

Scope of Work

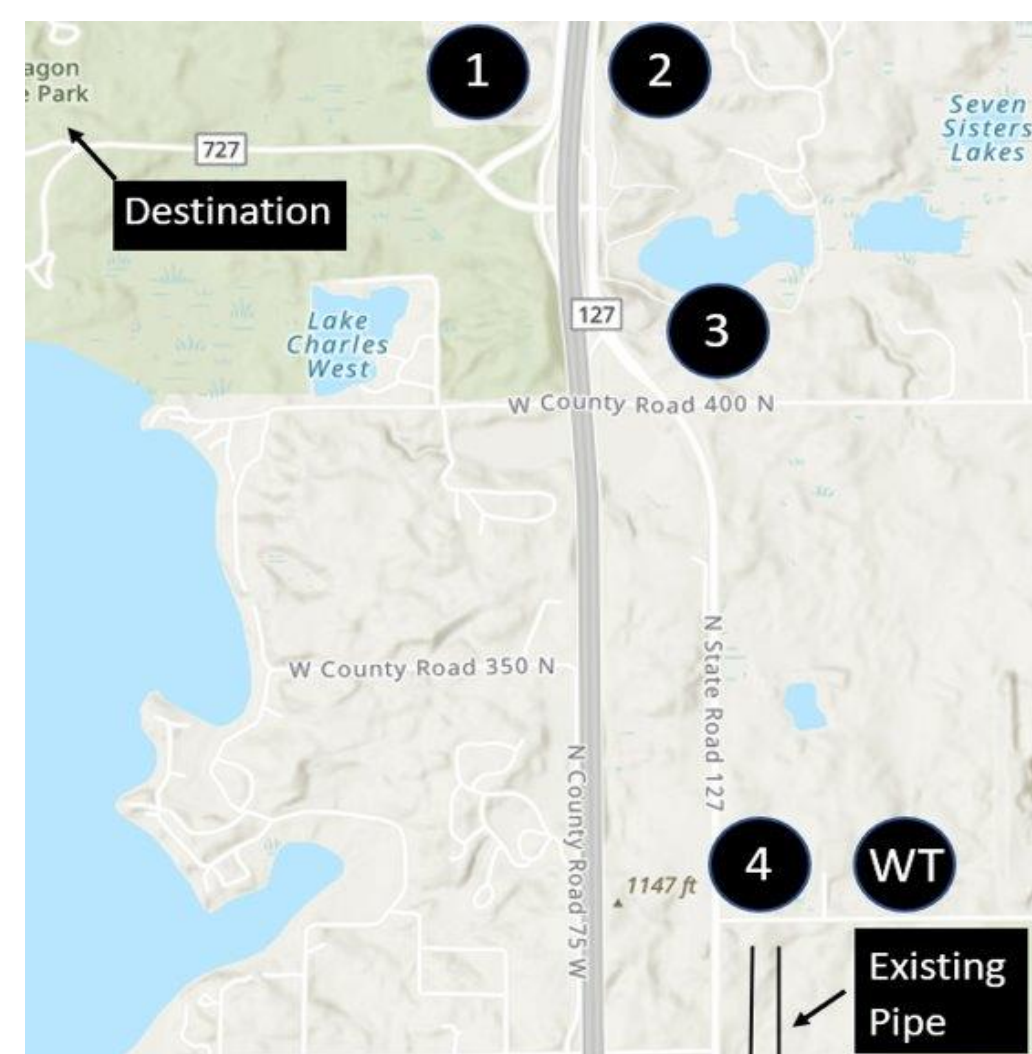
The City of Angola's water main currently stops at the city's northern water tank on County Road 300N. With a recent grant from the federal government, the city wants to extend the water main to Pokagon State Park. The City of Angola plans for further expansion to the north in the future including new subdivisions.

This extension will provide service to the Potawatomi Inn and the campgrounds at the state park and put the infrastructure in place for subsequent growth in the neighborhoods. Extending the existing system will allow more individuals access to the city's water supply and offer fire protection to the surrounding homes and businesses.

Miilin consulting is a multidiscipline private design firm in northern Indiana. Miilin designed the pipeline layout in conjunction with TDA. TDA is a private design firm based in northern Indiana, that is analyzing the chemical and hydraulic properties of the new pipeline.

Soil Testing

Miilin Consulting conducted soil borings at the locations shown in the Figure below using hand augers and collected samples of each soil type encountered. Each soil boring was conducted to hand auger down to at least six feet. There was only one soil boring to reach six feet due to dense soil that could not be penetrated. The other two soil borings were able to at least reach four feet out of the six feet requirement. These soil borings were collected to classify the soil to ensure that the soil being disturbed is safe enough to be constructed upon when the project begins. The locations were chosen because they were in separate locations to ensure that there could be soil differences. These locations were chosen with the thought of the beginning of the project, near the Ramada Inn, and near where the directional drilling process would take place.

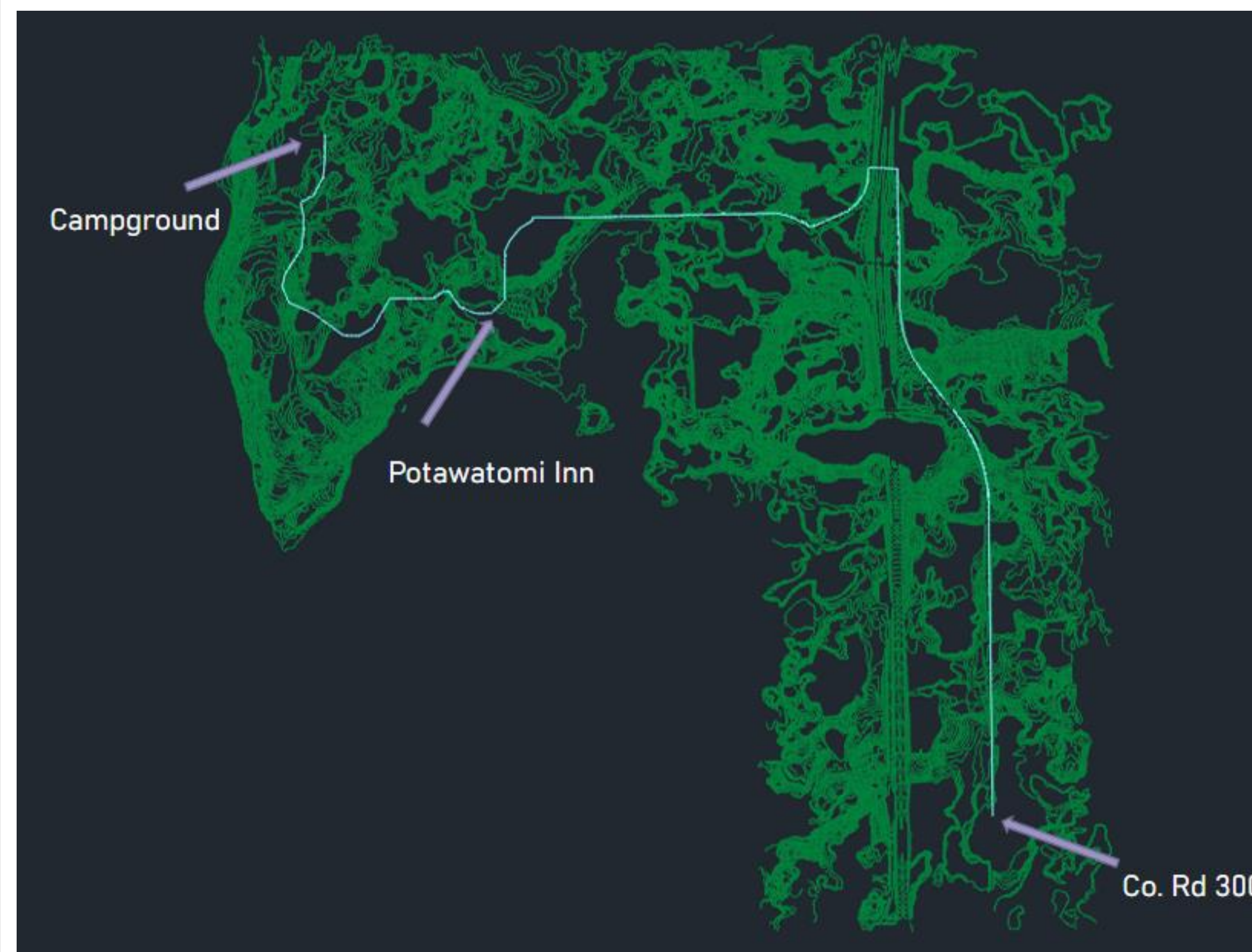


A representative sample from each boring location was taken to test in our accredited labs. To classify the samples, the following tests were conducted on the samples. A moisture test (completed within 24 hours of collection), Atterberg Limits test, and a Hydrometer test to classify the soil. There were three to four different soil samples collected from each of the soil borings, and one soil sample from each sample group was tested through the Atterberg limits and hydrometers tests for soil classifications.

Using the USDA Soil Classification method, we classified each of the three soil samples collected during the soil boring phase. Soil Sample 1-2, was classified as clayey sand (SC). This soil had traces of clay in it with many sandy features. Sample 3-3, which is Site 3, was classified as SC as well. This sample was very clayey and had sandy features as well. Sample 4-2, which was Site 1, was classified as SC as well. This sample had traces of clay and many sandy features. The below table shows the soil properties we found after testing.

Auger #	Depth (in)	Liquid Limit	Plasticity Index	Moisture Content	% Finer #200
1, 2	18	22.75	23.15	16%	2.3%
3, 3	36	22.75	21.03	13%	54.2%
4, 2	72	22.75	24.93	5%	23.5%

Project Map and Layout



We chose to use this route instead of heading directly to Pokagon State Park because this route avoids the biggest obstacles involved in placing an underground pipe. TDA determined through their hydraulic analysis that a 12-inch pipe will be needed for the extension, which will be run through the entire 3.97-mile length.

All utilities were located on the west side of SR 127 and 727, allowing us to continue unobstructed on the east side. The wetlands were also predominantly located to the west, meaning the east side of the road avoids any impact on them during and after construction. By crossing under I-69 from County Road 50 we avoid the narrowing of SR 127 as it goes underneath I-69 which limits the ROW, and the bridge supports make a direct route along SR 127 unfeasible. Once the pipe reaches SR 727, it simply follows the road that travels to the Potawatomi Inn and the campgrounds located to the north.

This route includes capped tees located every 500 feet until the I-69 crossing and a capped tee at the crossing, with fire hydrants at 1000 feet. We also placed hydrants by the Inn, the campground, and the entrance to the park. These capped tees allow for the future growth of the city to hook up new customers or install hydrants as needed. Pressure relief valves were also placed at the tops of every hill to regulate the pressure inside the pipe.

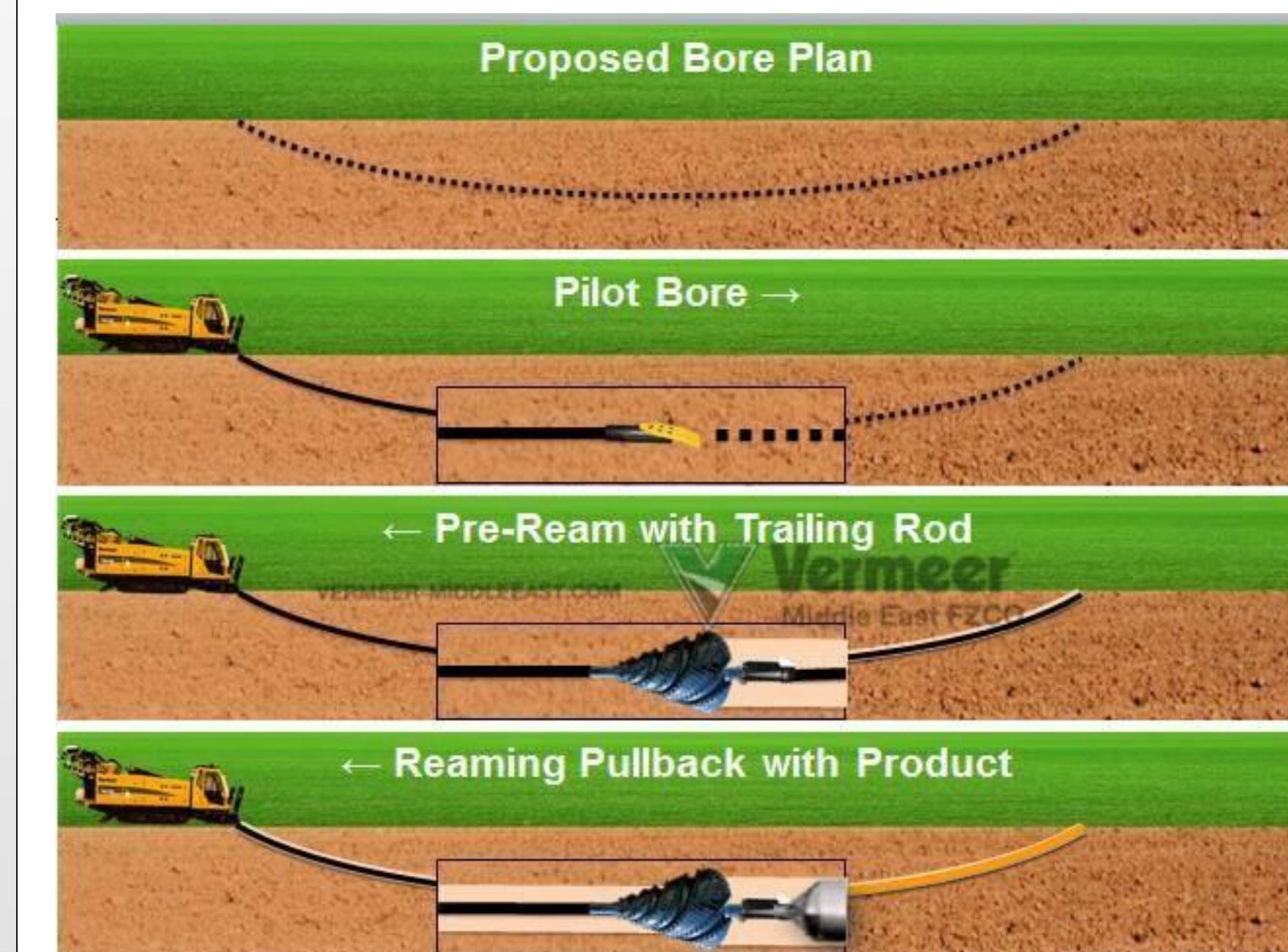
Project Team



Directional Drilling

Miilin Consulting has decided that utilizing horizontal directional drilling is the most efficient way to complete the Angola Water Main Extension project. With the number of obstacles, including an interstate highway, it is already a large convenience to eliminate the process of shutting down a road to cut and trench through the road. When cost is brought up it is more economical to use directional drilling when taking into consideration the reduction in man-hours. Utilizing new technology to use on this project is more time-efficient and allows for more convenient solutions to problems encountered in our project.

The graphic below shows how directional drilling works, which is similar to sewing but on a much larger scale. Most utility companies use this technology when installing pipes underground.



Cost Estimate

Miilin Consulting has estimated the final construction cost including design to be \$5.2 million, shown below. This also includes permit fees from various state agencies to obtain the required permits to construct.

The loadings cost refers to hauling the displaced soil from drilling away to a dump site.

Cost Summary	
Design	\$313,660
Permits	\$2,947
Materials	\$509,300
Contractor	\$2,503,700
Inspection	\$83,340
Loadings	\$863,000
Contingency	\$904,000
Total	\$5,117,000