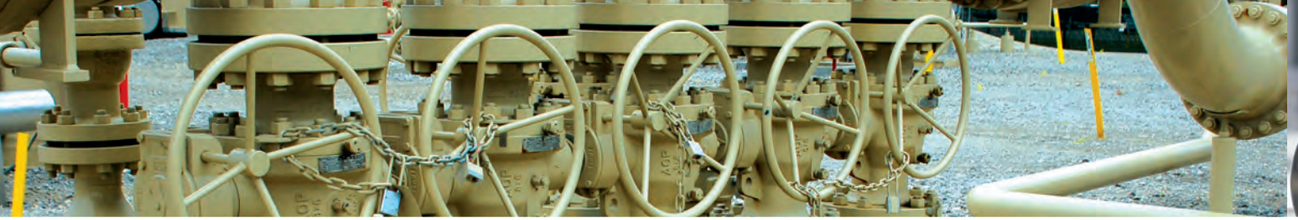
Water Management

Services for Oil & Gas Projects

FREESE AND NICHOLS



Our Services

Freese and Nichols, Inc. (FNI) provides engineering services to develop and characterize water management options and future water infrastructure needs. Our large group of dedicated water and wastewater system master planning and modeling staff, water supply planners and water conservation specialists are some of the most experienced in the Southeast United States.

FNI delivers a wide range of services to our energy clients, including:

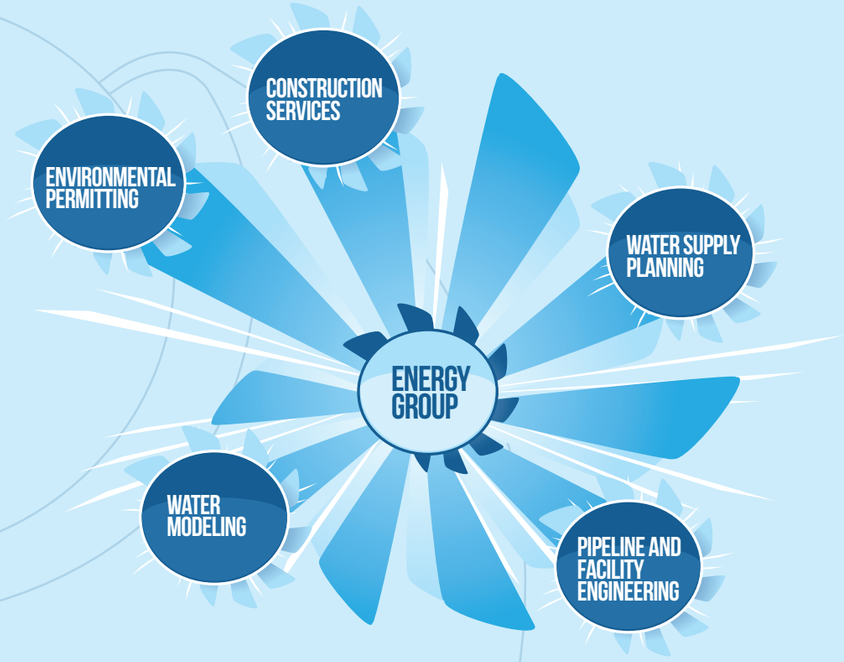
- Water Supply Source Evaluation
- Recycled Water System Evaluation
- Water Infrastructure Design
- Saltwater Disposal Facilities
- Regulatory Coordination and Permit Acquisition
- Water System Optimization
- Produced Water Management
- SCADA, Controls, Instrumentation, Distribution and Communications
- CAD Services/GIS Services
- Economic and Feasibility Analysis
- Water and Wastewater Treatment Services
- Construction Management

FNI provides our clients value and high-quality deliverables through our:

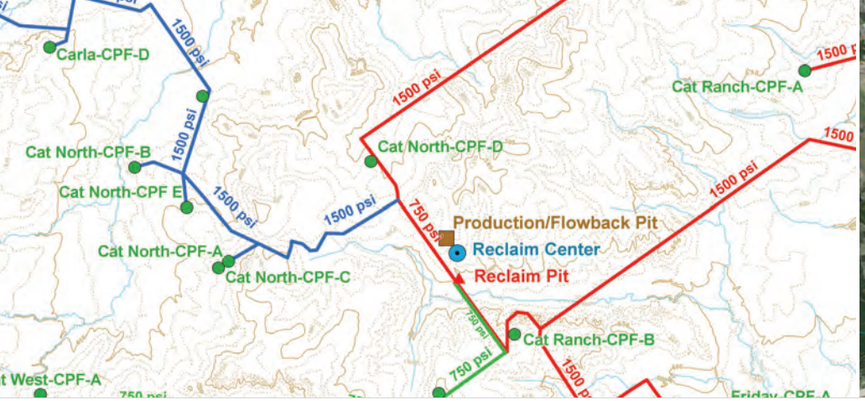
- ✓ **Unmatched Water Planning Capabilities**
- ✓ **Proven Project Management Team**
- ✓ **Experience Working Under Regulations in Oil & Gas Shale Plays**
- ✓ **Understanding of the Oil & Gas Industry**

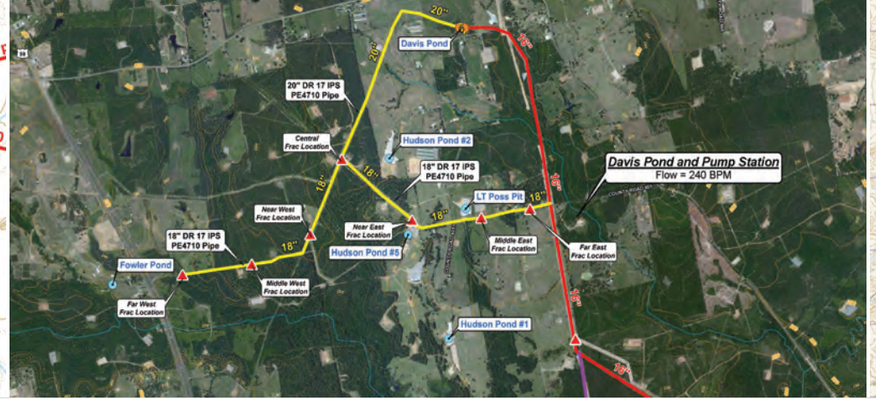
Innovative Support in the Quest for New Resources

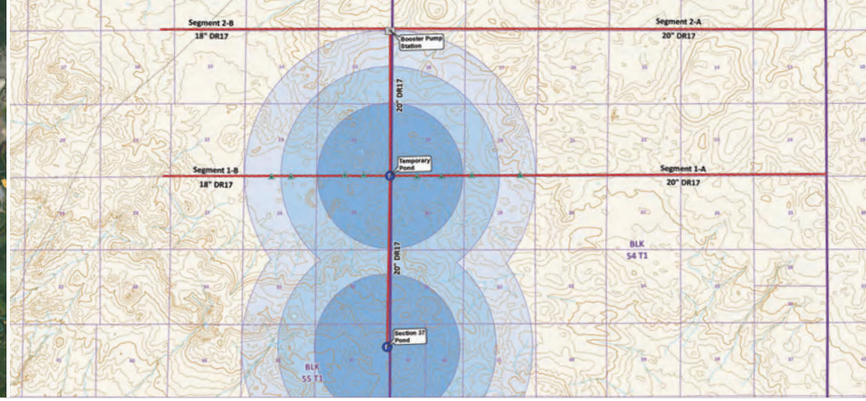
Our energy clients face many challenges as they explore and develop new energy sources in an environment of complex regulations, global competition and challenging economic conditions. FNI supports our clients' efforts with a flexible, client-specific approach and custom-tailored services designed to meet the unique needs of each client.



Freese and Nichols customizes our approach to meet the unique needs of each client. Our team members regularly work together across disciplines, giving our clients the benefit of total service integration.







Case Study

Water Management Plan, Confidential Client

FNI has performed various services for an energy client over the past three years to help maximize scarce water resources available for their drilling operations across the country. Our primary effort has been to assist the client with water system planning for three of their drilling operations – the Eagle Ford play in South Texas, the Haynesville play in East Texas and Louisiana, and the Avalon play in West Texas.

The **Eagle Ford Water System** required the development of a water distribution system to utilize water produced from multiple groundwater wells. The produced water was to be conveyed to temporary storage and then delivered to various drill pad locations as needed for well completions. FNI advised the client on acquiring water rights from the Rio Grande River and also assisted with the design of an intake pump station to move water from the river to the proposed drill sites. The water system consisted of more than 100 miles of water lines and 25 pump stations. We also performed a feasibility study for constructing a produced water collection system, a produced water treatment system and a recycled water transmission system. This study was completed to determine whether the money saved on reduced trucking and disposal costs would payback development costs within a three-year period and be protective of the environment by conserving water used in project operations.

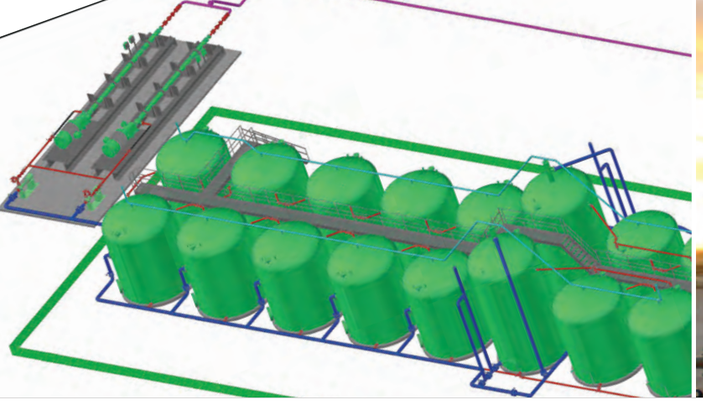
The **Haynesville Water System** was broken into two systems in order to utilize separate surface water sources in each state. The East Texas system utilized water from the Sabine River while the Louisiana system utilized water from the Red River.

FNI assisted the client with preliminary design of an intake pump station on the Sabine River and a water transmission system to supply their drilling operations in East Texas. In order to design the water transmission system, our team developed a water model and explored multiple alternatives for water delivery.

We also provided preliminary design services as the client explored the option of constructing a permanent water transmission system in the Louisiana Haynesville shale play. In order to determine a payback period for the capital investment in a permanent water supply system, we developed a water model and modeled multiple future drilling operation scenarios.

The **Avalon Water System** relied on groundwater supplies from a groundwater well field. The groundwater supplies in the area were determined to have a relatively high mineral content so our team also explored the use of reclaimed water from a nearby town. Our team provided planning and engineering services for the development of the water system required for the client's drilling operations.

We determined the necessary groundwater supplies required to deliver three design flow rates through a network of 23 miles of freshwater pipe. We also determined that the system will require three pump stations to overcome the friction and static head in the system. To determine whether the client should invest in a permanent or temporary system, our team performed a cost-benefit analysis on the system to determine the break-even point.



Case Study

Saltwater Disposal Facilities, Devon Energy

Devon's southeastern New Mexico saltwater disposal facilities are currently being constructed in the field with minimal engineering input on the design and construction of the facility. FNI was contracted to provide engineering recommendations to optimize their saltwater disposal facilities and minimize construction and piping redundancies. While the existing facilities improved with each field iteration, many areas to improve operational efficiencies and cost-saving measures remained.

Our team provided recommendations in three areas: facility optimization, operational efficiency and methods to streamline construction. Facility optimization recommendations focused on applications that would help the facility function at its peak water-handling and oil-capturing performance. Operational recommendations strive to ensure that the facility is designed in such a way to minimize operator requirements and efforts, reducing operation and maintenance needs. Construction recommendations provided a safe and efficient design reducing redundant materials and processes, saving time and money.

We performed a detailed 3-D model of the facility, producing isometric piping drawings for accurate facility construction.

Saltwater Gathering System Asset Integrity Assessment, Devon Energy

Devon's Barnett saltwater batteries and gathering facilities were experiencing integrity issues due to the highly corrosive nature of the fluid. FNI was contracted to provide an engineering analysis of existing facilities and recommendations to enhance functionality of facilities and prevent pipe failures, and implementation measures to mitigate the effects of a potential failure.

FNI reviewed the existing facility piping and provided a cost analysis to determine the most applicable corrosion resistant material application. The project team reviewed corrosion resistant piping materials based on service, maintenance, longevity, and material and construction costs. FNI provided typical facility piping drawings for existing facility rehabilitation implementing material recommendations.

FNI also performed a hydraulic analysis, using H20 Map Water, on the existing high-density polyethylene pipeline gathering system to determine if the pipeline was suitable for anticipated rates of future flows. The project team analyzed the hydraulic model by sequencing transfer pumps to locate high-pressure scenarios, providing recommendations for pump operations. They also reviewed the system's existing valving and controls from the perspective of a potential pipe failure. Valve and leak detection safety measure recommendations were identified to prevent and mitigate effects of a pipeline failure.

Case Study

Ward County Transmission System, Colorado River Municipal Water District

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.

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.

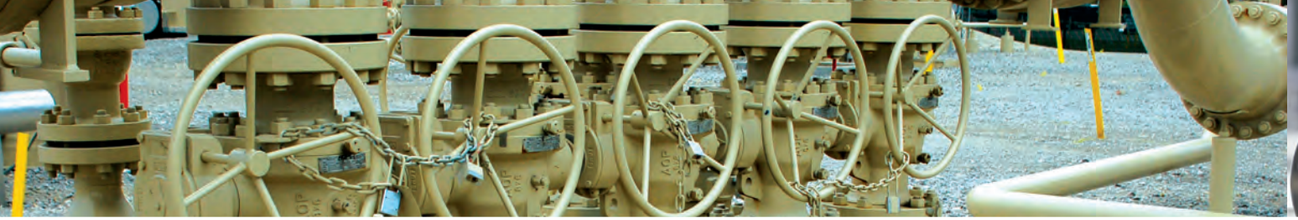
Although initial capacity is 30 MGD, the pipelines are designed for the future demand of 50 MGD. The transmission pump station is expandable to 50 MGD.

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 2014 Engineering Excellence Grand Award from the American Council of Engineering Companies; Gold Award in Water Resources in the American Council of Engineering Companies of Texas' 2014 Engineering Excellence Awards; and 2014 Outstanding Civil Engineering Achievement Award from the American Society of Civil Engineers – Texas Section. The project was also featured on the cover of ASCE's *Civil Engineering* magazine in January 2014.

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



Environmental Services

FNI's Environmental Science and Remediation Group has more than 20 years of experience managing projects for major and independent oil and gas companies. Because of our comprehensive approach, our environmental science team has developed extensive experience in oil and gas projects and frequently works alongside our engineering team, contributing its own specialized capabilities that extend outside the realm of standard oil and gas services.

Joining oil and gas engineering with environmental science allows us to deliver a broader range of services with **shorter project schedules** and **reduced costs** to our clients. This approach means projects are completed on a **quicker time frame**, and the client can get the job done by working with just one firm – Freese and Nichols – from start to finish.

Integrating environmental services into oil and gas projects from the start gives us the opportunity to guide clients through permitting processes and environmental considerations, saving them time and money. This also allows us to work as a trusted advisor on multiple levels and build a relationship to enhance project collaboration.

We provide assistance in environmental services and permitting, including:

- National Environmental Policy Act (NEPA) Documentation (Environmental Assessment, Environmental Impact Statement, Categorical Exclusion)
- U.S. Army Corps of Engineers (USACE) Section 404/10 and 208/408 Permits
- Endangered and Threatened Species
- Construction-Related Stormwater Plans
- Erosion Control Plans
- Spill Prevention, Control and Countermeasure (SPCC) Plans
- Tree Surveys and Urban Forestry Permits
- Geomorphology Assessments and Mitigation Design
- Program-Level Compliance, Avoidance and Minimization Strategies
- Contaminated Site Assessments and Remediation
- Air Permitting

About Freese and Nichols, Inc.

In 1894, John B. Hawley became one of the first independent consulting engineers in Texas. He soon invited Simon Freese and Marvin Nichols to join his firm. From those beginnings, FNI has grown to deliver innovative solutions to clients across the country, providing engineering, architecture, environmental science, planning, energy, program management and construction services.

Our staff of more than 500 talented and accomplished employees is dedicated to one vision: ***Be the firm of choice for clients and employees***. A full service professional consulting firm, FNI is the first engineering/architecture firm to receive the Malcolm Baldrige National Quality Award. Our services include:

- Architecture
- Construction Services/Program Management
- Environmental Assessments and Remediation
- Funding/Grant Applications
- Growth Management and Development
- Levee and Dam Evaluations and Design
- Mechanical, Electrical and Plumbing Engineering
- Municipal and Facility Planning
- Oil and Gas Facilities Engineering
- Stormwater Management and Master Planning
- Structural Engineering
- Transmission/Substation Engineering
- Transportation/Infrastructure Planning and Design
- Urban Planning and Design
- Water and Wastewater Master Planning
- Water and Wastewater Treatment
- Water Resources Planning and Facility Design

Headquartered in Fort Worth, Texas, Freese and Nichols serves clients from multiple offices across the south and southeast United States.

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

Malcolm Baldrige
National Quality Award

2010 Award Recipient

Malcolm Baldrige National Quality Award

In November 2010, Freese and Nichols was named a recipient of the Malcolm Baldrige National Quality Award. The award provides affirmation of our 15-year quality journey to develop Freese and Nichols into a Baldrige-class firm. The Baldrige award is the highest presidential honor given to U.S. organizations for performance excellence, and Freese and Nichols is the first engineering/architecture firm to receive this honor.

Baldrige History

In the mid-1980s, U.S. leaders realized that American companies needed to focus on quality in order to compete in an ever-expanding, demanding global market.

Then-Secretary of Commerce Malcolm Baldrige was an advocate of quality management as a key to U.S. prosperity and sustainability. After he died in July 1987, Congress named the Award in recognition of his contributions.

The goal of the Malcolm Baldrige National Quality Improvement Act of 1987 was to enhance the competitiveness of U.S. businesses. Its scope has since been expanded to healthcare and education organizations (in 1999) and to nonprofit/government organizations (in 2005).

Congress created the program to:

- Identify and recognize role-model businesses
- Establish criteria for evaluating improvement efforts
- Disseminate and share best practices

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

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