulic analysis and design standards
- Design of Segment 16 pipeline
- Design and construction management of Line J, Section 1
- Design of 710 MG of storage reservoirs/cells
- Program-wide construction management services

FNI completed a program-wide route study and provided program-wide environmental services and permitting for the proposed 149-mile Integrated Pipeline (IPL) from Lake Palestine in East Texas to Lake Benbrook in Fort Worth for TRWD and Dallas Water Utilities (DWU). The route study identified the initial route for the pipeline and locations for pump stations and reservoirs.

In addition, FNI provided a program-wide hydraulic analysis for the pipeline and reservoirs and developed standard details, specifications and design criteria manuals. The pipeline was designed in segments by multiple consultants; FNI was selected to perform the detailed design of Segment 16, which is 14 miles of 96-inch pipe, and Line J, Section 1, which is two miles of 108-inch pipe. FNI also provided construction management for the Line J, Section 1 project.

FNI also provided detailed design of three multi-cell reservoirs and the addition of a third cell at an existing reservoir. These cells/reservoirs are formed by earthen embankments, a waterproof liner and covered with soil cement. Two of the reservoirs are identical, each one is designed to have two 40-MG cells, and they are sited on the suction side of the pump stations. A new terminal storage reservoir was designed with four 100-MG cells. In addition, a 150-MG cell was added to an existing terminal storage reservoir.

FNI's environmental services included management of multiple teams of environmental scientists for jurisdictional determination of wetlands and other waters; applications for a Section 404 permit, Texas Parks & Wildlife Department Sand, Gravel and Marl permits, and TPDES discharge permits; cultural resources investigations; environmental information document preparation for submission with the 404 permit application; habitat surveys for threatened and endangered species; development of GIS database of environmental data; and coordination with multiple engineering design teams to avoid and minimize environmental impacts. The 404 permit was obtained in 2013 to maintain the schedule for this challenging project.

FNI coordinated extensively with the IPL Program Manager's land acquisition staff to schedule field surveys of properties within the proposed corridor. The environmental and cultural resources field data were catalogued in a GIS database.

The Line J, Section 1 portion of the project was evaluated according to the Envision™ Rating System (formal evaluation and rating is pending) and addresses aspects of sustainability in a number of ways. Most relevant is the use of native materials as the aggregate in controlled low-strength material (CLSM) embedment.

Other aspects of sustainability include streambank restoration and stabilization, meetings with city officials to minimize the impact of road closures, and preparation of traffic control plans.





## CASE STUDY — Lake Texoma-to-Wylie Pipeline and Water Treatment Plant Connection

### FAST FACTS

- Client: North Texas Municipal Water District
- \$280 million project
- CMAR project delivery
- Design and construction completed in 25 months
- 48 miles of 84-96 inch pipeline
- 240-MG earthen reservoir
- Extensive water treatment plant improvements

In 2009, the invasive zebra mussel was found in Lake Texoma, which is the source for approximately 25 percent of the raw water supply for the North Texas Municipal Water District (NTWMD). At the time, the water was pumped over the high point in the basin and discharged into a creek that flowed to Lake Lavon. However, the U.S. Army Corps of Engineers issued a directive to cease pumping operations to prevent the mussel from being transferred to a non-infested lake. Because the directive kept NTWMD from accessing its water, it initiated this project to bypass Lake Lavon and restore access to Lake Texoma. The project includes approximately 48 miles of 84-inch and 96-inch pipeline from the existing Lake Texoma outfall to NTWMD's water treatment plant in Wylie, Texas. The project also includes design of a 240-MG earthen balancing reservoir and modifications to the four existing water treatment plants to facilitate connection of the new system.

This \$280-million project has a total schedule of 25 months, and FNI performed the fast-track design in 13 months. The accelerated design was coupled with the CMAR delivery method to meet the required in-service

date. Using a CMAR enabled the design to be tailored so that the equipment and work packages requiring the longest lead time could be executed prior to final design and avoid delays. The pipe material was pre-purchased through the CMAR and manufactured by two pipe companies using three production plants.

The overall system is designed to transport 120 MGD of Lake Texoma water to Wylie; bring 70 MGD of future Lake Texoma water to a future pipeline and the NTMWD's north water treatment plant; carry 55 MGD of future Lake Jim Chapman water to Wylie; and facilitate an emergency scenario in which Lake Texoma water is combined with the NTMWD's East Fork system for a combined flow of 260 MGD to Wylie.

The \$62-million water treatment plant improvements consist of five 1- to 2-MG ground storage tanks; four mixing junction structures that combine three sources of raw water, associated piping and flow-control structures; and automation of the water treatment plants' chemical feed systems. These structures and systems will allow the NTMWD to maintain a strict blending ratio between Lake Texoma water and its other raw water sources so that finished water quality is not impacted.





## CASE STUDY—Lake Tawakoni Water Supply Project

### FAST FACTS

- Client: North Texas Municipal Water District
- \$90-million project
- 10-month design schedule
- 0.23% change orders
- Expedited construction with five design teams and contracts

FNI completed fast-track design and expedited construction services using five design teams for NTMWD's \$90-million Lake Tawakoni Water Supply Project to enable NTMWD to deliver newly contracted water to its drought-plagued service area. FNI engaged multiple design, survey and right-of-way acquisition teams to develop and acquire the 30-mile route through Hunt, Kaufman, Rockwall and Van Zandt counties. FNI also managed resources and coordinated environmental permitting on a program-wide basis to facilitate meeting NTMWD's quick deadline.

Due to drought conditions, the project was put on a fast-track schedule for design and construction to alleviate water restrictions as quickly as possible. FNI completed the alignment study, survey and design within 10 months, meeting the owner's required schedule and budget.

The project included 10 miles of 60-inch pipeline, 20 miles of 54-inch pipeline, a 75-MGD lake pump station and a 75-MGD intermediate pump station.

## CASE STUDY—Water Delivery Pipeline for Regional Carrizo Project

### FAST FACTS

- Client: San Antonio Water System
- Fast-track 10-month design schedule
- Bored tunnel section in Edwards limestone formation
- Project aligns with City's 50-year plan for alternative water sources

The Regional Carrizo Project will transfer water from the Carrizo Aquifer to serve the City of San Antonio. This project is one of several in the 50-year plan to bring water to San Antonio from alternative water sources.

A key component of the program is the water delivery pipeline designed by FNI. The project consists of 11.5 miles of 36-inch potable water transmission main at construction cost of \$19 million. The pipeline travels from the City of Schertz to the City of San Antonio through urban areas of Guadalupe, Comal and Bexar counties. Detailed design tasks include thrust restraint, corrosion protection, hydraulic design basis, and details and specifications.

The project included extensive coordination with utility companies and landowners and was fast-tracked for a 10-month design, which required a condensed schedule for design and land acquisition. Aerial topographic survey also shortened the typical ground survey timeline.

Specific challenges included route adjustments to cut construction costs, analysis of surge relief and thrust restraint, and design of coating and lining. The project included several tunnel sections and extensive coordination with local municipalities.





## CASE STUDY—Allen-Plano-Frisco-McKinney Pipeline

### FAST FACTS

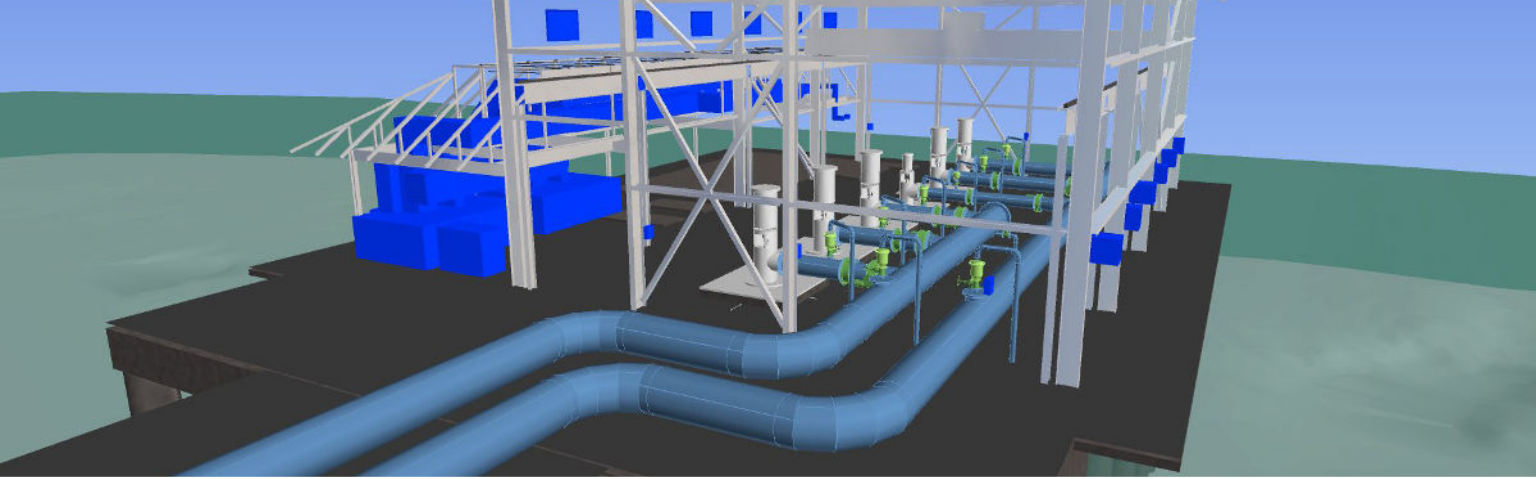
- Client: North Texas Municipal Water District
- Four-phase project to meet demands of fast-growth population
- Extensive stakeholder coordination
- Construction in congested urban areas

The \$56-million Allen-Plano-Frisco-McKinney Pipeline provides treated water to NTMWD Collin County customers, including the Cities of Allen, Plano, Frisco and McKinney, to meet their fast-growth population needs. The four-phase project is 18.6 miles long, with the most critical segments completed in priority order.

The first three phases totaled 13.2 miles of 72-inch pipeline. Construction was completed for each phase in 2006, 2007 and 2008, respectively. The final phase was 5.4 miles of 96-inch pipeline, with construction completed in early 2011.

The area between the NTMWD's Wylie Water Treatment Plant and the Frisco-McKinney Booster Pump Station features some of the United States' most rapidly developing areas, posing significant challenges. FNI performed route studies for each phase, which required close coordination with all local entities, developers and transportation agencies. In much of the heavily urbanized areas, the pipeline was placed under the median and turn-lanes of a major parkway.

The greatest challenge was working with the large number of stakeholders to avoid existing and future conflicts. FNI utilized its local relationships to help resolve these conflicts.



## CASE STUDY—Lake Conroe Pump Station

### FAST FACTS

- Client: San Jacinto River Authority
- Analysis of six intake/pumping alternatives
- CMAR delivery method
- Response to alternative surface water supply
- 3D design technique

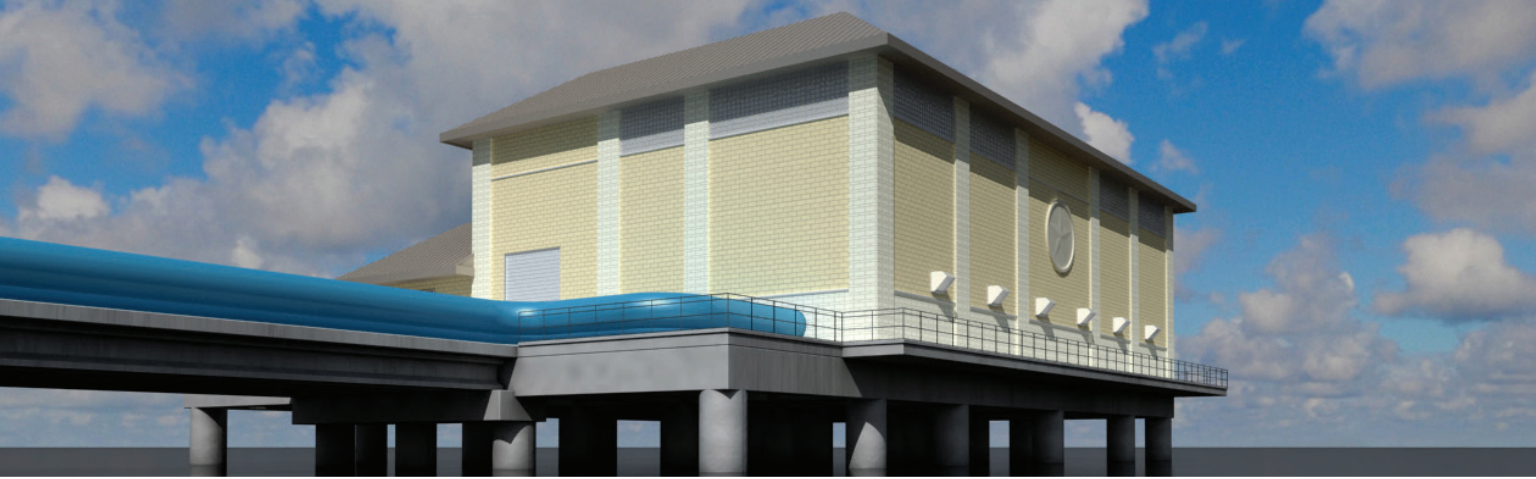
In Southeast Texas, the San Jacinto River Authority (SJRA) is implementing a program to connect surface water supplies to reduce dependence on groundwater in Montgomery County aquifers by 2015. Part of the program is the Lake Conroe Pump Station designed by FNI.

The pump station is designed to be supported by a platform over the lake with a bridge to the dam. Since the project required specialized marine construction, the CMAR approach was used to deliver the project. This allowed the CMAR and FNI to continually evaluate the constructability of the design.

Most components of the pump station are sized for the ultimate firm capacity of 126 MGD. However, this capacity will not be needed until sometime in the future and will be reached by incrementally adding pumps as they are needed. The initial firm capacity is 47.25 MGD, which is provided by vertical pumps that are suspended into submerged intake barrels. The barrels have gates to control the water intake elevation.

FNI modeled the pump station in 3D during the design phase to help the design and construction teams visualize the construction and avoid conflicts.





## PROJECT LIST

Pipelines (partial list)

Project	Client	Year	Miles	Bid Day Cost (\$MM)
96-/84-inch Eagle Mountain Pipeline	TRWD	2008	19.5	\$85.4
48-/42-inch Ward County Transmission Line	CRMWD	2012	42	\$53.0
108-inch Section Line J, Section 1 Pipeline	TRWD	2013	2	\$20.0
84-96-inch Texoma-to-Wylie Pipeline Extension	NTMWD	2012	48	\$250.0
12-36-inch Ward County Well Collection Lines	CRMWD	2012	20	\$10.0
60-/54-inch Tawakoni Pipeline	NTMWD	2008	30	\$49.8
36-inch Regional Carrizo Project: Water Delivery Pipeline	SAWS	2011	11.5	\$12.0
96-inch Allen-Plano-Frisco-McKinney Project B Phase 2 Pipeline	NTMWD	2009	5.4	\$21.9
96-inch Integrated Pipeline - Section 16	TRWD/DWU	2013	16	In Design
54-inch Mary Rhodes Phase 2 Pipeline	Corpus Christi	2013	42	\$84.0
48-inch East Williamson Co. Pipeline	Brazos River Authority	2011	4	\$6.0
42-/48-inch Lake Alan Henry Pipeline	City of Lubbock	2009	50	\$50.0

## PROJECT LIST

Pump Station and Tanks (partial list)

Project	Client	Year	Capacity	Bid Day Cost (\$MM)
Rolling Hills Booster Pump Station	TRWD	2008	400 MGD	\$19.0
Benbrook Booster Pump Station	TRWD	2008	230 MGD	\$18.0
Ward County Transmission Pump Station	CRMWD	2012	30 MGD	\$13.0
Ward County Odessa Pump Station	CRMWD	2012	25 MGD	\$6.0
Ward County Well Field Pump Station	CRMWD	2012	30 MGD	\$6.7
Lake Tawakoni Intake and Booster Pump Stations	NTMWD	2008	75 MGD	\$23.7
Lake Conroe Raw Water Intake Pump Station	SJRA	2012	31.5 MGD	\$30.0
Mary Rhodes Phase 2 Intake and Booster Pump Stations	Corpus Christi	2013	46 MGD each	\$29.0
East Williamson County Intake Pump Station	Brazos River Authority	2011	18 MGD	\$10.5
Eagle Mountain Connection Tank	TRWD	2006	7 & 14 MG	\$5.0
Ward County Water Supply Tank	CRMWD	2011	2x2 MG	\$2.6
Tawakoni Water Supply Tank	NTMWD	2008	6 MG	\$1.5
Texoma-to-Wylie Reservoir	NTMWD	2013	240 MG	\$21.6





## QUALITY

### QUALITY CONTROL

Quality Control (QC) at FNI involves technical review of all project components to verify accuracy and quality of studies, verify design calculations and details, and check constructability of construction documents. FNI considers QC to be the ongoing responsibility of each team member, but formal QC reviews are led by each project's QC/QA Manager at key milestones throughout the project. The goal of a QC review is to check for sound technical principles and accuracy. Most reviews are multidisciplinary, and construction plans and specifications are also reviewed for constructability.

### QUALITY ASSURANCE

Quality Assurance (QA) at FNI is an overall project review to determine whether an effective approach is taken for a project, confirm that project objectives are carried out, detect conceptual problems early, and verify that coordination and the QC functions and reviews have been performed. The QC/QA Manager will take responsibility for administering the QA process by submitting the appropriate information and materials to a QA Leader, who will be assigned by FNI's Office of the President and be responsible for conducting a formal QA review after each formal QC review.

Our QC/QA methodology is supported by our internal Technical Excellence Program and rooted in a system of formal checklists, meticulous analysis and planning, design, and construction excellence to help produce quality deliverables for our clients.

## MALCOLM BALDRIGE NATIONAL QUALITY AWARD

In November 2010, FNI was named a recipient of the Malcolm Baldrige National Quality Award, becoming the first engineering/architecture firm to receive this national honor.

The Baldrige award is the highest presidential honor given to U.S. organizations for performance excellence. It was established in 1987 to enhance the competitiveness of U.S. businesses in an ever-expanding, demanding global market. The Baldrige program promotes excellence in organizational performance, recognizes the achievements of U.S. organizations and publicizes successful performance strategies.

For more information, visit: [www.freese.com/baldrige](http://www.freese.com/baldrige).

*Pictured above: FNI CEO Bob Pence, FNI Chairman Emeritus Jim Nichols, FNI CFO Cindy Milrany, U.S. Congresswoman Kay Granger, Fort Worth Mayor Betsy Price, and FNI Vice President Lee Freese*

### Baldrige by the Numbers

Nearly **1,700** applicants

**110** recipients

**7** categories in Baldrige criteria

**1st** engineering/architecture firm to receive this honor: Freese and Nichols





## MISSION

Innovative approaches

Practical results

Outstanding service

## VISION

Be the firm of choice for  
clients and employees

## GUIDING PRINCIPLES

We are ethical

We deliver quality

We are responsive

We add value

We improve continuously

We are innovative

We develop professionally

We respect others

We appreciate our employees and clients

We give back to our communities



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